VERSION 3 UPDATE SUMMARY

Information / Clarification – Existing Conditions

Some comments were received from the joint federal and provincial review team and from the public and Aboriginal stakeholders regarding the existing conditions on site. In some instances, clarification was requested; in other instances, CMC has continued to gather information either in response to requests from the GRT, or as part of ongoing site monitoring. References are provided periodically within Chapter 3 to direct the reader to the most recent information available, within the documentation of the subject matter.

3.0 EXISTING CONDITIONS

Chapter 3 provides a description of the environmental and socio-economic conditions in the area surrounding the Project, drawing from detailed discipline-specific assessments presented in 15 Technical Support Documents (TSDs). Extensive reference is made to specific TSDs throughout the chapter and the TSDs should be consulted for more detailed information.

The existing conditions are defined on the basis of existing information available from a number of sources, including government agencies datasets, scientific literature, modelling, and extensive field studies conducted at the Project Site from 2010 through 2013.

The overall approach and objectives of the existing conditions description are provided in Section 2.3.

3.1 Project Site Overview

The Project is located in the Seine River watershed (6,250 km^2) in northwestern Ontario. The project location is shown in Figure 1-1. The Seine River originates in the Savanne River at Raith, flows east-west for about 250 km and empties into Rainy Lake near Fort Frances and the Canada-U.S. border. The Hammond Reef deposit is located on a peninsula of land extending into the north end of the Upper Marmion Reservoir, one of three reservoirs within the Seine River watershed.

The peninsula containing the ore body is surrounded by the Marmion Reservoir on three sides with Sawbill Bay to the northwest and Lynxhead Bay to the southeast. Upper Marmion Reservoir is a popular destination for both local and tourist anglers, and the sport fisheries it supports, consisting of walleye, northern pike and small mouth bass is actively managed. The area surrounding the Project also contains a number of smaller lakes of which Mitta Lake is the largest. Mitta Lake is a small, steep-sided waterbody located atop mineralized zones of the reef with high potential for gold resources. A number of small ponds and streams drain the upland area on which the Project is located.

Gentle topography is characteristic of the area. The granitic rocks of the site are characterized by rounded hills and shallows slopes. Overburden is generally thin and discontinuous.

The Project Site is located in a typical boreal climate region, which is characterized by long, usually very cold winters, and short, cool to mild summers. With no major mountain ranges blocking Arctic air masses, winters are generally very cold, especially in the far north and northwest. The first snowfall often comes in October and the last snow can come as late as May.

The Project Site is within the boreal forest region of Ontario, near the transition zones with the Great Lakes-St. Lawrence mixed forest region and the prairie grasslands. The forest communities of the area are dominated by black spruce, jack pine, trembling aspen and white birch.

The following sections provide an overview of the physical, biological and socio-economic conditions within and surrounding the Project Site. The information in these sections has been derived from detailed assessments in the individual TSDs for each of the study disciplines.

3.2 Physical and Biological Environment

3.2.1 Regional Geology

The Project Site is underlain by 2.6-billion- to 3-billion-year-old bedrock of the Superior Province of the Canadian Shield, a stable craton that forms the core of the North American continent. The Superior Province has been divided into various regionally extensive east-northeast-trending subprovinces based on lithology, age, genesis and metamorphism. The Project Site is situated in the Marmion Batholith of the Central Wabigoon Subprovince.

The Marmion batholith is a diverse assemblage of felsic intrusive rocks, varying from granite to tonalite (quartz diorite) with a gneissic tonalite predominating, and including late stage pegmatite dykes. The Marmion Batholith is transected by a major structural feature, the 1 to 6 km wide Marmion Deformation Corridor (MDC) (also known as Marmion Lake Fault) that trends northeast to southwest through the area. The MDC is variably faulted, sheared and altered, and exhibits a complex braided structure of brecciated and veined granitoid and tonalite rock. This rock mass has been overprinted with a quartz stockwork that hosts gold mineralization (Brett 2009).

The bedrock is overlain by a thin discontinuous veneer of overburden including glacial deposits that accumulated in low points on the bedrock surface during the progressive retreat of the ice sheet during the end of the Wisconsinan glaciations. These glacial deposits include glaciolacustrine (near shore beach deposits, ice contact deposits and basin/quiet water deposits) and tills that are overlain by younger fluvial deposits (modern flood plains) and organic (peat) deposits (Barnett et al. 1991). Bedrock, which is situated at or near the ground surface throughout much of the area, controls the topography and surface drainage conditions.

3.2.2 Geology

Version 3 Update: Additional geological in the area of the TMF was compiled from previous exploration drilling activities, surficial geology studies and ongoing engineering investigations to support supplemental hydrogeological analyses. This supplemental geological baseline data is provided in the response to T(3)-08.

This section provides a summary of the discussion on regional and local geology, provides relevant mapping and cross sections, lithological descriptions; metamorphism, alteration styles, structural relationships and fabric, mineralogy, occurrence and intensity. Ore mineralogy, including sulphide types, abundance, mode of occurrence, extent of previous oxidation and an estimate of relative sulphide reactivity, as well as the history of seismic activity of the area are discussed below.

3.2.2.1 Study Area

The geological investigation is described for a Geology Regional Study Area (RSA). The basis of Geology RSA mapping is a subset of the regional mapping provided by the Ontario Ministry of Natural Resources (MNR) Natural Resources and Values Information System (NRVIS) (MNR 2004) (Figure 3-1).

3.2.2.2 Methods

The methods of the geological investigation involved secondary data review and primary data collection by OHRG. Secondary data were collected through a review of Ontario Geological Survey reports and regional geological mapping provided by the MNR (MNR 2004). Primary data collection was completed by OHRG and through drilling programs associated with the hydrogeological program. A hydrogeological drilling program was completed to define potential bedrock structures that could influence water inflow to the open pits as presented and discussed in the Hydrogeology TSD.

3.2.2.3 Results

3.2.2.3.1 Geology and Physiography

This section provides a summary of bedrock and ore deposit geologic descriptions. Further details are provided in the Geochemistry, Geology and Soil TSD. Figure 3-1 shows the quaternary geology and the Geology RSA and Figure 3-2 shows a representative cross-section of the ore deposit.

Gold mineralization at the Hammond Reef property is hosted by quartz stockworks within the Marmion granitoid suite. This suite is characterized by fresh to intensely altered tonalite-trondhjemite; subordinate, unaltered granitoid gneiss; and minor mafic lenses (typically highly altered). The quartz stockworks overprint all phases but is only weakly developed in the mafic lenses. Disseminated gold mineralization was delineated in two deposits situated along a northeast-southwest trend: the 41 Zone and the A Zone, in the vicinity of the proposed east pit and west pit respectively (Figure 3-2).

3.2.2.3.2 Seismic Activity

The Project Site is located in a seismically stable area near the centre of the Canadian Shield, on the interior of the North American Plate. Seismic activity in areas like these seems to be related to the regional stress fields, with the earthquakes concentrated in regions of crustal weakness (NRCan 2012). From 1982 to 2008, 57 seismic events of 3.0 or greater were recorded in Northern Ontario. The largest event recorded at the Atikokan station between 1982 and 2008 was magnitude 3.2, recorded in 2008 (NWMO 2008).

Peak accelerations for in the Project Site are considered in engineering activities for feasibility and design and appropriate design and construction measures are implemented according to the *Canadian Dam Association Guidelines* and the *National Building Code of Canada.*

3.2.2.3.3 Influence of Geology and Physiography on Project Infrastructure

As noted, the Project Site lies over a major geological structure (MDC) that transects the Marmion Lake batholith. This structure is characterised by a variably faulted, brecciated sheared rock mass that has been extensively altered and overprinted with a quartz stockwork that hosts the gold mineralization. Exploration drilling has identified mineralized rock at the Project Site that is generally bounded by two significant shear zones that dip steeply to the southeast and extend southwest to northeast. These shear zones control the distribution of gold mineralization and thus the size and depth of the open pits which are required to access and mine the ore. To optimise materials handling requirements, the processing plant and various stockpiles (low-grade ore, waste and overburden) are located in the vicinity of the open pits.

The geological structure has influenced the water transmitting capabilities (hydraulic conductivity) of the rock that will form the pit slope adjacent to Marmion Reservoir. Fracturing of this rock mass was assessed during the field program and considered in the prediction of inflows to the open pit as is described in the Hydrogeology TSD.

Glacial erosion of the bedrock and subsequent deposition of limited overburden materials has left extensive bedrock outcrops in portions of the Project Site. The Tailings Management Facility (TMF) has been sited to take advantage of bedrock outcrops to provide natural containment around a portion of the TMF. This is discussed in Chapter 4.

3.2.3 Geochemistry

Version 3 Update: Clarification regarding the geochemistry of overburden material is provided in response to T-31 and R(2)-06. Explanation of rationale regarding geochemical characteristics related to acid generation and metal leaching is provided in response to T-46.

Response to T-27 directs the reader to the location of geochemical data (in particular selenium) as provided in the EIS/EA report. Clarification and context regarding the geochemistry sample representation is provided in T-29, T-30, T-32 (waste rock sampling); T-48 (geochemical analysis); and MOE SW-2B (cyanide).

The geochemical characterization program was carried out to determine the acid generation and metal leaching behaviour of waste rock and tailings generated by the Project and to determine the expected quality of the water associated with the tailings and water that may come in contact with other mine materials or disturbed soils (i.e., contact water). The sample selection, collection, analytical testing and interpretation of results are consistent with international guidelines (Price 1997; MEND 2009; INAP 2012). This work is also consistent with the requirements listed in Regulation 240/00 of the Ontario *Mining Act*.

Exposure of waste rock and tailings to atmospheric conditions can result in the oxidation of metal sulphide minerals, the generation of acidity and the release of constituents into the dissolved phase. The generation of acidic and metal-rich waters, as a result of sulphide oxidation, is commonly referred to as Acid Rock Drainage (ARD). If ARD water is not captured or managed effectively, it can migrate to the groundwater and nearby surface water bodies.

ARD can be neutralized by the interaction of other minerals if present in sufficient quantities. Carbonate minerals, for example, are particularly important neutralizing minerals, since they are generally the most effective in counteracting acidic conditions. Although low-pH conditions can enhance metal release and mobility, metals can leach and occur at elevated concentrations under near-neutral to basic-pH conditions.

Measured water quality reflects the leaching process that occurs naturally, prior to any disturbance by mining activities. A summary of the existing water quality at the Project Site is provided in Section 3.2.8.

3.2.3.1 Study Area

The geochemical characterization specifically focuses on the extraction of ore and waste rock from the two proposed open pits. The Geochemistry Local Study Area (LSA) contains the Hammond Reef deposit, the Mine including the two open pits (i.e., east pit and west pit) and the TMF where the tailings will be deposited after processing. The Geochemistry LSA is shown in Figure 3-3.

3.2.3.2 Methods

The geochemical characterization of the waste rock and tailings for the Geochemistry LSA involved a literature review and laboratory testing.

The sample selection, collection, analytical testing and interpretation of results are consistent with international guidelines (Price 1997; MEND 2009; INAP 2012). This work is also consistent with the requirements listed in Regulation 240/00 of the Ontario *Mining Act*.

A total of 123 samples that are representative of waste rock expected to be removed from the open pit were collected. The waste rock samples were selected from drill core based on both the rock types observed (Table 3-1), as well as the spatial and stratigraphic representativeness, using cross sections and plan views provided by OHRG.

Tailings will be produced at the Project Site through a process comprising the crushing, grinding, flotation, cyanidation-leaching of the excavated ore, carbon-in-pulp gold recovery, gold elution, gold electro-winning, induction furnace smelting, cyanide destruction and tailings recovery. Ten samples of ore, from across the deposit, were selected and tested in 2009 based on the type and degree of alteration, which is correlated with the grade of ore, and additional ten metallurgical composite samples were tested in 2011 to provide additional variability analysis. It is considered that the samples provide a reasonable representation of expected tailings to be produced from the process (Ounpuu 2012, pers. comm.).

Further discussion of sample selection, preparation and methods is provided in the Geochemistry, Geology and Soil TSD.

The analytical program consisted of a series of static tests designed to assess the general physical and geochemical characteristics, specifically elemental composition, acid-base accounting (ABA), net acid-generating (NAG) testing and short-term leach tests.

The number of samples tested for each test is presented in Table 3-2. A sub-set of samples were selected for short-term leach testing and subsequent kinetic testing and mineralogical analysis based on the range of solid-phase composition of each material type observed in the results of ABA and metal analysis. Each of the physical and geochemical analyses listed above are described in greater detail in the Geochemistry, Geology and Soil TSD.

3.2.3.3 Results

The following three paragraphs provide a summary of the resells of the geochemical al testing program for the Geochemistry LSA. Subsequent paragraphs, figures and tables provide the detailed results.

Extensive laboratory testing of 123 samples of waste rock obtained from boreholes drilled in the area of the mine showed that only one sample could be considered as possibly acid-generating. Overall, the deposit is considered to be non-acid-generating with excess neutralization potential.

Leach test results indicate the leachate pH was generally alkaline ranging between 9.6 and 10.1, and that aluminum was generally most readily leached from most waste rock samples at concentrations greater than the guidelines. Additional metals that were greater than the PWQOs for four (4) or fewer samples include: arsenic, cadmium, copper, selenium and vanadium. Mercury concentrations in the leach samples were all below the detection limit.

The ABA results indicated that the tailings can be classified as non-acid-generating. Leach test results indicated the tailings pH was more alkaline than the PWQO guideline range. Concentrations of copper and aluminum were also greater than one or more of the guidelines. Similar results obtained from humidity cell testing showed that pH values were near-neutral and within the ranges specified by the PWQO, CCME and MISA criteria while concentrations of aluminum, copper, cadmium and zinc were greater than one or more of the guideline values for the first two weeks of testing only. Iron concentrations were greater than the PWQO and CCME criteria at week 10 only. All other parameters meet the considered criteria. The following discussion focuses on the acid generation and metal leaching potential of waste rock and tailings. The results of the geochemical testing are used in the effects assessment (Chapter 6) with respect to predicting water quality.

ABA was performed to evaluate the acid generation potential. As part of ABA, the bulk quantities of acid-generating minerals (e.g., sulphide minerals) and acid neutralizing minerals (e.g., carbonate minerals) are measured to assess whether the materials tested will have sufficient capacity to neutralize acidity or if the materials have the potential to generate acidity. This analysis determines, among other things, sulphur species, acid potential (AP), neutralization potential (NP) and carbonate content.

The acid potential (AP) represents the bulk amount of acidity that can be produced by oxidation of sulphide minerals. The AP is calculated from the sulphide content and assumes that all sulphide minerals occur as pyrite.

The neutralization potential (NP) represents the “bulk” amount of acidity that the sample can potentially consume or neutralize.

Acid generation potential is commonly interpreted according to the ratio of NP to AP, referred to as the neutralization potential ratio (NPR), according to the guidelines recommended by Mine Environment Neutral Drainage (MEND) (2009) and described in Table 3-3.

The results of short-term leach testing (Shake Flask Extraction ([SFE]) conducted on samples of waste rock are summarized in Table 3-4, and the results of the net acid generation (NAG) leach testing are summarized in Table 3-5. The testing results are compared with the following guidelines:

- Provincial Water Quality Objectives (PWQO) (Ontario Ministry of Environment and Energy 1994).
- Canadian Council of Ministers of the Environment (CCME 2007), Canadian Environmental Quality Guidelines, for the protection of freshwater aquatic life.
- Municipal/Industrial Strategy for Abatement (MISA): Effluent Monitoring and Effluent Limits — Metal Mining Sector (O.Reg. 560/94).

The results of the leach tests indicate that the leachate pH was generally alkaline ranging between 9.6 and 10.1, and that aluminum was generally most readily leached from most samples at concentrations greater than the guidelines. Additional metals that were greater than the PWQOs for four or fewer samples include: arsenic, cadmium, copper, selenium and vanadium. Mercury concentrations in the leach samples were all below the detection limit.

- Based on the results of the static testing, nine waste rock samples were selected for mineralogical analysis and humidity cell testing. Specific rock types tested included fine-grained granite (two samples), tonalite (two samples), chloritic granite (two samples) and one sample each of pegmatite, chloritic granite porphyry and altered granitoid. These results are presented in the Geochemistry, Geology and Soil TSD.

- The mineralogy indicates that sulphides were present primarily in the form of pyrite [FeS_2] with trace chalcopyrite [$CuFeS_2$]. Total sulphide mineral concentrations were low, ranging from 0.019 to 0.662%, by weight. Carbonate mineral content of the samples ranged from 0.75 to 29%, averaging 8.8% by weight distribution and is comprised primarily of Calcite and Dolomite with smaller amounts of Magnesite. The mineralogical composition of the tonalities, pegmatite, chloritic granite porphyry, altered granitoid and chloritic granites was dominated by quartz (28 to 45%) plagioclase (18 to 36%) and muscovite (9.7 to 28%).

Humidity cell testing was conducted over a 44-week period with leachate samples collected at weekly and/or five-week intervals. Test results showed that aluminum and copper were leached during the first five weeks of testing, reaching concentrations that exceeded PWQOs and CCME criteria in nearly all samples (the exception was the fine-grained granite). Thereafter concentrations declined. The results also indicate there was minor leaching of arsenic in two of the rock types (pegmatite and tonalite) and copper from all samples with the exception of the fine-grained granites. Generally, concentrations of most measured parameters stabilized after the first five weeks of testing.

As indicated in the Geochemistry, Geology and Soil TSD each of the individual ore samples and tailings samples, as well as the composite tailings samples were non-acid generating with excess neutralization potential, regardless of their location within the deposit. Water associated with the master composite tailings sample (process water) was shown to be within the acceptable pH range for all considered guidelines. Several metals in the process water were greater than the PWQO and CCME criteria and include: aluminum, cobalt, copper, cadmium, molybdenum, lead and uranium.

3.2.4 Terrain and Soil

3.2.4.1 Study Area

The terrain and soil investigation was conducted within the Terrain and Soil LSA. Soil mapping is a subset of the regional mapping provided by the Ontario Ministry of Natural Resources (MNR 2004) as supplemented by additional information where available.

3.2.4.2 Methods

Terrain and soil map units were used to assist in the characterization of soils in the Terrain and Soil LSA. The approach to classifying and describing terrain and soil units involved a review of existing information, soil sampling and analysis, and development of terrain and soil maps in a Geographical Information System (GIS) platform.

The terrain and soil mapping used existing data in the Terrain and Soil LSA. Sources of existing terrain and soil data are provided in the Geochemistry, Geology and Soil TSD. For soil mapping, the Ecological Land Classification (ELC) vegetation units are used as part of the mapping process to derive correlations between soil types and the ELC vegetation types. Due to the resolution of the ELC data, the soil map units are presented as complexes to capture the range of soil types on the landscape and minor components of a soil series (i.e., less than 20% representation within a map unit) are not mapped. The soil map unit delineations are inferred from the interpretation of landscape features (i.e., elevation contours and landform) and ELC units, without field groundtruthing. Thus, the soil map should be viewed as a general predictive model of soil distribution. The information provided is suitable for inclusion in an environmental assessment; however, it should not be used to predict discretized site-specific characteristics for purposes such as engineering design without collecting additional field information.

Soil samples were collected within the Terrain and Soil LSA and analyzed for metals. Soil metal data was collected during the April 2012 field program at 18 sites (Table 3-6, Figure 3-5).

3.2.4.3 Results

Five terrain units have been defined and mapped for the Terrain and Soil LSA (Table 3-7, Figure 3-6). The most common terrain map unit encountered in the Terrain and Soil LSA is the bedrock terrain unit which covers 5,633 ha (66% of Terrain and Soil LSA). The second most abundant terrain unit is the glaciolacustrine unit which covers 1,277 ha (15% of Terrain and Soil LSA). The remaining terrain units compose less than 10% of the Terrain and Soil LSA. The topography of the Terrain and Soil LSA is outlined in Figure 3-6.

Six soil map units were described and mapped for the Terrain and Soil LSA (Table 3-8, Figure 3-7). The most common soil map unit in the Terrain and Soil LSA is the Regosol-bedrock (4,816 ha, 57% of Terrain and Soil LSA), followed by Dystric Brunisol-Gleysol-fine (1,096 ha, 13% of Terrain and Soil LSA). The rest of the soil map units occupy less than 10% of the Terrain and Soil LSA (Table 3-8).

3.2.4.3.1 Soil Erosion Risk

Soil erosion risk is one of the primary concerns for disturbed soils because the limited amount of vegetation cover exposes soil materials to the elements (e.g., wind and water). With continuous exposure to wind or rain, the uppermost portions of the soil profile may be eroded, washed, or blown away, depending on terrain and soil characteristics, resulting in loss of topsoil and subsequent soil quality.

Sandy soils and low moisture soils are especially at risk of wind erosion. The majority of soils in the Terrain and Soil LSA are rated as having a low risk of wind erosion.

Most soil series on the Terrain and Soil LSA are rated as having a low risk for water erosion on slopes less than 5%. Slopes more than 10% are generally rated as a high risk for water erosion in the Terrain and Soil LSA. However, most of the Terrain and Soil LSA has slopes in the range of 5 to 9%. There are limited areas within the Terrain and Soil LSA at risk of water erosion due to a combination of slopes more than 10% and sandy-textured surface soils overlaid by a clay-textured subsoil located mainly within the creeks and near the water's edge. On average, the overall water erosion risk varies from low to moderate. However, special attention to soil conservation is required on erosion prone areas.

A summary of the overall erosion sensitivity for each soil map unit is presented in Table 3-9.

3.2.4.3.2 Soil Chemistry

Sampling for the existing conditions metal chemistry of soil was completed in 2012 during the vegetation field program. Results from the existing conditions metal chemistry sampling program are summarized in Table 3-10.

Soil samples were collected within the Terrain and Soil LSA, in undisturbed locations. Metals concentrations in soils were compared to Table 1 of the Ontario MOE Soil Standards for Parkland Land Use, which are based on the Ontario Typical Range (OTR) (MOE 1993). These define the natural ranges of metals in soils, based on testing of a range of soils in the province.

The results in Table 3-10 show that metals concentrations in soils in the Terrain and Soil LSA are well within the range of natural soils within the province. While Table 1 Soil Standards are not available for aluminum and iron, MOE (1993) reports mean concentrations of aluminum in parkland soils of approximately 15,000 µg/g, and an OTR of 27,000 µg/g. Aluminum concentrations in the Terrain and Soil LSA soils therefore are slightly above mean concentrations though still within the range of natural soils. MOE (1993) reports mean concentrations of iron in Ontario parkland soils of approximately 20,000 µg/g, with an OTR of 33,000 µg/g. Iron concentrations in Terrain and Soil LSA soils can therefore be considered as typical of average concentrations in Ontario soils.

3.2.5 Atmospheric Environment

The atmospheric environment consists of climate, air quality, noise, vibration and light.

The Project is located approximately 23 km north of the town of Atikokan, within the boreal forest region of Ontario. Existing air quality conditions in the Project Site are expected to be typical of background values in northern Canada. The existing air quality for the Project was characterized using published literature and air quality data from established long-term monitoring stations in northern Ontario and western Canada, which represents the upwind catchment for air flowing into the region.

Existing noise levels in the Project Site are expected to be typical of background noise for the boreal region, dominated by natural sounds and the effects of wind. Existing noise levels were established using published literature and accepted background noise levels for remote areas in Ontario.

3.2.5.1 Climate

Climate describes the long-term weather conditions for the area.

3.2.5.1.1 Study Area

The description of the climate that is of importance to the Project is regional and uses the same study area as the Air Quality RSA (Figure 2-3C).

3.2.5.1.2 Methods

Climate in the Air Quality RSA has been characterized using the climate normals data for the Environment Canada monitoring station in Atikokan Marmion (daily observations from 1979 to 2007) supplemented, as needed, by data from the monitoring station at Sioux Lookout A (daily observations from 1970 to 2010).

Although there are a number of data gaps in the observations at the Atikokan Marmion monitoring station (58% missing mean temperature, and 57% missing total precipitation) the Atikokan Marmion station has been selected to describe the meteorology for the Project Site due to its closer proximity. Sioux Lookout A has 1% missing data.

3.2.5.1.3 Results

The meteorological data show that the climate in the Air Quality RSA is typical of the boreal climate region, which is characterized by long, usually very cold winters, and short, cool to mild summers. In the summer, hot weather occasionally reaches even the northernmost parts of Ontario, although humidity is generally lower than in Southern Ontario. With no major mountain ranges blocking arctic air masses, winters are generally very cold, especially in the far north and northwest. The snow can remain on the ground much longer in the region relative to Southern Ontario; the first snowfall often comes in October and the last snow can come as late as May. The annual temperature average is 1.6˚C for Atikokan with a seasonal average of 16.2˚C for summer while the average winter temperature is minus 15.4˚C.

Tables 3-11 and 3-12 present the temperature data obtained from Environment Canada's 1971 to 2000 climate normals for the Atikokan Marmion meteorological station. Table 3-11 shows monthly values and extremes, and Table 3-12 shows seasonal values. Figure 3-8 presents the monthly temperatures in graphical form, displaying daily average, maximum and minimum and extreme values over the calendar year.

Tables 3-13 and 3-14 present the precipitation data obtained from Environment Canada's 1971-2000 climate normals for the Atikokan Marmion. Table 3-13 shows monthly values and extremes, and Table 3-14 shows seasonal values. Figure 3-9 presents the monthly precipitation in graphical form for Atikokan, displaying total rainfall, rainfall, snowfall and all time extreme values over the calendar year.

The annual normal total for precipitation is 739.6 mm for Atikokan with a seasonal maximum of 299.0 mm for the summer period. Spring, summer and fall rainfall contribute on average 657 mm, with the remainder occurring as snowfall.

The annual average wind speed for Atikokan Marmion is 14.2 km/hr with a predominant westerly direction for the year. Mean monthly wind speeds show little variability from month to month (Figure 3-10).

3.2.5.2 Air Quality

Version 3 Update: Clarification regarding background air quality data is provided in response to MOE-Air-1 and MOE-Air 1B. Tables and figures provided in the response to MOE-Air 1 and MOE-Air 1B include background concentrations of TSP.

The existing environment for air quality includes current air quality conditions in the area surrounding the Project.

3.2.5.2.1 Study Areas

The description of air quality uses the Air Quality RSA. There are no existing industrial applications within the Air Quality RSA and the area is undeveloped. Thus, the existing air quality in the Air Quality RSA is not impacted by local sources. Ambient air monitoring stations are typically installed in locations where air quality is an issue and there are no stations that monitor air quality within hundreds of kilometres of the Project Site. Northern Ontario does not typically have air quality issues as much of the landscape is natural and undisturbed.

3.2.5.2.2 Methods

Since the predominant west wind limits contributing emissions from Southern Ontario, it is assumed that North Western Canada background levels are most appropriate to characterize the air quality. Field studies were not undertaken to characterize the existing air quality, since available data was judged to be sufficient to characterize the local and regional air quality for the particulate matter and combustion gases.

Background measurements are not available for all indicator compounds. It is expected that in remote locations such as the Air Quality RSA, the background air quality contaminant levels will be lower than the available measured values. Alternatively, they were assigned a value of zero for indicator compounds such as ammonia.

The following sources of information were used in the characterization of the existing air quality:

- Ontario Ministry of the Environment, Air Quality Monitoring Station Data.
- Government of Saskatchewan Air Quality Readings.
- Northwest Territories Air Quality Monitoring Network.
- Quebec Department of Sustainability, Environment and Parks, Air Quality Index Monitoring Stations.
- Government of Manitoba, Manitoba Air Quality.

- Government of Alberta, Clean Air Strategic Alliance, The Alberta Ambient Air Quality Monitoring System.
- Environment Canada, National Air Pollution Surveillance Network.

3.2.5.2.3 Results

Figure 3-11 illustrates the location of the monitoring stations in relation to the Project Site. The data from these monitoring stations were analyzed to estimate the air quality in the Air Quality RSA. Table 3-15 provides the station information. A large number of monitoring stations was required in order to air quality estimates result for as many indicator compounds as possible. Table 3-16 provides a summary of the monitoring data available from each of these stations.

Air monitoring data collected is assumed to represent the naturally occurring sources and those from long range transport for into the Air Quality RSA. The emissions transported into the region could be considered to be the "background air quality." Based on feedback from regulators, and expert judgement, the 90th percentile of the available monitoring data is considered a conservative estimate of background air quality.

Existing data is not sufficient to characterize all of the indicator compounds concentrations in the air in this region. Criteria air contaminants are the only parameters monitored at this time. It is not anticipated that long range transportation of metals or process chemicals would have an influencing concentration on air quality. Therefore, background concentrations of these compounds will not be further considered.

Ambient monitoring data for the SPM size fraction is not readily available for the above-mentioned stations; however, an estimate of the background SPM concentration can be determined from the available PM_{10} and $PM_{2.5}$ monitoring results. Fine particulate matter (i.e., $PM_{2.5}$) is a subset of the PM_{10}, and PM_{10} is a subset of SPM (Atmospheric Environment TSD). Therefore, it is reasonable to assume that the ambient concentrations of SPM will be greater than corresponding PM_{10} levels, and PM_{10} concentrations will be greater than the corresponding levels of $PM_{2.5}$. The overall levels of $PM_{2.5}$ in Canada were found to be about 50% of the PM_{10} concentrations and so on (CEPA/FPAC 1998). By applying this ratio, it is possible to estimate the background SPM concentration for the region.

Table 3-17 provides a listing of the 90th percentile concentrations from the air monitoring stations for the Air Quality RSA as well as the background concentrations derived from the monitoring results. Since there are no existing sources in the Air Quality RSA, the lowest value for each compound of all the monitoring stations was used as the background concentration. Each station has some influence from existing sources so using the lowest values of all the sources is still a conservative estimate of the background condition for the Project.

3.2.5.3 Noise

The study area and methods for noise evaluation are described in the Atmospheric Environment TSD. Based on the remote nature of the Project and PORs, the existing noise conditions have been assumed to be unimpacted by man-made sources and therefore onsite measurements were not required.

3.2.5.4 Vibration

The study area and methods for vibration evaluation are described in the Atmospheric Environment TSD. Effects of energy released from the Project in the form of air and ground vibration are most likely to be experienced by those living in close proximity to the Project Site. As there are currently no blasting operations, an assessment of background conditions was not necessary for this assessment.

3.2.5.5 Light

Based on the remote nature of the Project, the existing light conditions have been assumed to be unimpacted by man-made sources and therefore on-site measurements were not required.

3.2.6 Hydrology

Version 3 Update: At the recommendation of the Ontario Ministry of Environment and Climate Change (MOECC), the baseline hydrology monitoring program was re-initiated in 2015. Data collection is ongoing as of the submission of this Version 3 EIS/EA. This data will be used to support permitting and confirmation of project effects (see MOE Hydrology-5).

The Hydrology component is described in terms of streamflows, lake water levels and navigability. Prior to a description of these sub-components, the following section provides an overview of the location and context of the Project Site, including a description of the watershed, water users and water management plans.

The Project is located adjacent to Upper Marmion Reservoir, which is part of the Seine River system. The Seine River originates as the Savanne River near Upsala and flows westerly for about 250 km before emptying into Rainy Lake southeast of the town of Mine Centre (Figure 3-12). The Seine River watershed encompasses approximately 6,250 km². The Seine River system is a highly managed system. Three bodies of water are used as reservoirs for power production and cooling water along the Seine River: Lac des Mille Lacs, Upper Marmion Reservoir and Lower Marmion Reservoir. The proposed Project Site will be located on a point of land that, due to the configuration of the reservoir, forms a peninsula in northwest Upper Marmion Reservoir, approximately 9 km from its outflow at Raft Lake Dam. Upper Marmion Reservoir has a surface area of 55.3 km², representing 1.2% of its total watershed area (4,426 km²).

The Upper Marmion Reservoir drains to Finlayson Lake through the Raft Lake Cut. Finlayson Lake in turn drains to the Seine River. The Valerie Falls Generating Station is located downstream of the outlet of Finlayson Lake on a man-made diversion of the river around the site of the former Steep Rock Mine. The generating station is owned and operated by Valerie Falls Limited Partnership (Brookfield Renewable Energy Group). The man-made diversion joins the main channel of the Seine River downstream of Steep Rock Lake.

Steep Rock Lake has been isolated from the main flow of the Seine River due to development of the Steep Rock Iron Mine in the 1940's. During operation of the Steep Rock Mine, Steep Rock Lake was isolated form the Seine River system. According to Sowa et al. (2001), Steep Rock Lake was used as a retention basin to allow settlement of dredged colloidal clay. The lake contains 90 Mm³ of disposed dredged lake bottom sediments. Restoring the Seine River to its original flow path would have resulted in an increased sediment load that would have serious environmental effects on the fish habitat downstream. The mine ceased operations in the 1970s, and since then the open pits have proceeded to fill with water. The pits are predicted to eventually overflow at which time it is possible that surface waters from these historic mine pits will drain to the Seine River.

Downstream of Steep Rock Lake are two hydro-electric facilities:

- Calm Lake Generating Station, located on the Seine River at the outlet of Calm Lake, and owned and operated by H2O Power Limited Partnership.
- Sturgeon Falls Generating Station, located about 90 km east of Fort Frances, also owned and operated by H2O Power Limited Partnership.

The Seine River ends at Rainy Lake. The Seine River is a tributary of the Rainy River system that forms the international border between Canada and the USA from Rainy Lake to Lake of the Woods. Additional details regarding water rights and jurisdiction downstream of Rainy Lake are discussed in the Hydrology TSD.

Waterpower development on the Seine River commenced in 1909, with the construction of a dam across the Rainy River at Fort Frances. In 1926, the Calm Lake, Sturgeon Falls and Moose Lake generating stations were built, and the Marmion Reservoir was created to serve as the primary storage basin for power regulation at these generating stations. In 1943, the Seine River was diverted around the Steep Rock mining operations and the Moose Lake generating station was decommissioned. The Raft Lake Dam was built to replace the Moose Lake structures as the principal control works for the system. Between 1944 and 1961, Lower Marmion Reservoir was isolated from Upper Marmion Reservoir to minimize the amount of material from dredging operations in the East Arm of Steep Rock from entering the Seine River. The Valerie Falls generating station was built in 1993-1994.

The waterpower facilities rely on two upstream reservoirs (Lac des Mille Lacs and Upper Marmion Reservoir) for “peaking” operations as well as to produce even flows to the head ponds throughout the year. Water is held back at the reservoirs during periods of high flows (spring and autumn) for use by the generating stations in periods of low flows (Boileau 2004).

Water levels in a third reservoir (Lower Marmion Reservoir) are managed to provide suction head to cooling water pumps for the coal-fired Atikokan Generating Station. The plant is located near the town of Atikokan and is owned and operated by Ontario Power Generation. The facility draws in cooling water from Lower Marmion Reservoir, and discharges the water into Snow Lake which is connected to a number of smaller lakes that ultimately feed back into Lower Marmion Reservoir.

The 2004 to 2014 Seine River Water Management Plan specifies operating rules for the Seine River water control structures which include the Raft Lake Dam. The objectives of the operating plan for Raft Lake dam are to:

- Optimize power generation values from the system.
- Maintain or improve aquatic health of the system.
- Address public safety and property damage by minimizing flooding throughout the system.
- Maintain navigational, recreational and social opportunities throughout the system.

Lower Marmion Reservoir is separated out of the system during the winter to maintain head for cooling water pumps. Operating plans for the water control structures are described in the 2004 to 2014 Seine River Water Management Plan (Boileau 2004). Water levels in the three reservoirs are regulated as follows:

- Upper Marmion Reservoir levels are controlled between a minimum elevation of 412.5 masl and a maximum elevation of 415.5 masl. Lake levels can be no higher than 413.7 masl on April 1st of each year to provide capacity for the spring freshet.
- Lower Marmion Reservoir drawdown is constrained to a minimum elevation of 414.80 masl to ensure suction head for cooling water pumps for Atikokan thermal generating station. Lower Marmion Reservoir covers 25% of its watershed area (1.557 km^2). However, the lake is not dependent on its local watershed for water replacement. Water is replaced with inflows from Upper Marmion Reservoir during the spring refill.

- In all three reservoirs, lake levels will be stable or rising between 15th April and 15th June to enhance spawning of walleye and pike.

Lake levels and outflows at the water control structures are monitored by the owners/operators and provided to the local Ministry of Natural Resources (MNR) offices under the compliance monitoring programme.

3.2.6.1 Study Areas

The review of existing conditions is based on the Mine Study Area (MSA), the Hydrology LSA and the Hydrology RSA. The MSA consists of the site watersheds that would be directly affected by the Project; the Hydrology LSA includes the adjacent local watersheds that would be indirectly affected by the Project. Both these areas form part of the drainage system of the Seine River, which forms the Hydrology RSA.

- The MSA includes 29 small watersheds that have been identified in the vicinity of the Project (Figure 3-13). These drainage basins range in size from 0.05 km² (watershed AI) to 6.33 km² (watershed R). Bedrock outcrops interspersed with glacial till (unsorted deposits of boulders/gravel/mud) typically covers 65% to 95% of the surface area of these watersheds; the balance is covered by organic terrain. Exceptions are watersheds B, R, AF, AG, AH which are covered by 20% to 65% sand and gravel deposits (from outwash deltas and meltwater channels) and 35% to 60% bedrock outcrops interspersed with glacial till. Organic terrain (45%) and sand and gravel deposits (40%) are found in watershed Q. The vegetative cover consists mainly of a mix of grass, shrubs and/or trees. The percentage of the watershed area covered by lakes and wetlands generally ranged from 0% to 15%, but exceeded 20% in five watersheds (A, K and Q).

The Hydrology LSA includes Upper Marmion Reservoir from Turtle Bay to the east of the Project Site to the Raft Lake Cut and the contributing watersheds. The contributing watersheds include two local watersheds that drain directly into the small embayments surrounding the Project Site (Figure 3-14). These tributaries are:

- **Lumby Creek:** Lumby Creek is the principal drainage system in the Lynxhead-Trap-Turtle Bays watershed. The Lumby Creek drainage basin extends over an area of 62.8 km². The drainage basin is mainly covered by bedrock outcrops interspersed with unsorted glacial deposits of boulders/gravel/mud (till). There is also some organic terrain; areas where peat and muck occur as bogs and muskegs, low lying floodplains and lakeshore swamps. Glacial deposits of sand and gravel from outwash deltas and meltwater channels also occur northwest of Lizard Lake. Land use is predominantly forest.
- **Sawbill Creek:** Sawbill Creek is the principal drainage system in the Sawbill Bay watershed. The drainage area to Sawbill Creek at Sawbill Bay is 106 km², more than half of which is drained by Serpent Creek. The drainage basin is predominantly covered by bedrock outcrops interspersed with glacial till (unsorted deposits of boulders/gravel/mud). Sand and gravel deposits from outwash deltas and meltwater channels and pockets of organic terrain (peat and muck occurring as bogs, muskegs, low-lying floodplains and lakeshore swamps) are also found. The predominant land use is forest.

The Hydrology RSA includes the Seine River downstream from the Raft Lake Cut to Rainy Lake and is included in the discussion on regional watersheds as described in the Hydrology TSD.

3.2.6.2 Methods

The assessment of existing hydrological conditions was completed through collection and evaluation of primary (field collected) and secondary data as described in the Hydrology TSD.

A total of 13 flow monitoring stations were installed to gauge flows in the local scale watercourses. These stations were operated for a period of two years from August 2010 to August 2012. Year-round monitoring of flows in the site scale watercourses draining these watersheds was not considered practical given the number of streams and their small drainage areas (6.3 km^2 and less). Instead, surveys of the watercourses were completed in May and August 2012, and were limited to the reach 200 m upstream of the mouth of each watercourse.

Daily mean outflows from Lac des Mille Lacs at Lac des Mille Lacs Dam and from the Upper Marmion Reservoir at Raft Lake Dam on the Seine River are monitored by Valerie Falls Limited Partnership (Brookfield Renewable Energy Group) and H2O Power LP respectively as part of compliance monitoring under the 2004 to 2014 Seine River Water Management Plan and were evaluated as part of the assessment.

Field studies for monitoring of lake water levels consisted of the installation and operation of five lake water level monitoring stations in local scale water bodies (Figure 3-15) for a period of two years from August 2010 to August 2012. Daily mean water levels for Lac des Mille Lacs and the Upper Marmion Reservoir are also monitored as part of compliance monitoring under the 2004 to 2014 Seine River Water Management Plan.

Based on the primary monitoring data collected specifically for the Project and review of secondary data collected at nearby regional scale hydrometric stations operated by Environment Canada and waterpower companies, the existing stream flow and lake level regimes were characterized in terms of the monthly and seasonal fluctuations in flows and levels and the year-to-year variability.

Field and desktop studies were also carried out to classify navigable water that may be affected by the Project. The navigable water classification was based on the 2009 Minor Works and Waters Order (*Navigable Waters Protection Act*).

3.2.6.3 Results

Existing hydrologic conditions are described in terms of the three subcomponents: streamflows, lake water levels and navigability. Information on annual means, seasonal means and monthly means is provided for streamflows and water levels.

Streamflows

The assessment of the existing flow regime focuses on the watercourses within the MSA that would be directly affected by the development of the mine and associated infrastructure, as well as watercourses in the Hydrology LSA that would be indirectly affected by the Project. The assessment considers the contribution of these watersheds to the inflows to Upper Marmion Reservoir, and consequently the outflows from Upper Marmion Reservoir at Raft Lake Cut.

The results of the description of the existing streamflow conditions provided in this section can be summarized as follows:

- Of the 12 site-scale watercourses directly affected by the Project, only three are perennial (watercourses I, Q and AF). The remaining are intermittent/ephemeral streams and cease flowing for weeks or months each year or flow only for hours or days following a snowmelt/rainfall event.

- Average annual unit runoff rates for site and local scale watersheds in the range 6 to 11 L/s/km² is expected.
- Flows are expected to be highest during the spring (40-57% of annual unit runoff) as a result of the freshet (snowmelt and spring rains), and lowest during the winter (6%-21% of annual unit runoff) due to diminishing baseflows.
- The monthly distribution of flows follows a weak bimodal pattern with a primary peak in May and a small secondary peak in October.

Details on these conclusions are provided in the following paragraphs in terms of annual mean flows, seasonal mean flows, and monthly mean flows. A reader who does not wish to review this detail may skip to the section on "Lake Water Levels", below.

In the MSA, 12 watercourses B, I, J, K, L, Q, R, AB, AD, AF, AH and AI may be affected (Figure 3-16). Watercourses B and R were included in the local scale flow monitoring program and correspond to stations SW-11 (Sawbill Bay East Tributary) and SW-12 (Lizard Lake West Tributary) respectively.

In the Hydrology LSA, two watercourses lie within the Project Site and are indirectly affected by Project activities:

- Sawbill Creek above Sawbill Bay (SW-01).
- Lumby Creek above Lizard Lake (SW-02A) and below Lizard Lake (SW-03).

The Project will affect Upper Marmion Reservoir inflows and consequently may have an effect on regulated outflows from Raft Lake Dam under the 2004 to 2014 Seine River Water Management Plan. The MSA includes 29 site scale watersheds (Figure 3-13) covering a total drainage area of 2,812 ha. The total drainage area to Raft Lake Dam on the Upper Marmion Reservoir is 442,575 ha (when separated from Lower Marmion Reservoir) and 458,145 ha (when they are operated as a single water body). Thus, the site scale watersheds represent 0.64% of the total drainage area to Upper Marmion Reservoir (excluding the reservoir surface area).

Annual Mean Flows

Mean annual flows in 15 watercourses in the MSA and the Hydrology LSA are presented in Table 3-18 along with the total Upper Marmion Reservoir inflows. The table shows the estimated long-term average and range of annual (September to August) mean flows.

The total mean annual flow in the 12 site scale watercourses (I to AI) within the MSA was calculated as 0.149 m^3/s. By comparison, the average annual inflow from 2005 to 2010 to the Upper Marmion Reservoir was estimated as 32.1 m^3/s. As such, the MSA watercourses represent approximately 0.4% of the mean annual flow at the Raft Lake Dam.

Seasonal Mean Flows

Table 3-19 shows the estimated long-term average seasonal mean flows in the MSA and Hydrology LSA watercourses directly affected by the Project, with Upper Marmion Reservoir inflows shown for comparison.

Monthly Mean Flows

Table 3-20 shows the estimated long-term average monthly mean flows in the watercourses of interest.

Lake Water Levels

The assessment of the existing lake water level regime focuses on five water bodies within the MSA since these would be directly affected by the development of the mine and associated infrastructure, and on two waterbodies in the Hydrology LSA which are indirectly affected by the Project.

In the MSA, the five water bodies of interest are:

- Mitta Lake (API #12), located within the footprint of the west pit.
- Unnamed Lake 1 (API #13), which is to be used as the mine water emergency spill pond.
- Unnamed Lake 3 (API #11), located within the footprint of the waste rock stockpile.
- Unnamed Lake 4 (API #2), located within the footprints of the base case and Alternative #1 tailings management facilities.
- Unnamed Lake 5 (API #8), located to the east of the base case and Alternative #1 tailings management facilities.

In the Hydrology LSA, the water bodies of interest are:

- Lizard Lake situated southeast of the base case and Alternative #1 tailings management facilities and northwest of the Alternative #2 tailings management facility.
- Upper Marmion Reservoir which surrounds the Project to the west and south.

The results of the description of the existing lake water level conditions provided in this section can be summarized as follows:

- In unregulated lakes, the highest lake water levels occur during the spring in response to the freshet, and the lowest in the winter due to diminishing baseflows. May represents the month with the highest water levels, and February the month with the lowest water levels.
- Lake water levels in Upper and Lower Marmion reservoirs are highest in the summer (June/July) and lowest in the winter (March).
- Fluctuations in lake water levels in Upper Marmion Reservoir are greater than those in unregulated lakes. The average annual range in daily mean lake water levels in Upper Marmion Reservoir was 2.27 m, under the 2004 to 2014 Seine River Water Management Plan, which is greater than that observed in unregulated lakes (1.600 m in Little Turtle Lake near Mine Centre and 1.555 m in Lac La Croix at Campbell's Camp).
- Fluctuations in lake water levels in Lower Marmion Reservoir are less than those in unregulated lakes. The average annual range in daily mean lake water levels in Lower Marmion Reservoir was 0.55 m between 2004 and 2012, which is lower than that observed in Upper Marmion Reservoir.

Details on these conclusions are provided in the following paragraphs in terms of annual mean lake water levels, seasonal mean lake water levels and monthly mean lake water levels.

Annual Mean Lake Water Levels

Table 3-21 shows the estimated long-term average and range of annual mean lake water levels for the affected water bodies.

Seasonal Mean Lake Water Levels

Table 3-22 shows the estimated long-term average seasonal mean water levels in the water bodies of interest. Lake water levels are highest in the spring in the unregulated lakes and in the summer in the Upper and Lower Marmion Reservoirs. Lake water levels are lowest in the winter in both the unregulated lakes and Upper and Lower Marmion Reservoirs.

Monthly Mean Lake Water Levels

Table 3-23 shows the long-term average monthly mean water levels in the affected water bodies. In the unregulated lakes, lake water levels are highest in May and lowest in February. In Upper and Lower Marmion Reservoir, lake water levels are highest in June/July and lowest in March.

The monthly patterns for lake water levels in Upper and Lower Marmion Reservoir reflect the management of water levels in the reservoirs: water is drawn down between November and March to generate power and to provide storage capacity for the spring melt. Water levels are rising from April to June/July in response to the spring runoff and to enhance walleye spawning opportunities and success. Water level fluctuations in the Lower Marmion Reservoir are lower than those in the Upper Marmion Reservoir: water levels in the former are maintained to provide suction head to cooling water pumps for the Atikokan Generating Station.

Figure 3-17 shows the long-term average monthly mean lake water levels in regional scale water bodies, expressed as fluctuations about the long-term average annual mean lake water levels for the same water bodies. The fluctuation in lake water levels in Upper Marmion Reservoir is markedly greater than those observed in the unregulated lakes.

Navigability

Version 3 Update: Clarification regarding traditional land uses and navigable transportation routes are provided in responses to T-25, T(2)-14 and T(3)-03.

Table 3-24 presents a summary of the watercourses and water bodies that were included in field and desktop assessments to determine the navigability classification under existing conditions.

A total of 91 sites were considered in the combined field and desktop assessment. Of these, 30 sites may be classified as minor navigable waters based on Transport Canada's screening process, 20 may be subject to the Transport Canada application process and 41 sites could not be assessed due to insufficient information. For the unassessed sites, an assessment for navigability will be carried out at the Project application stage, as required, to comply with Transport Canada's screening process.

3.2.7 Hydrogeology

Version 3 Update: Additional hydrogeological data in the area of the TMF was collected in 2016 to support supplemental hydrogeological analyses. This supplemental hydrogeological baseline data is provided in the response to T(3)-08.

Response to T-41 provides supplemental information with respect to baseline hydrogeological conditions.

Hydrogeology consists of groundwater quality and flow. The geological conditions described in Section 3.2.1 influence the hydrogeology of the Project Site.

3.2.7.1 Study Area

The hydrogeology study area is primarily in the immediate vicinity of the Mine and Project facilities due to the low hydraulic conductivity of the underlying bedrock and is defined in more detail in the Hydrogeology TSD. The Project is expected to influence groundwater conditions within the peninsula on which the open pits and Project infrastructure will be located. Therefore, the hydrogeological component includes only a Hydrogeology LSA (Figure 2-2G).

3.2.7.2 Methods

Groundwater quality and quantity were investigated through a hydrogeological work plan initiated in February 2011. Existing groundwater conditions are based on boreholes drilled between March 17 and May 2, 2011 at 34 locations for the purpose of collecting information about the subsurface material and to facilitate the installation of monitoring wells.

A total of 49 boreholes were drilled in overburden and shallow bedrock at 34 locations within the Hydrogeology LSA between March 17, 2011 and August 21, 2012. Borehole depths ranged from 1.5 to 28.9 m with an average drilled depth of 8.7 m. At most locations, a borehole was advanced some metres into the bedrock and a second (adjacent) borehole advanced to the overburden/bedrock contact or into the uppermost section of the bedrock where no overburden was present. Monitoring wells were installed in 47 of the 49 boreholes drilled.

Monitoring well nests were constructed with screened intervals set in the upper (shallow) bedrock and in the adjacent borehole at the bedrock/overburden contact or in overburden soils where a sufficient thickness of saturated overburden was present. Monitoring well nests were installed with the shallow screen set at depths of generally less than 10 m and the deeper screen set between 15 to 20 m depths.

Borehole and monitoring well locations are shown in Figures 3-18 and 3-19.

The Hydrogeology TSD provides estimates of hydraulic conductivity for select samples of granular overburden materials derived using the Hazen method. Estimates of hydraulic conductivity from single well response tests carried out in monitoring wells screened in overburden and shallow bedrock are provided in the Hydrogeology TSD. Estimates of hydraulic conductivity from packer tests completed during the 2010 geotechnical investigation are also provided in the Hydrogeology TSD.

3.2.7.3 Results

Following an initial overview of the bedrock and surficial geology, the results of the hydrogeological characterization are presented in terms of groundwater flow and direction, and groundwater quality.

The results of exploration drilling show the bedrock is dominated by two Shear Zones and splays associated with the MDC. The Shear Zones dip steeply eastward and extend northeast to southwest through the Mine Area with the intervening rock characterized as foliated, extensively quartz veined with some local faulting, fracturing and jointing. These shears are identified as the Upper Shear and Lower Shear and generally bound the mineralized rock. The Upper Shear Zone is about 1 to 5 m wide, comprised generally of brecciated rock with few fracture zones. While the Shear Zones are traceable as continuous structural features, they generally have been infilled/sealed by vein minerals or clay/gouge materials. The Lower Shear contains quartz veining and clay/gouge up to 35 mm thick.

At a geotechnical borehole located near the southwestern end of the peninsula on which the Mine will be located (GT-04) (Figure 3-19) that intersected the upper Shear Zone, a sand seam with a thickness of approximately 0.5 m thickness was encountered. While the Shear Zones are traceable as continuous structural features, they generally have been infilled/sealed by vein minerals or clay/gouge materials and differ little from the surrounding country rock in terms of their hydraulic conductivity.

The youngest geologic materials regionally comprise a thin veneer of organic soils and recent alluvium as well as glacial deposits that accumulated with the progressive retreat of the ice sheet during the end of the Wisconsinan glaciations. It is likely that any earlier deposits have been largely or entirely removed by glacial erosion, which stripped away the pre-existing overburden and eroded the crystalline bedrock in the area. The northward retreat of the ice sheet started approximately 12,000 years ago and the area became ice-free approximately 10,500 years ago (Dyke et al. 2003).

Topographic lows in the southwest portion of the Hydrogeology LSA are typically infilled with glacial till overlain by glaciofluvial deposits and recent alluvium and organic soils. The till is comprised mainly of silt, sand and boulders and rarely exceeds two metres in depth. Bedrock, which is situated at or near the ground surface throughout much of the area, controls the topography and surface drainage conditions.

Overburden materials are comprised of a thin veneer of glacial till or waterlain outwash deposits overlain by organic peat with typical thickness of up to about 2 m encountered in the topographic lows. Within the Mine Area, a bedrock trough with about 8 m of unconsolidated material that includes layered deposits of clay, silt and sand was encountered. This trough extends beyond the northeast end of the Marmion Reservoir where as much as 25 m of unconsolidated material was encountered in the TMF Area. At borehole location BRH-0020, located at the head of a narrow inlet near the upper end of Sawbill Bay close to the proposed location of the TMF (Figure 3-19) these materials comprise layered deposits of clay, silt and sand to approximately 15 m and bouldery sand and gravel to bedrock at a depth of 25 m. The bedrock lows near the perimeter of the TMF Area are typically infilled with organic topsoil overlying layered till deposits comprised of clay, silt, sand and gravel that are generally less than 4 m thick.

Groundwater Flow and Direction

The depth to groundwater throughout the Hydrogeology LSA averages approximately four metres below ground surface (mbgs) and ranges from 32.93 mbgs at areas of higher elevation and steep topography to flowing (above ground level) at lower elevations near swampy areas and lakes. Artesian conditions, as evident by flowing monitoring wells, were encountered at seven monitoring wells generally located at the base of steep slopes.

Groundwater flows outward towards Marmion Reservoir with the exception of the southwest portion of the proposed open pits where locally groundwater flow converges on Mitta Lake. Groundwater flow directions are shown on Figures 3-20, 3-21 and 3-22. Figure 3-21 shows inferred groundwater flow directions and groundwater divide between Mitta Lake and Marmion Reservoir in the vicinity of the west pit. The pattern of groundwater flow provides a subdued reflection of the topography with flow from recharge areas at higher elevation to discharge to Mitta Lake and Marmion Reservoir. Groundwater elevations in the area of the proposed TMF (Figure 3-22) reflect local topography and decrease with proximity to nearby lakes (Marmion Reservoir and Lizard Lake). In general groundwater is recharged at the higher elevation areas and discharges directly to Marmion Reservoir or to other nearby surface water bodies.

The water level in Marmion Reservoir is lowered during the winter to provide for storage of the spring freshet. Groundwater level data have been reviewed to assess the extent to which changes in the level of Marmion Reservoir influence groundwater levels within the Hydrogeology LSA.

The hydrograph for BRH-0009 located along the southern end of the peninsula at the head of a small inlet of Lynxhead Bay (Figure 3-23) shows a near parallel decline in groundwater and reservoir levels after mid-November 2011, with a separation of about 0.15 m, while for the preceding period, groundwater levels were typically about 0.5 m above those of the reservoir and underwent a similar pattern of fluctuations. The near parallel water level trend after mid-November suggests a direct hydraulic connection with the reservoir located at a distance of approximately 91 m from this monitoring well. The similarity of water levels suggests the hydraulic connection between the monitoring well and Marmion Reservoir is relatively permeable.

Approximately 1 km to the west, also along Lynxhead Bay, groundwater levels at BRH-0003B (Figure 3-18), located only 27 m from the reservoir, groundwater levels are about 1 to 2 m above those of the reservoir and follow a generally similar pattern of decline through most of the winter months. However, groundwater levels did not decline for a period of about four weeks during January/February 2012 while reservoir levels continued to decline and thereafter through to the freshet groundwater levels declined at a less steep rate and reservoir levels at a steeper rate relative to the period before January. That the rate of decline of groundwater and reservoir levels diverges through January to the freshet suggests an indirect hydraulic connection, if any, between shallow bedrock and the reservoir at this location. Groundwater levels at higher elevations and ranging in distances from 57 m (BRH-0001 at the west side of the peninsula adjacent to Sawbill Bay) to more than 550 m (BRH-0004 located in the approximate centre of the peninsula in the area of the east pit) from the reservoir show no indication of a hydraulic connection between the upper bedrock and the reservoir.

These data indicate that a relatively permeable direct hydraulic connection between the bedrock and the reservoir is observable at one location only (BRH-0009), located at a distance of approximately 91 m from the shoreline of Marmion Reservoir. Elsewhere, including at monitoring wells located closer to the reservoir, a direct hydraulic connection was not observed. Therefore, the data indicate that the seasonal lowering of the reservoir has only a limited influence on nearby groundwater levels within the shallow bedrock at some locations.

At the southwest section of the TMF in the valley of a small stream draining from the TMF area, a trough of granular material was encountered to depths of approximately 25 m (BRH-0020, Figure 3-19). Groundwater elevations at this monitoring well nest are about two metres above those of the nearby surface water (Sawbill Bay of Upper Marmion Reservoir) and exhibit similar fluctuations. This suggests that overburden groundwater in this area readily discharges to Marmion Reservoir through a permeable pathway in granular materials.

Groundwater recharge areas were noted at relatively high elevations and adjacent to steeply sloping land. Consistent downward (recharge) hydraulic gradients were observed at four locations: at BRH-0001, BRH-0005, BRH-0007 and BRH-0016 (Figure 3-18). Consistent upward (discharge) hydraulic gradients were observed at two nested monitoring wells in the Mine Area (BRH-0002 and BRH-0008). Artesian conditions were observed in the deeper monitoring wells at each of these locations (BRH-0002A and BRH-0008A). Similarly, artesian conditions were observed at a number of exploration boreholes.

Swampy areas and seeps are observed generally near the base of some sloped areas. These features are indicative of groundwater discharge (Figure 3-24).

Measured hydraulic conductivities are consistent with the expected values for given rock types within the various formations and are provided in Table 3-25 for the Mine Area and Table 3-26 for the TMF area.

Limited test data is available for overburden materials at each of the open pit and TMF Areas due to the general lack of continuous overburden in these areas.

To assess the hydraulic characteristics of the fractured bedrock mass influenced by test pumping, composite drawdown plots were prepared (Hydrogeology TSD). The drawdown slopes indicate a low transmissivity for the fractured bedrock, with values ranging from 4 m^2/d to 16 m^2/d.

Pumping test results indicate that some fractures are "open" and form a direct hydraulic connection between the pumping and observation well. Other fractures may be partially infilled and/or form a much less direct hydraulic connection to the observation well. The response to pumping suggests a variable and moderately well interconnected fracture network in the bedrock.

The upper section of the bedrock is variably fractured and comprises the shallow active flow system. This system includes the overburden materials where present and is inferred to extend laterally across the Project Site to a depth of up to 30 m below ground surface.

Groundwater levels in this flow system respond readily to rainfall and most noticeably to snow melt events, as shown on continuous hydrograph records obtained. Detail is provided in Hydrogeology TSD. Flow occurs through a well interconnected fracture network within the upper bedrock (where such fractures are present) with flow directions reflecting local topography. Groundwater discharges locally to Mitta Lake and as seepage at the base of steep slopes, with Upper Marmion Reservoir comprising the ultimate discharge area for the shallow active flow system at the Project Site. Water level measurements collected at about 126 exploration boreholes indicate a relatively uniform pattern of groundwater flow that reflects local topography.

The short-term tests conducted at 46 exploration boreholes indicate moderate to low permeable bedrock across the area of the planned open pit. This is supported by the weakly radial pattern of groundwater level drawdown observed around the two exploration holes at which longer-term pumping tests were conducted. These results indicate the upper fractured bedrock zone is characterised by a moderately well interconnected fracture network.

The variation in transmissivity of between 4 and 16 m^2/d as determined from test pumping likely reflects hydraulic conditions over the full depth of the borehole rather than the upper section of the bedrock only.

In the area of the proposed open pits, thin overburden materials locally may comprise a source of seasonal recharge. In the area of the TMF, thicker overburden deposits provide for lateral flow locally with discharge to nearby surface water as well as providing a source of recharge to the directly underlying fractured bedrock. While groundwater levels respond quickly to recharge and snow melt events, the volume of storage available in the upper fractured rock is low. Given the extent of exposed bedrock, and the limited extent of fine grained overburden materials with high water tables, recharge to the groundwater system is expected to be low. Preliminary estimates of baseflows in streams in the Hydrogeology LSA suggest a recharge rate of between 50 to 100 mm per year (Hydrology TSD).

Groundwater flow in the deep bedrock occurs through a network of joints and fractures that are present primarily between the Shear Zones, including the Ore Zone, and along the Shear Zones where these have not been sealed by vein mineralisation and/or clay/gouge material.

Hydraulic conductivity values for the deeper bedrock ranged from 7.2×10^{-10} to 1.5×10^{-5} m/s with a geometric mean of 3.6×10^{-8} m/s (Table 3-25). The country rock (outside the Shear Zones) appears to display a weak trend to decreasing fracture permeability with increasing depth which is consistent with similar granitic bodies elsewhere in northern Ontario. Where unfractured, the deep bedrock is expected to have a hydraulic conductivity on the order of 10^{-10} m/s.

Fractures and joints are present to a considerable depth between the main Shear Zones where the bulk of the mineralisation is encountered. The presence of these features results in a variably higher hydraulic conductivity, ranging between 1.0×10^{-9} to 1.0×10^{-5} m/s with a geometric mean of 1.9×10^{-7} m/s (Table 3-25). The wide range in hydraulic conductivity values for the rock mass between the Shear Zones indicates the variable extent and degree of interconnection of the fractures and joints.

Groundwater Quality

Bedrock groundwater within the Hydrogeology LSA has as a calcium-bicarbonate type composition and is typified by low major ion concentrations. Concentrations of bicarbonate, the dominant anion, generally range from about 100 to 180 milligrams per litre (mg/L) and average 140 mg/L, while concentrations of calcium, the dominant cation, generally vary between 7.4 to 84 mg/L and average about 40 mg/L. The pH of the groundwater is weakly acidic to near-neutral, ranging from 5.9 to 8.1. Overburden groundwater is generally similar in composition to bedrock groundwater, although higher dissolved and total concentrations of parameters were reported for some samples collected from monitoring wells screened in overburden.

Groundwater quality data within the Hydrogeology LSA have been compared to Ontario Drinking Water Quality Standards (ODWS) and Provincial Water Quality Objectives (PWQO). While PWQOs are applicable to surface waters groundwater quality has been compared to PWQOs recognizing the immediate proximity of surface waters to the Hydrogeology LSA. These comparisons should not be interpreted as an assessment of regulatory compliance. It should be noted that no groundwater supply wells are present in the Hydrogeology LSA and groundwater is not used locally as a source of drinking water.

Generally, pH values were within the ranges specified by the ODWS and PWQOs (6.5 to 8.5). Mercury concentrations were below detection limits in both shallow groundwater and deep groundwater samples (complete groundwater sampling results are provided in the Hydrogeology TSD).

Manganese concentrations were typically greater than the ODWS (0.05 mg/L) in most samples, ranging from less than 0.001 to 7.6 mg/L. Concentrations of dissolved organic carbon (less than 1.0 to 47 mg/L), aluminum (less than 0.05 to 2.7 mg/L) and iron (less than 0.02 to 88 mg/L) were greater than ODWS values (5.0, 0.1 and 0.3 mg/L, respectively) in several of the groundwater samples.

Several parameters, including iron (less than 0.02 to 88 mg/L), tungsten (less than 0.01 to 0.5 mg/L), cobalt (less than 0.0005 to 0.061 mg/) and copper (less than 0.001 to 0.03 mg/L) reported concentrations greater than the PWQO values (0.3, 0.03, 0.0009 and 0.005 mg/L, respectively) in several of the groundwater samples. Other parameters exceeding PWQO values in less than ten samples include aluminum, arsenic, zinc, cadmium, uranium, silver and vanadium. Higher concentrations of aluminum, iron and some of the metals such as copper in groundwater samples are to be expected given that the geochemical assessment has shown that these metals can be leached from most of the rock types present in the Project Site. The presence of these metals in groundwater also has implications for surface waters where groundwater expressed to surface. This would include both streams and wetlands within the Project Site, as well as Upper Marmion Reservoir.

Groundwater quality values are provided in Appendix 3.I of the Hydrogeology TSD.

3.2.8 Water and Sediment Quality

<u>Version 3 Update</u>: Response to MOE SW-10B provides clarification on water quality parameters detection limits. A minor clarification on the water quality survey locations is provided in MOE SW-9B.

3.2.8.1 Study Areas

Regional Study Area: The lake water and sediment quality Regional Study Area (RSA) is delineated in Figure 1-3 of Version 1 of the Lake Water and Sediment Quality TSD. The Project Site is located in Ontario at approximately 150 km west of Thunder Bay and 23 km northeast of the Town of Atikokan. The RSA includes Upper and Lower Marmion Reservoir and the upstream catchment of the Seine River. The RSA extends south to Highway 622. Upper Marmion Reservoir is separated from Lower Marmion Reservoir by a series of dams constructed in the early 1950s (Boileau 2004). Flow between the Upper and Lower Marmion Reservoir is regulated by the Marmion Sluiceway also constructed in the early 1950s. The Seine River is regulated by the Raft Dam located approximately 30 km from the site. The inflow from the Seine River into Upper Marmion Reservoir is also regulated by the Lac Des Mille Lacs Dam (built in 1952) located approximately 80 km upstream of the site (as described in the Hydrology TSD).

3.2.8.2 Local Study Area

The lake water and sediment quality Local Study Area (LSA) is delineated in Figure 1-4 of Version 1 of the Lake Water and Sediment Quality TSD. The Project Site is located on the south-west corner of Sawbill Bay. The Mine is surrounded by Sawbill Bay on the north side and Seine River on the south side. The Seine River forms a series of basins separated by shallow areas collectively called Upper Marmion Reservoir as shown on Figure 1-3 of Version 1 of the Lake Water and Sediment Quality TSD. The LSA extends generally to the middle of Sawbill and Lynxhead Bays of Marmion Reservoir on the west and south sides respectively, the Lizard Lake catchment area to the east is also included. Methods

Water and sediment quality sampling was conducted on a seasonal basis in order to monitor temporal changes in water quality. The sampling locations in the MSA were chosen to reflect specific locations that could be affected by individual Project components such as the open pits, waste rock stockpile, exploration camp, previously proposed alternative tailings management facilities, downstream water users and other infrastructure. Sampling locations within the Water Quality LSA were chosen to characterize the existing environment at locations upstream and downstream of the Project. Sampling was not conducted in the Water Quality RSA since no impacts on water quality were expected in this area.

Sampling has also included assessment of limnological conditions through water column profiling. The baseline study was designed to capture the seasonality of the area and to include low- and high-flow periods. To date, the sampling was performed during:

- September 2010 – Low flow conditions, summer.
- November 2010 – Prior to freeze-up.
- March 2011 – Low flow conditions, minimum temperature.
- June 2011 – Spring freshet.
- April 2012 – Spring freshet.
- August 2012 – Low flow conditions, summer.

Detailed methods related to collection of sediment and water quality data is provided in the Water and Sediment Quality TSD.

Surface water samples were collected from 30 locations for the first four sampling campaigns. While an attempt was made to collect sediment at each of the same 30 surface water locations, rocky substrate prevented sediment collection at some locations. Hence, a total of 19 sediment samples were collected. Eight additional locations (Mitta Lake, Sawbill Bay, Lizard Lake, Light Bay, Hawk Bay, Turtle Bay, Lynxhead Bay and Premier Lake) were sampled to provide a water column profile including both water and sediment quality and limnology.

Sampling at water column profile stations involved the collection of two water samples at each location (one near the top of the water column and one near the bottom of the water column). It was possible to collect sediment samples at each column profile location.

Field parameters (temperature, depth, pH, dissolved oxygen, oxygen-reduction potential, and conductivity) were measured at each surface water grab station, as well as throughout the entire depth of water column profile stations in one-metre intervals. It should be noted that the YSI multiparameter meter malfunctioned during some field events, resulting in reported values that were unrealistic and outside of an acceptable range. These values were removed from the complete data set and have been noted in the Water and Sediment Quality TSD.

Measurements of pH, oxygen-reduction potential (ORP), temperature, electrical conductivity and dissolved oxygen (DO) were collected in the field at the time of sampling using a YSI multiparameter meter (YSI). The YSI meter was calibrated by the supplier and in the field with calibration solutions provided by the supplier. Calibration for pH (two points: 4 and 7), electrical conductivity and ORP was carried out daily before sampling and documented in field notes. The YSI was placed downstream to equilibrate during the sampling procedure before measured parameters were recorded.

Water was collected approximately one metre below surface and one metre above lakebed using an eight-litre capacity plastic Van Dorn water sampler. Field parameter measurements were collected using the YSI in one-metre intervals from the surface of the water column to the lakebed. Water samples not requiring filtration (general parameter, major ions, nutrients, organics, microorganisms, total metals and total organic carbon) were decanted to individual sample bottles from a clean 500 mL sample bottle (rinsed three times with sample water). Samples requiring filtration (dissolved metals, dissolved organic carbon and dissolved inorganic carbon) were collected with a sterile syringe and passed through a 0.45 µm sterile filter into individual sample bottles.

Sediment at surface water stations was collected from the river/stream bed either by hand (gloved) or by scooping sediment using laboratory-provided glass sediment jars. Sediment at water column profile stations was collected using a stainless steel Petit Ponar dredge sampler.

Water and sediment samples were analyzed at ALS Thunder Bay for all sampling events. Surface water quality samples were submitted for the following analysis:

- **Physical Parameters:** pH, acidity, alkalinity, conductivity, hardness, temperature, total dissolved solids, total suspended solids, total organic carbon (TOC) and dissolved organic carbon (DOC).
- **Major Ions:** calcium, magnesium, potassium, sodium, sulphate, chloride, fluoride and cyanide (free and total).
- **Nutrients:** nitrate, nitrite, ammonia (total and un-ionized), total phosphorus and orthophosphate.
- **Organics:** oil and grease and phenols.
- **Microorganisms:** E coli and total coliform.
- **Metals:** total and dissolved metals (mg/L) including aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium(III), chromium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, tungsten, uranium, vanadium, zinc, and zirconium.

Sediment quality samples were submitted for the following analysis:

- **Metals** – total metals (mg/kg) including aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, calcium, chromium, cobalt, copper, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, phosphorus, potassium, selenium, silver, sodium, strontium, thallium, tin, titanium , uranium, vanadium, zinc, and zirconium.
- **Polycyclic Aromatic Hydrocarbons (PAHs)** (mg/kg) including 1-Methylnaphthalene, 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Acridine, Anthracene, Benz(a)anthracene, Benzo(b&j)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Benzo(a)pyrene, Chrysene, Dibenzo(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene, Pyrene, and Quinoline.
- **Polychlorinated Biphenyls (PCBs)** (mg/kg) including Aroclor 1254, Total PCBs, 2-Fluorobiphenyl, p-Terphenyl d14, Aroclor 1242, Aroclor 1248, Aroclor 1260, d14-Terphenyl, and Silicon.

3.2.8.3 Results

Water quality data from the numerous sampling campaigns is presented in the Water and Sediment Quality TSD. Sediment quality data are also presented in the Water and Sediment Quality TSD.

The following paragraphs provide a summary of both groundwater and surface water quality.

Water quality data indicate that similar conditions exist throughout the waterbodies and watercourses in the MSA, and that these are governed by local geological conditions (i.e., the shield geology that contributes aluminum and iron to local waterbodies), and the presence of wetlands that contribute to fluctuations in pH.

Geochemical testing, soils quality data, and groundwater quality data all show that aluminum and iron, as well as some other metals are present in leachate samples from all rock types, in soils at above average concentrations for aluminum, and also present in groundwater samples. All of these are potential sources that can and likely have influenced water quality in Project Site lakes and streams.

The larger lakes within the system show distinct thermal stratification during the summer months that results in a decrease in bottom oxygen levels that in turn drives mobility of the major metals, aluminum, iron and manganese from sediments during periods of low oxygen as a consequence of redox changes in the bottom waters. None of the larger bodies of water, such as Sawbill Bay, Lynxhead Bay and Lizard Lake appear to experience anoxic conditions in the deeper basins, likely a combination of two influences: the larger surface area that promotes wind-driven mixing of the water column, and the flow of water through these systems. These lakes also show evidence of oxygen reduction during the winter months when ice cover prevents mixing of the water column. These lakes also receive tributary inflows of slightly lower pH waters that are also slightly enriched in aluminum and iron, and in some cases, silver and mercury. The combination of local geologic sources and natural stratification of these lakes determines the fluctuations in aluminum and iron levels in these waterbodies.

Under oxic conditions, the aluminium, iron and manganese complexes (hydroxides and oxides) in sediment are relatively stable. However, as oxygen levels decrease in bottoms waters and a reducing environment develops, the iron and manganese hydroxides undergo reductive dissolution with the result that the aluminium, iron and manganese are released to the pore water as the oxygen is consumed.

The changes in redox during lake turnover may result in cycling between oxic to anoxic conditions. These changes in redox, as lakes stratify in summer, and in some cases in winter, as oxygen levels decrease are a major factor in the cycling (binding and release) of metals such as aluminum, iron and manganese in freshwater systems (Wetzel 1975).

Conditions in Mitta Lake differ in that oxygen concentrations in the bottom waters of the lake decrease to very low levels both during summer stratification, and in winter under-ice conditions. The small surface area of the lake limits wind-driven mixing of the water column, and as a result this lake is more susceptible to oxygen depletion.

Occasional exceedances of the CWQG and/or PWQO for mercury were noted in some waterbodies. Since the geochemical testing has indicated that the rock types present do not leach mercury, sources related to atmospheric deposition and release from wetlands are postulated as the reasons for the occasional detection of mercury at concentrations above detection limits. Similarly, there were occasional exceedances of the PWQO for cobalt and cadmium, though these are likely from geological sources. The geochemical testing has shown that both can leach from some of the rock types tested.

Concentrations of other metals are typically low in all the lakes and streams within the Upper Marmion Reservoir system, and there is little evidence of internal cycling of metals in conjunction with the cycling of aluminum and iron. The lack of any historical development within the watershed is reflected in the low concentrations of metals in the surface waters.

The following sub-sections present detailed information on water quality in the MSA and Water Quality LSA, including water quality in the larger waterbodies. A reader not wishing to review this detailed description may skip to Section 3.2.8.3.9 "*Sediment Quality*."

Tables 3-27 and 3-28 present a summary of baseline water quality that exceeds receiving water guideline values.

3.2.8.3.1 Mitta Lake Water Quality

Mitta Lake is a small irregularly shaped lake within the MSA perched on the peninsula on which the Project will be located (Figure 3-25). Mitta Lake lies directly over the gold deposit, and will be eliminated when mining commences. Mitta Lake is a small waterbody of 17.1 ha in size. The lake is steeply sided, and consists of three deeper basins, which reach a maximum depth of 16. Figure 3-26 shows the bathymetry of the lake.

Water column profiling was undertaken in the deeper basin of the lake (shown on Figure 3-25 as HRWQP-1). The lake undergoes stratification during the late summer as indicated by the strong temperature gradient between surface and bottom and the low dissolved oxygen concentrations below the thermocline that forms at approximately the 6 m depth (Figure 3-27). While a strong thermocline does not appear to form in late winter, the depletion of dissolved oxygen with progressive depth indicates there is minimal mixing of the water column during the winter. Bottom water dissolved oxygen concentrations decrease to less than 1 mg/L during the late summer and late winter. Fall turnover results in complete mixing of the water column. In November 2010, water column temperature was isothermal at approximately 6°C, with dissolved oxygen concentrations at approximately 10 mg/L. Figure 3-27 shows that dissolved oxygen concentrations in the deeper basins were slightly lower than the mixed water column and suggest the deepest basins may be resistant to full turnover. By late winter, water column temperature had decreased to approximately 4°C, with near-surface waters somewhat colder. The data indicate that while temperatures in the water column are near isothermal, full mixing of the water column has not occurred based on the dissolved oxygen concentrations.

Water column data shows that pH ranged between 6.0 and 7.9 throughout the study period, and was generally higher in the surface waters compared to the near bottom waters. Levels between surface and bottom waters were most similar in the fall after turnover, and then began to diverge as winter oxygen depletion affected bottom waters, and continued to decrease in summer as thermal stratification became established.

Concentrations of nearly all metals, with the exception of aluminum and iron were below PWQOs and CWQGs in Mitta Lake during all sampling campaigns. Concentrations of both of these metals were naturally higher due to local geological conditions (aluminum and iron are major constituents of the shield rock), since there have been no historical influences on Mitta Lake from any anthropogenic sources. Sections 3.2.2 to 3.2.4, which provide a discussion of the geology, geochemistry, terrain and soil existing conditions, show aluminum as a major constituent of local bedrock, while the results of soil sampling show high levels of aluminum in soils. The leach test results in Sections 3.2.2 to 3.2.4 also show that aluminum is readily leached from the rock, while groundwater monitoring (Hydrogeology TSD) shows elevated levels of aluminum and iron also occur in groundwater. Based on this data, it is considered that existing geologic sources and natural weathering processes are responsible for elevated aluminum and iron concentrations in surface waters.

Concentrations of most metals showed little seasonal fluctuation, and also showed little change with depth. Aluminum, manganese and iron concentrations showed both seasonal changes and changes with depth. During late summer (September 2010) concentrations of aluminum, iron and manganese in bottom waters was higher than in the surface waters. This coincided with the maximum period of stratification when dissolved oxygen concentrations had decreased to 0.55 mg/L in the bottom waters (near surface D.O. was 9.1 mg/L). The decreased oxygen and resultant change in redox that would accompany the low oxygen levels would be a major factor driving the release of aluminum, manganese and iron from sediments, which would result in an increase in bottom water concentrations. The stratification would prevent mixing of the bottom waters with surface waters, and would account for the observed differences in concentrations. Lake turnover in November 2010, resulted in similar concentrations of these three metals at surface and near bottom, an indication that the water column had fully mixed. During this period there was also much less difference in dissolved oxygen concentrations between surface (10.4 mg/L) and near bottom (7.3 mg/L). The increase in oxygenation of the bottom waters would also reduce the mobility of these metals from sediments.

Sampling in March 2011 indicates that during winter there is severe depletion of oxygen in the bottom waters (D.O. decreased to 1.14 mg/L compared to 11.3 mg/L at surface), which again would have facilitated the release of aluminum, iron and manganese from sediments, resulting in an increase in the concentrations of these metals in the bottom waters. While approximately 50% of the aluminum occurred in the “dissolved” phase (i.e., as defined by the filtered water samples) over 80% of the manganese and iron were present in the dissolved phase, suggesting that release of these metals from sediments as a result of changes in redox is the major source. As stratification became established in the summer of 2011, concentrations of these metals in bottom waters continued to increase as dissolved oxygen concentrations remained low.

A similar result was observed in the April 2012 results, which again indicate that during the winter, oxygen concentrations in the bottom waters becomes depleted and the concentrations of these metals increase as a result of the change in redox. All three metals reached their highest concentrations during this period. The August 2012 results show that during this period, dissolved oxygen concentrations reached their lower concentration (0.48 mg/L).

The changes in oxygen levels and redox appear to have little influence on the concentrations of the other metals, and there was little change in concentrations in near surface samples compared to near bottom samples. It is likely that low concentrations of these metals in sediments provide a small reservoir of these metals for release to the water column during periods of change in redox.

The results indicate that concentrations of the three metals naturally fluctuate in the bottom waters as dissolved oxygen levels and redox conditions change as a result of stratification of the lake in both summer and in winter under the ice cover. Conditions appear to change only in late fall when the lake undergoes turnover, and oxygen levels increase in the bottom waters, resulting in mixing of the water column, and change in redox that reduce the flux of aluminum, iron and manganese from sediments.

Concentrations of other metals were generally below the PWQOs and CWQGs, though mercury concentrations in one sample exceeded the CWQG. The higher mercury concentration was recorded only in the near-surface sample in March 2011, and may be related to snow melt. Atmospheric deposition of mercury has been recognized as a major source of mercury affecting northern lakes and streams (Watras and Morrison 2008).

3.2.8.3.2 Lizard Lake Water Quality

Lizard Lake is a long narrow lake that lies directly east of the proposed TMF, within the LSA. The lake consists of two separate basins connected by a narrow causeway (Figure 3-28). The northern basin consists of a long narrow relatively shallow basin that reaches a maximum depth of 8 m at the southern end. The southern basin is larger and consists of a shallow northern basin of approximately 6 m depth, and a deep southern basin that reaches a maximum depth of approximately 19 m.

Water column profiling was undertaken in the shallower northern end of the southern basin (shown on Figure 3-25 as HRWQP-3). Due to the shallow depth of this basin, the lake does not appear to thermally stratify in summer, but rather, the entire water column warms (Figure 3-29). While there is indication of weak thermal stratification, with surface temperatures reaching approximately 17°C in June 2011, bottom temperatures also increased to 12°C. Isothermal conditions occurred in late fall (November 2010) indicating that full mixing of the relatively shallower areas of the lakes had occurred. Oxygen concentrations remained high during both summer and fall, and were generally above 9 mg/L throughout the water column.

Lizard Lake drains via an outlet to the south that flows through a narrow channel to the north end of Turtle Bay, one of the many embayments that form Upper Marmion Reservoir.

Water quality parameters in Lizard Lake during all sampling periods were below PWQOs and CWQGs except for occasional increases in aluminum concentrations. In the shallower areas of Lizard Lake where water samples were collected at both near surface and near bottom (5 m depth) little variation was observed in metals concentrations between surface and bottom samples. The high dissolved oxygen concentrations at both near surface (ranged from 9.01 to 12.3 mg/L) and near bottom (ranged from 7.6 to 12.1 mg/L) during all sampling seasons would preclude conditions where fluctuations in metals concentrations would be expected in the bottom waters. Slight variations were observed only for aluminum, iron and manganese in surface waters on a seasonal basis, that are most likely related to seasonal changes in tributary stream water quality (concentrations of aluminum, iron and manganese were generally higher in these streams (Water and Sediment Quality TSD).

3.2.8.3.3 Turtle Bay Water Quality

Turtle Bay is a larger basin that is connected through two narrow channels to the main flow path of the Seine River that in its current managed state forms Upper Marmion Reservoir. It is located within the LSA. The upper end of Turtle Bay is a shallow waterbody that grades to wetland in areas along the margins. Lizard Lake drains to Turtle Bay via a narrow channel that flows into the north end of Turtle Bay. As a result, the upper end of Turtle Bay is affected by water quality in Lizard Lake, while the lower end is influenced by both Lizard Lake and the Seine River. A narrow channel connects the upper bay to the main body of the bay, of which the eastern arm is known as Flood Bay. The main basin reaches a maximum depth of approximately 10 m (Figure 3-30). Water column profiling was undertaken in shallower areas of the bay (shown on Figure 3-25 as HRWQP-6) and is provided on Figure 3-31.

Turtle Bay drains via two narrow channels at the south end of the bay to the main stem of the Seine River/ Upper Marmion Reservoir. The system flows to the west and drains to Lynxhead Bay, the next large bay, through a narrow channel (Figure 3-25).

Water quality in Turtle Bay shows no exceedances of PWQOs or CWQGs with the exception of isolated exceedances of the guideline for aluminum and iron. As such, water quality in Turtle Bay differs little from water quality in Lizard Lake. It is worth noting that silver concentrations in both surface and bottom water samples on occasion were at, or slightly above the PWQO. Since there is no development in the watershed that could account for the higher silver concentrations, these are considered to be naturally occurring, and suggests local geological conditions would be the source of the silver. The higher silver concentrations are consistent with the results of the geochemical testing that showed potential leaching of silver from some of the rock types. Mercury concentrations were generally below detection limits, though the concentration in the near-surface sample in June 2011 exceeded both the CWQG and the PWQO.

3.2.8.3.4 Lynxhead Bay Water Quality

Lynxhead Bay of Upper Marmion Reservoir, located within the LSA, is formed from a widening of the Seine River and lies adjacent to the south end of the proposed mine site (Figure 3-25). Lynxhead Bay consists of a single deep basin that reaches a maximum depth of approximately 32 m (Figure 3-32). The Bay contains a number of smaller bays, the largest of which forms an extension of the Lynxhead Bay to the east.

Water column profiling was conducted to a depth of 12 m in the western end of the deep central basin (the water column profile location is shown on Figure 3-25, identified as HRWQP-7). The data indicate that the basin stratifies during the summer months with the thermocline beginning at approximately the 11 m depth, but appears to undergo full water column mixing during the fall turnover (Figure 3-33). Dissolved oxygen concentrations remain high in the summer to depths of approximately 11 m, and then begin to decrease. Spring 2012 data (April) indicate that the water column was isothermal, and suggest there had been a slight depression in dissolved oxygen concentrations with depth over the winter months.

Similar to the other basins, concentrations of aluminum, iron and manganese show slight fluctuations seasonally with minor increases occurring in the summer months. Concentrations also fluctuate with depth as a result of changes in dissolved oxygen concentrations, with concentrations in the bottom water increasing slightly during the summer and also late winter compared to near surface waters. The largest increase in all three parameters was noted in August 2012, when dissolved oxygen concentrations in the bottom waters decreased to 5.21 mg/L, the lowest concentration measured. As with the other deeper basins, decreases in oxygen levels in the bottom waters during summer stratification results in an increase in concentrations of these metals as redox conditions change, and flux of metals from sediments is favoured.

As noted in both Turtle Bay and Sawbill Bay (see following section) silver concentrations in surface waters are slightly elevated due to natural sources and on occasion are at or slightly above the PWQO.

Lynxhead Bay drains to the west and southwest through two channels that, through a series of other larger bays ultimately drains via the Raft Lake Cut to Findlayson Lake. The western channel is also one of the two channels that drain Sawbill Bay, which lies to the north, and forms the western boundary of the Project Site.

3.2.8.3.5 Sawbill Bay Water Quality

Sawbill Bay is the largest body of open water in the Project Site (Figure 3-32), and is located within the LSA. Sawbill Bay forms the western boundary of the Project site, and was formed by the flooding of Sawbill Lake during construction of the Upper Marmion Reservoir. The bay is approximately 7 km long, up to approximately 3 km wide and reaches a maximum depth of approximately 28 m in the central area of the lake (Figure 3-32).

Water column profiling was undertaken in the large open central basin of the bay (shown on Figure 3-25 as HRWQP-2). The data indicate that the bay stratifies in late summer at approximately the 12 m depth, below which both temperatures and oxygen concentrations decrease (Figure 3-34). Oxygen concentrations in the bottom waters reached a low of 4 mg/L in September 2011, indicating that bottom waters still remained oxygenated under late summer conditions. The data for the fall indicates that full turnover of the basin occurs.

Figure 3-34 shows that by November 2011, water column temperatures were isothermal, and dissolved oxygen concentrations were consistently above 10 mg/L throughout the full depth of the water column. Data for April 2012 show that water column temperatures were isothermal throughout the water column but that dissolved oxygen concentrations were generally above 8 mg/L except for a section of the water column between 12 m and 16 m where concentrations decreased to a low of 6 mg/L. Water column pH also decreased below the 12 m depth, and the two profiles suggest that there is separate mixing in the bottom waters (greater than 12 m depth) and surface waters (less than 12 m depth) during the winter, suggesting that freshwater inflows may be influencing the bottom waters during the winter months, replenishing dissolved oxygen levels.

Concentrations of metals in Sawbill Bay were also below PWQOs/CWQGs for most parameters, with again aluminum, and occasionally iron slightly exceeding the guidelines. Comparison of surface waters with bottom waters shows that aluminum, iron and manganese concentrations in bottom waters increased during the summer as weak stratification was established in the water column. Fall turnover resulted in near uniform conditions in the water column. Dissolved oxygen concentrations in surface and bottom waters showed less variation that in the other deep basins, likely a consequence of the weak stratification in this basin. The large open water area would favour wind-driven mixing to a greater extent than in the other smaller basins, and likely accounts for the observed similarity of oxygen levels and the weak stratification.

3.2.8.3.6 Upper Marmion Reservoir Downstream of Sawbill Bay and Lynxhead Bay – Water Quality

Two locations were monitored downstream of the confluence of the outflow of Sawbill Bay and Lynxhead Bay, both of which are located within the LSA. The first location was approximately 2 km downstream of the confluence (location HRWQ13, See Water and Sediment Quality TSD), and the second was near the Raft Lake Cut (HRWQ22, Figure 3-25) where Upper Marmion Reservoir discharges to Findlayson Lake at the Raft Lake Dam.

Water quality at both sampling locations was similar to water quality in Sawbill Bay and Lynxhead Bay, with aluminum, iron and occasionally silver concentrations in excess of the PWQO values. Fluctuations in aluminum and iron concentrations paralleled the changes in Sawbill Bay and Lynxhead Bay. Since the Upper Marmion Reservoir drains to the west through these locations, the similarity with upstream concentrations is expected.

3.2.8.3.7 Hawk Bay Water Quality

Hawk Bay is located upstream of the Project Site in the Seine River watershed (HRWQP5, Figure 3-25). Hawk Bay is located upstream of any watercourse that could be affected by the operation of the Project, and is included as an upstream reference both for assessing existing conditions and for future monitoring during operations and closure.

Hawk Bay forms a smaller basin of approximately 3 km by 2 km in the Seine River system. The bay has a maximum depth of 15 m. The water column showed weak evidence of thermal stratification in the summer of 2010 (Figure 3-30) when a thermocline appeared to form at the 11 m depth, and a stronger temperature gradient in 2011. Dissolved oxygen concentrations showed a decrease in the deepest basin in 2010, but little change in 2011. Full mixing of the water column appears to occur in the late fall.

During summer stratification, dissolved oxygen concentrations in the near bottom waters decrease to low levels (less than 1 mg/L in August 2012). Bottom waters show consistently higher concentrations of aluminum and iron, similar to the other deep basins in the system. The data from November 2010 indicate that during fall turnover concentrations of aluminum and iron remain elevated compared to surface waters, though temperature, pH and dissolved oxygen levels indicate that there has been full mixing of the water column. However, like the other deeper basins, there is no concurrent increase in concentrations of other metals in the bottom waters as compared to near surface waters (though silver concentrations were slightly above PWQOs in both surface and near bottom waters. Occasional exceedances were also noted for mercury in near surface samples in June 2011, suggesting that there may be upstream sources of mercury to the system as well. Mercury could originate from both geological sources, as well as wetlands that act as sources of mercury to aquatic systems.

3.2.8.3.8 Tributary Streams Water Quality

A number of small streams drain from the MSA and Water Quality LSA, the largest of which drain from the TMF Area.

The Lumby Creek system is the largest tributary within the Water Quality LSA. Lumby Creek drains the area to the northeast of the proposed TMF through a series of small lakes, emptying into Lizard Lake near the south end of the north basin. Water quality at the outlet of this stream (HRWQ7, Figure 3-25), was characterized by slightly lower pH than was observed in the lake samples (ranged from 6.25 to 6.81, with a single occurrence above 7 (7.3) in September 2010). The lowest pH was accompanied by low D.O. (1.27 mg/L) in August 2012, and also higher concentrations of aluminum and iron. The data suggest that water quality at this location is influenced by the small lakes within the drainage area, and that low D.O. in these lakes has influenced water quality in the outlet stream. None of the other metals exceeded PWQOs or CWQGs.

The other larger stream drains from the proposed TMF to the west, emptying into the east side of Sawbill Bay at the head of a small inlet at the northeast end of the bay (HRWQ4, Figure 3-25). This system was characterized by circumneutral pH (range 6.6 to 7.7, with the majority of measurements above 7.0) and generally high dissolved oxygen concentrations. Aluminum and iron were again the only metals that on occasion exceeded guidelines, and showed similar fluctuation as in the lakes and other streams.

A number of smaller tributaries, many of which are intermittent in flow, drain from the MSA to Sawbill Bay, Lynxhead Bay or Lizard Lake. Three small tributaries drain from the west side of the Project Site to Sawbill Bay (HRWQ2, HRWQ3, HRWQ25 and HRWQ6, Figure 3-25). In addition, samples were collected at the mouth of a larger inlet to Sawbill Bay (HRWQ5). The drainage area that flows to this inlet includes an extensive wetland area that is fed by a number of smaller tributaries.

Water quality in the small tributaries is generally similar to water quality in Sawbill Bay. Dissolved oxygen concentrations are generally above 5 mg/L during all sampling events, and there are only occasional exceedances of the PWQOs/CWQGs for aluminum and iron. As noted earlier, the local geological conditions would largely determine the metals concentrations in surface waters, and would account for the higher concentrations of aluminum and iron. Water quality in the larger inlet (HRWQ5) was similar to Sawbill Bay, and resulted in no exceedances of either PWQOs or CWQGs. A single exceedance of the CWQG for mercury was noted in the small stream at the north end of Sawbill Bay.

A single tributary drains from the south end of the Project site to the east end of Lynxhead Bay (HRWQ14, Figure 3-25). Water quality in this tributary was characterized as generally circumneutral pH, relatively high dissolved oxygen (though like other streams, dissolved oxygen was lowest in the August 2012 samples). Slightly higher concentrations of aluminum were noted in this stream during late summer and early fall of 2010 and 2012, and may reflect changes in runoff from wetland areas and or groundwater discharge from the Project site. Low DO also suggests a potential groundwater influence at this location.

A number of small tributaries also drain to Trap Bay (HRWQ21) and Turtle Bay (HRWQ17 and HRWQ20). All three tributaries exhibit the same characteristics: fluctuations in pH (range 6.2 to 7.4), relatively high dissolved oxygen, and periodic exceedances of the PWQO/CWQGs for aluminum and iron and occasional exceedances of the PWQOs for silver and thallium.

3.2.8.3.9 Sediment Quality

Sediment quality data reflect the inputs to the waterbodies within the Upper Marmion Reservoir system. Metals in the water column will typically either remain suspended in the water column (either as free ions, or more commonly, complexed to dissolved constituents in the water column), or will complex with larger particles and settle to the bottom. Sediment quality in undeveloped areas, such as the waterbodies in the Project Site, will reflect the geologic sources within the watershed.

Sediment quality in Mitta Lake, Sawbill Bay, Lynxhead Bay, Lizard Lake, as well as upstream in Hawk Bay was characterized by concentrations of arsenic, cadmium, copper, manganese, lead, nickel and zinc that in one or more samples exceeded the PSQG LEL. None of the metals exceeded the SEL, and, therefore, present minimal risk to aquatic life. Given the similarity in sediment quality between basins, and since (with the exception of Sawbill Bay) there has historically been no development in the up-stream bays within the Upper Marmion Reservoir watershed, the values observed are considered to be natural levels due to the characteristics of the local geology of the region. Concentrations of these metals were similar in all of the larger waterbodies, and no areas of higher concentrations that could be related to specific anthropogenic or natural geologic anomalies were noted. Since similar concentrations occurred in Hawk Bay, upstream of the proposed site in the Seine River, the sediment concentrations likely reflect general sources to the watershed.

Higher concentrations of some of the metals were noted in the smaller watersheds draining to the Upper Marmion Reservoir system. The results suggest therefore, that in addition to upstream sources in the Seine River system, local drainage also contributes some metals to the system that ultimately end up in sediments.

The higher concentrations of iron and manganese in sediments also likely contribute to the observed cycling of iron and manganese in the bottom waters of some of the larger waterbodies, as discussed in the previous section.

The presence of some metals at concentrations above the LEL does not necessarily imply that there would be impacts on aquatic life. Metal behaviour in sediments is controlled by the geochemical characteristics of the sediment, including pH, redox potential, surface area, cation exchange capacity, organic matter content, clay content, iron and manganese oxide content, and carbonate content. The complexation of metals with sediment constituents also controls metal bioavailability and hence, toxicity of metals in sediments (i.e., the metals have to be available to be toxic). As a result, metals bound to sediments are typically much less bioavailable (Tessier and Campbell 1987). A number of solid-phase materials present in sediments have been identified as materials that have the potential to sequester, and therefore control metal availability, including organic carbon, sulphides, iron and manganese hydroxides, and carbonates (Tessier et al. 1984). The importance of the solid-phase materials in controlling the availability depends on the environmental conditions, with the pH and redox conditions typically being the most important geochemical variables (Mok and Wai 1990). The lack of availability of metals from the sediments is exemplified by the results of the bottom water samples discussed in the preceding sections. Despite the higher concentrations of aluminum and iron in bottom waters, there is no detectable increase in the concentrations of other metals, suggesting that even under redox conditions that would favour metals flux from sediments, the metals in the sediments are relatively stable. As such the metals concentrations in sediment do not appear to affect water quality and suggest limited bioavailability.

The MOE (MOE 2008) noted in its guidance that "The Ministry recognizes that in an area as geologically diverse as Ontario, local natural sediment levels of metals may vary considerably." and for metals "in areas where local background levels are above the LEL, the local background levels will form the practical lower limit for management decisions." For the environmental assessment, the existing concentrations of metals in sediments are considered as the baseline against which predicted changes in water and sediment quality are assessed.

A summary of CSQG and PSQG screening of sediment quality results is provided in Table 3-29, showing the number (percent) of samples that did not meet the screening criteria. Sampling locations are shown in Figure 3-25.

3.2.9 Aquatic Environment

Version 3 Update: Response to T(3)-07 provides requested clarification with respect to fish and fish habitat baseline data collection methods.

Response to MNDM 6 includes a commitment to conduct a fish tissue sampling study at the request of the local public and Aboriginal stakeholders. This study was completed in 2014 and reported submitted to the government for appropriate distribution.

The aquatic environment consists of aquatic habitat, fish species and benthic communities. Aquatic habit comprises the Marmion Reservoir, Seine River, other lakes and the small river network.

3.2.9.1 Study Areas

The MSA includes those watercourses and water bodies located on the peninsula on which the Project will be located. The aquatic environment of the MSA is comprised of a number of permanent and intermittent watercourses, and a number of small lakes, ponds and wetland areas, the largest of which is Mitta Lake.

The Aquatic Environment LSA (Figure 2-2B) includes the adjacent water bodies and watercourse that are not directly affected by the Project footprint. These include Lizard Lake, Upper Marmion Reservoir, Lumby Creek and Sawbill Creek.

The Aquatic Environment RSA (Figure 2-3B) includes the reaches of the Seine River downstream of the Raft Lake Dam.

3.2.9.2 Methods

Field studies of the aquatic environment were undertaken in 2010, 2011 and 2012 and included characterization of aquatic habitat, collection of basic surface water quality data (e.g. pH, dissolved oxygen, conductivity), benthic invertebrate community (BIC) and fish community assessment and the analysis of metals burdens in fish muscle tissue. Data was collected and archived using the field methods outlined in the Aquatic Environment TSD.

The field program was undertaken in consultation with MNR and DFO. Both agencies have had the opportunity to review baseline information, particularly fish and fish habitat information. Following MNR and DFO review, data gaps were discussed with the agencies and additional field studies were implemented. In addition, a series of meetings/workshops were held with regulatory agencies to review/discuss a number of issues including field scope, approach to habitat assessment, regulatory requirements/approach to mitigation/compensation and data completeness. The details are provided in the Aquatic Environment TSD.

OHRG has engaged with identified Aboriginal communities throughout the environmental assessment process, including soliciting feedback on valued ecosystem components. First Nation Monitors participated in Project baseline field data collection programs by accompanying the Golder technical staff on a number of occasions.

Field Studies

Field studies were focused on waterbodies within the project footprint, and adjacent or nearby waterbodies. These included the lakes and streams within the MSA and Aquatic Environment LSA, as well as beaver ponds and small tributaries. The field studies did not include the Aquatic Environment RSA, since no impacts were expected downstream in the Seine River. The sites were visited on at least two occasions over the duration of the sampling program, with a number of key features being sampled in both sampling years. Details on the sampling program are provided in the Aquatic Environment TSD. A summary of field sampling events is provided in Table 3-30.

The objectives of fish community assessment studies were to establish what fish species were present in each aquatic feature, verify the presence of various life history stages present, identify fish frequented waters and non-fish bearing waters relative to the Project footprint and collect samples to determine baseline concentrations of metals in fish muscle tissue. A variety of gear and techniques were used to confirm fish presence and fish community composition including Nordic nets, standard experimental gill nets, large and small mesh broadscale monitoring nets, minnow traps, seine nets, backpack electroshocking, boat electroshocking and visual observations. Details on the equipment used are provided in the Aquatic Environment TSD.

Data recorded on catch records included location (Global Positioning System [GPS] coordinates) at each end of stationary gear, start and end locations for electrofishing, time, date, gear type, depth, effort (square metres seined, metres of stream electroshocked or hours fished), numbers and life history stage (young-of-the-year, juvenile and adults) of all fish species captured by species. Each location where fishing effort was expended has been assigned a unique number and these numbers appear in catch tables and on fish habitat maps.

Fish Habitat Mapping

Fish habitat was mapped to provide an inventory of the available habitats and to show the locations of habitats that are of importance to fish, such as spawning and rearing habitats. Physical features, their locations and/or distribution were measured and recorded on data sheets and field maps by field crews who walked or navigated each aquatic feature. GPS referenced digital photos illustrating channel/shoreline characteristics were collected for each aquatic feature. Habitat maps for the Project were created by overlaying Light Detection and Ranging (LiDAR) images of aquatic features as provided by OHRG with field data.

For Mitta Lake and the small lake within the proposed TMF footprint (identified as API #2), side scan sonar imaging was conducted to map bathymetry and bottom substrate. The survey was completed to generate an accurate Digital Elevation Model (DEM) for the bathymetry within the water bodies noted above for use during fish habitat no net loss planning.

In beaver ponds, littoral zone habitat was mapped. Spot depths and bottom grab samples were collected in order to determine general bathymetric and substrate characteristics. Habitat characteristics including maximum depth, temperature, dissolved oxygen and substrate characteristics were recorded.

Fish Tissue Analysis

Tissue samples were collected from fish species captured in potential receiving waterbodies using minnow traps, small mesh Nordic nets and experimental gill nets and analyzed to determine the baseline levels of bioaccumulation of metals and other potential contaminants. Samples of tissues (e.g., muscle) from a minimum of five individuals representing various trophic levels (e.g., planktivorous, benthic grazer and piscivorous species) and whole-body samples of a small body fish species (e.g., cyprinids) were collected and analyzed to determine the existing levels of bioaccumulation of heavy metals (e.g., ICP-metal scan including total mercury) that may pose risks for human health and fish eating biota.

The heavy metals analyzed included: total silver, total aluminum, total arsenic, total barium, total beryllium, total bismuth, total boron, total calcium, total cadmium, total cerium, total cobalt, total chromium, total cesium, total copper, total europium, total iron, total gallium, total mercury, total lanthanum, total lithium, total magnesium, total manganese, total molybdenum, total niobium, total nickel, total lead, total rubidium, total antimony, total scandium, total selenium, total tin, total strontium, total thorium, total titanium, total thallium, total uranium, total vanadium, total tungsten, total yttrium, total zinc and total zirconium. Averages were calculated using the detection limit for non-detect values.

Benthic Community Assessment

A benthic community assessment was conducted in October 2010. Sample locations were selected above the influence of the receiving water bodies (i.e. Marmion Reservoir, Lizard Lake). At each station, five replicate samples were collected. Benthic samples were collected using a standard petite ponar dredge measuring 15 cm by 15 cm square.

Five benthic invertebrate community descriptors were calculated for each of the six sampling stations.

- Mean density, expressed as number of invertebrates per m^2.
- Mean taxa richness, the number of taxa (families) present at each station.
- Mean Simpsons Diversity index (SDI) value, based on the formula provided by Krebs (1985):

  D = 1 – ∑ (pi)2, where D = Simpson's Diversity Index, pi = the proportion of the ith taxa at the station

- Mean Simpsons Evenness Index (SEI), evenness is calculated following Smith and Wilson (1996):

  $E = 1/\sum (p_i)^2/S$, where E = Simpson's Evenness Index, pi = the proportion of the ith taxa at the station,

  S = the total number of taxa at the station

- % EPT, total percentage of the orders Ephemeroptera, Plecoptera, and Trichoptera
- Community composition, the percent representation (relative abundance) of major taxonomic groups at each station.

Mean values for density, richness, SDI, SEI, and percent relative abundance were derived from the five replicate samples collected at each station in 2010.

3.2.9.3 Results

This section provides an overview of the aquatic habitats, fish species, benthic communities, and fish tissue analysis related to the waterbodies in the MSA and Aquatic Environment LSA. Further details on habitat types and uses, and the fish species present are provided for each waterbody and watercourse in the Aquatic Environment TSD.

3.2.9.3.1 Aquatic Habitats

Marmion Reservoir was first constructed in 1926 (Boileau 2004) and the three block dams and the Raft Lake Dam were constructed in 1943 as part of the Seine River diversion. The three block dams include a spillway that effectively isolates Lower Marmion Reservoir from Upper Marmion Reservoir. Water levels in Upper Marmion Reservoir are managed for multiple water uses including sustaining walleye spawning flows, storage for water power production and maintaining minimum water levels in Lower Marmion Reservoir for the Atikokan Generating Station. Operation of the various dams and spillways is managed according to the Seine River Water Management Plan (Boileau 2004). In general, the dams controlling water levels in Upper Marmion Reservoir allow for a winter drawdown of about 2.5 m, followed by rising water levels from April 15 to June 15 to accommodate walleye spawning as shown in Figure 3-35.

The Marmion Reservoir has been a focus of MNR fisheries management over the past two decades and in particular, MNR has been interested in potential impacts on the walleye sports fishery. The Lower Marmion Reservoir was closed in the late 1990's in response to estimates of population declines (MNR, various; Jackson 2007). MNR identified a reduction of spawning success related to the Atikokan TGS, and a walleye spawning shoal was constructed at the inlet to Abie Lake to enhance spawning habitat. Monitoring of this spawning shoal and subsequent population assessments indicate that the walleye population is showing signs of recovery. As part of their past assessment work, MNR have identified Lynxhead Bay Narrows as a potential walleye spawning area in Upper Marmion Reservoir.

Aquatic habitats in the area of the Project include a range of habitat types and sizes. Lentic habitats ranged from small wetland ponds to large lakes such as Marmion Reservoir while lotic habitats included small intermittent streams and larger permanent streams. No large rivers occur in the MSA. While Marmion Reservoir is part of the Seine River system, in the area of the Project it behaves more like a lake, and is considered as such for the environmental assessment.

Aquatic habitats within the MSA and Aquatic Environment LSA can be considered as two connected units:

- Small waterbodies and watercourses that occur on the upland areas (i.e., the MSA) in which the Project will be located. The upland area is defined as the area bounded by Lizard Lake to the east, and Upper Marmion Reservoir, comprised of Lynxhead Bay and Sawbill Bay, to the south and west. These typically drain to the larger waterbodies.
- The larger waterbodies of Lizard Lake and Upper Marmion Reservoir into which the smaller watercourses drain (i.e., the Aquatic Environment LSA).

The MSA, which includes the Project footprint and surrounding areas that are bounded by the Lizard Lake watershed to the east and Upper Marmion Reservoir to the south (Lynxhead Bay) and west (Sawbill Bay), is at an elevation of approximately 20-30 m above the level of Upper Marion Reservoir. Aquatic habitats within the MSA include a number of smaller waterbodies that are perched on top of the peninsula that drain to larger water bodies such as Lizard Lake to the east of the Project site, and Upper Marion Reservoir to the south and west of the Project site through a number of small watercourses.

Aquatic habitats within the MSA that are directly affected by the Project footprint consist of wetlands, temporary and permanent ponds, small lakes (up to 17 ha), and small watercourses draining from the site to adjacent larger waterbodies such as Upper Marmion Reservoir and Lizard Lake. Many of the streams drain a small area, lack substantial groundwater inputs, and therefore flow in these streams is intermittent, depending mainly on rainfall and snowmelt. The largest body of water in the MSA that is within the area affected by the Project footprint is Mitta Lake (~17 ha), which lies directly over the ore deposit and will need to be drained in order to develop the open pits.

The accessible portions of the streams in the MSA, including mainstem ponds, and stream crossings, are important areas due to their contribution to fish populations in Upper Marmion Reservoir, particularly Sawbill Bay and Lynxhead Bay, as well as Lizard Lake. They provide direct and indirect fish habitat through the transport of food and nutrients as well as habitat for baitfish and other small bodied fishes. These reaches provide spawning habitat for a variety of species that reside in Upper Marmion Reservoir. They also are the immediate “receivers” of indirect and direct fish habitat located within the project footprint.

Mine Study Area Watercourses and Waterbodies

The stream network within the MSA provides a variety of aquatic habitat ranging from small permanent headwater streams to intermittent watercourses that flow only during rainfall and snowmelt events.

Headwater drainage systems and associated fish communities that exist upstream of the lower reaches in the watercourses within the mine footprint contribute indirectly to the quality and quantity of fish habitat within the lower reaches and include predominantly intermittent streams and small waterbodies (beaver impoundments and some larger ponds), with occasional small lakes and permanent streams. Fish communities are predominantly limited to baitfish and other small-bodied fish. Northern Pike were present in two of the larger waterbodies within the footprint of the proposed TMF. Upstream passage of fish from the lower reaches is blocked by natural barriers; however, some downstream movement of fish may occur. Headwater ponds and streams occur in both the northern area of the MSA where the TMF will be located, and in the southern section of the site where the mine and associated infrastructure will be located. In these small headwater ponds and streams fish communities were typically reduced, or in the case of intermittent watercourses and waterbodies were typically absent. In those waterbodies that had fish populations, these typically were comprised of northern redbelly dace, finescale dace and fathead minnow.

The lower reaches of the watercourses within the MSA include permanent streams and small waterbodies (beaver impoundments and larger ponds), with some small lakes that are accessible by fish from Lizard Lake, Sawbill and Lynxhead Bays. Fish communities are more diverse than headwater drainage systems and include a greater diversity of small-bodied fish, and commonly support species, such as northern pike, white sucker and yellow perch. Fish passage to and from these features occurs throughout the year, however it may be impeded by the fluctuating water levels in Sawbill and Lynxhead Bays. There is no documented use of these features by walleye and smallmouth bass.

Two small lakes occur in these headwater areas within the MSA that would be eliminated by the Project (Figure 2-1 of the Aquatic Environment TSD). At the northern end of the MSA, within the footprint of the TMF is a small unnamed lake (identified as API #2 in the Aquatic Environment TSD). This lake has a surface area of approximately 122,000 m^2 (12.2 ha), and a maximum depth of 5 m. The range of species encountered in this lake included adults and juveniles of pumpkinseed, yellow perch, northern pike, white sucker, as well as small-bodied forage fish, such as Iowa darter and blacknose shiner. The lake drains via a small stream to another small lake (this lake lies outside of the MSA), that in turn drains to Lizard Lake. Within the small stream draining from the lake, no fish were obtained, though the presence of fish in the small lake indicates that fish likely can pass up this stream on occasion.

The watercourse and waterbodies in the MSA represent a total catchment area of about 19 km^2, with a median catchment size of 0.84 km^2. Approximately 1/3 of the features draining the project site are considered perennial (about 7), while the rest are intermittent or ephemeral. They represent 5.9% of the drainage to Upper Marmion Reservoir (excluding the Upper Seine River) and about 14% (9 km2) of the drainage to Lizard Lake (in the Lumby Creek Catchment).

Mitta Lake

The other small lake within the MSA is Mitta Lake, near the southern end of the MSA (Figure 2-1 of the Aquatic Environment TSD). Mitta Lake has a surface area of approximately 171,000 m^2 (17.1 ha), with a maximum depth of 16 m. The lake stratifies in both late summer and late winter, when oxygen levels in the bottom waters decrease to less than 1 mg/L, which would limit the ability of the deeper profundal areas of the lake to support fish populations during these periods. As a result, the littoral areas are the more productive areas of this lake. The lake supports populations (both adults and juveniles) of white sucker, brook stickleback, fathead minnow, Iowa darter, mottled sculpin and finescale dace. No sport fish were encountered in the lake during sampling. Mitta Lake is drained by a small stream that flows south to Upper Marmion Reservoir. The stream runs dry on occasion, and permanent habitat is present only in the lower reaches of the stream, where a limited fish fauna of finescale dace, northern redbelly dace and fathead minnow were encountered.

Aquatic Environment Local Study Area Waterbodies

Lizard Lake

Lizard Lake is located to the east of the MSA and is a medium to large lake near the mouth of Lumby Creek, which flows into Turtle Bay and then into Hawke Bay/Lynxhead Bay. Lizard Lake has been identified as a lake with potential recreational value in MNR's Land Use Planning Guidelines.

Lizard Lake has a surface area of 193 ha and has a drainage area of about 62.8 km^2 in the Lumby Creek watershed. Several small catchment areas with a total drainage area of about 9 km^2 drain to Lizard Lake from the project, representing about 14% of the total drainage area of the lake.

Lizard Lake is a long narrow lake, consisting of two water bodies joined by a short, shallow, narrows (Figure 3-28). The upper portion of the lake is shallow with the majority of the area being less than 4 m and only a small area greater than 8 m. The lower portion is deeper with a relatively small area less than 4 m and a moderately large area with a moderately large area greater than 8 m and a maximum depth of over 20 m. This lower portion has fairly steeply sloping littoral areas, including a very steep drop off near the deepest part of the lake. Lizard Lake supported a diverse range of species, including cisco, white sucker, burbot, smallmouth bass, pumpkinseed, walleye and yellow perch as well as a variety of small-bodied forage fish.

Sawbill Bay and Lynxhead Bay

Sawbill Bay and Lynxhead Bay are located immediately to the west and south of the Project Site respectively. These large bays and lakes are important both socio-economically and biologically. They provide an environment for tourism and angling and are sensitive receiving waters for any contaminants occurring within their watersheds.

The receiving bays of Sawbill and Lynxhead Bays may represent significant habitat for locally important fish species and alternation of these habitat may result in loss of fish and productivity.

Lynxhead Bay, on the southeasterly side of the peninsula carries flows from the upper Seine River, generally westward past the end of the peninsula towards the Raft Lake Dam outflow of Upper Marmion Reservoir. Sawbill Bay, on the northwesterly side of the peninsula, receives inflows from a number of small watersheds to the north and west of the peninsula.

There are three deep basins: two in Sawbill Bay and one in Lynxhead Bay, with the one in upper Sawbill Bay and the one in Lynxhead Bay exceeding 25 m in depth, while the one in lower Sawbill Bay is generally less than 20 m in depth (Figure 3-32). Because of the difference in inflows, Sawbill Bay becomes thermally stratified; however, only weak stratification occurs in Lynxhead Bay.

Water levels in the Upper Marmion Reservoir are managed according to a rule curve established for the Raft Lake Dam as part of the Seine River Watershed Management Plan (Hydrology TSD). While this rule curve anticipates a smooth transition of water levels at critical times of the year, while maintaining downstream flows to accommodate hydropower requirements, the mode of control is by manually operating stop logs within the headgate structure of the Dam. This manual operation, combined with a significant contribution of uncontrolled flows from tributaries of the Upper Marmion Reservoir (representing 46% of the upstream contributing drainage), result in poor tracking of actual water levels with the rule curve. The total annual fluctuation is approximately 2.5-3.0 m (Figure 3-36). The consequence of this has been reported by MNR as contributing to negative impacts on spawning success by northern pike, smallmouth bass and walleye, generally low-quality nursery habitat in the shallow bays around the Upper Marmion Reservoir, and possibly reduced access (fish passage) into local tributary streams. There is also some evidence that this fluctuation is also reflected in local groundwater elevations at the mine site.

3.2.9.3.2 Fish Species

The fish community of Sawbill and Lynxhead Bays is diverse, consisting of about 13 fish species including baitfish and other small-bodied fish, lake whitefish, cisco, yellow walleye, smallmouth bass, yellow perch, northern pike and white sucker. Walleye, northern pike and smallmouth bass are considered important recreational fisheries and the area is widely known for its smallmouth bass derby. Although Upper Marmion Reservoir is separated by dams at its outlet (Raft Lake Dam) and Marmion Lake (Marmion Sluiceway), fish populations can pass both ways between Lower Marmion Reservoir and Upper Marmion Reservoir and fish can pass downstream from Upper Marmion Reservoir into Finlayson Lake (through the Raft Lake Dam).

The fish community is similar to the community in Sawbill and Lynxhead Bays, consisting of about 13 fish species including baitfish and other small-bodied fish, lake cisco, walleye, smallmouth bass, yellow perch, pumpkinseed, northern pike and white sucker. Walleye, northern pike and smallmouth bass are considered important recreational fisheries. Fish movement occurs between Lizard Lake and Turtle Bay; however, fish passage may be impeded for parts of the year because of the water level fluctuations in the Upper Marmion Reservoir and steep gradients in the interconnecting stream channels. Fish can also move upstream of Lizard Lake into the Lumby Creek, however, there are barriers to upstream movement here as well.

Fish species captured in waterbodies around the Project site are listed in Table 3-31.

3.2.9.3.3 Benthic Communities

Benthic communities were assessed in the lower reaches of the streams draining from the MSA since these represented permanent habitats where benthic communities could become established. Upstream reaches that experience intermittent flows would not establish permanent benthic communities, and these reaches were not assessed. Similarly, the benthic communities in the large waterbodies, such as Sawbill Bay, Lynxhead Bay and Lizard Lake would not be affected by the Project activities. As well, water levels fluctuations in Upper Marmion Reservoir would preclude the establishment of permanent benthic communities in the littoral areas within the drawdown zone. As a result, only the deeper water communities that in northern Ontario lakes are dominated by chironomids and oligochaetes would be present in these areas.

Benthic communities in the small streams draining from the site were also dominated by the chironomids that at most locations comprised over 50% of the taxa present. The chironomid community was diverse and included both species typical of warmer waters (e.g., *Chironomus, Tanytarsus, Procladius*) as well as species typical of cool oligotrophic waters (e.g., a number of species of the subfamily Orthocladiinae). Detailed community data are provided in the Aquatic Environment TSD. Sphaeriid molluscs were also common in these habitats, and comprised the second largest group in terms of density of organisms. Aquatic insect species were sparsely distributed, and reflect the more quiescent areas of the streams that were sampled. The species present, such as *Caenis* (Ephemeroptera) and *Oecetis* (Trichoptera) are typical of more quiescent areas of streams. Oligochaetes at most location sampled comprised only a small component of the benthic community.

The benthic community in these areas therefore represents a range of species that would typically occur in the more quiescent areas of smaller streams. No particular group dominates to the exclusion of others, and while diptera (mainly chironomids) were by far the largest group, diversity among this group was high. The communities present are those that would be expected in small streams that have undergone no perturbations. The distribution of major benthic taxa is shown on Figure 3-37.

3.2.9.3.4 Fish Tissue Analysis

A total of 88 tissue samples were collected and analyzed from Lizard Lake, Sawbill Bay and Turtle Bay. A total of five species were analysed for heavy metal content within their tissues (Cisco, White Sucker, Walleye, Lake Whitefish and Blacknose Shiner). Table 3-32 provides a summary of the results. The laboratory results are provided in the Aquatic Environment TSD.

Mercury is of particular concern because of its toxicity to humans who may consume fish. Total mercury content for fish tissue samples from Lizard Lake, Sawbill Bay and Turtle Bay are provided in Table 3-33.

Accumulation of mercury by fish is a common problem in lakes in northern Ontario. The MOE *Guide to Eating Sport Fish in Ontario* lists consumption restrictions for a number of the larger adult sport fish species form lakes across northern Ontario. Atmospheric deposition of mercury has been identified as the major source of mercury. Wetlands have been identified as a significant site of mercury methylation, from which transport to other receiving waters has been well documented. As a result, the fish tissue levels are likely a result of local wetlands contributing mercury to the Seine River system. The water quality existing conditions (Water and Sediment Quality TSD) show periodic exceedances of the CWQG for mercury in the Seine River, which is likely related to localized natural zones of mercury methylation and transport.

Analytical results for fish tissue were compared to existing sport fish consumption guidelines and Canadian Tissue Guidelines for the Protection of Wildlife Consumers of Aquatic Biota (Canadian Council of Ministers of the Environment 1999). The Ontario Ministry of the Environment publishes the *“Guide to Eating Sport Fish in Ontario”*, and recommends the following consumption restrictions:

- Women of child-bearing age and children under 15, consumption restrictions for sport fish containing mercury begin at levels of 0.26 parts per million with total restriction advised for levels above 0.52 parts per million.
- For the general population, consumption restrictions begin at levels above 0.61 parts per million with total restriction advised for levels above 1.84 parts per million.

Based on these guidelines, 97% of the Walleye analyzed exceeded the consumption restrictions for sportfish containing mercury for women of child-bearing age and children under 15. Thirty-two percent of White suckers sampled and 27% of Lake Whitefish sampled also exceeded this guideline. Forty-one percent of Walleye samples analyzed exceeded the total restriction advised for sportfish containing mercury for women of child-bearing age and children under 15 while 35% exceeded the general population consumption restriction level of 0.61 ppm. No fish sampled exceeded the total restriction for the general population of 1.84-ppm.

3.2.10 Terrestrial Environment

Version 3 Update: Response to MNR-Terrestrial 5 provides clarification with respect to terrestrial baseline data collection and on the definition of ‘significant habitats’. Bear Baiting Stations should be referenced as Bear Population Index Lines, as indicated in response to MNR-Terrestrial 5. Clarification on the standardized ecosystem classification used is provided in response to T(3)-06. Clarification of the spatial extent for which the secretive marsh bird surveys were conducted is provided in response to MNR-Terrestrial 5.

Additional bat and SAR survey were conducted in the summer of 2017 (see response to MNR-Terrestrial-1 and MNRF-11). These surveys were initiated to address review comments from the MNRF regarding the Assessment of Access Road and Transmission Line Routing Alternatives and to satisfy the initial stages of the Endangered Species Act, 2007 (ESA) information gathering process. In discussion with the MNRF and the joint provincial-federal government review team, CMC agreed to complete the additional SAR surveys to fill the data gaps as a condition of EIS/EA approval. It was agreed with the MNRF and joint provincial-federal government review team that the results of supplemental SAR surveys will be provided to the MNRF for review but are not required to be submitted as part of the Version 3 EIS/EA Report. The scope of these 2017 natural environment studies was developed in consultation with the MNRF and is provided in Part 4 of the Addendum to the Version3 EIS/EA

The Terrestrial Environment consists of vegetation, avifauna, mammals, invertebrates; and wildlife corridors.

3.2.10.1 Study Areas

The MSA encompasses the footprints of the open pits, the Waste Rock Management Facility (WRMF), the Ore Processing Facility, the Tailings Management Facility (TMF), and the Support and Ancillary Infrastructure. Aggregate Pits are not included, as they are subject to a separate permitting process. The total land area occupied by the MSA is 2,062 ha.

The Terrestrial Ecology LSA was selected to measure the existing baseline conditions at a scale large enough to capture the maximum predicted spatial extent of the combined direct and indirect effects (i.e., zone of influence) from the Project on soils, vegetation, and wildlife (Figure 2-2J). For the terrestrial ecology assessment, this area corresponds to the site watersheds as they capture the drainage to and from the mine footprint and are associated with natural linkages on the landscape through wetlands and along riparian corridors. The delineation of the Terrestrial Ecology LSA considered local landscape connections such as wildlife migration corridors large enough to contain all or most plant species and plant communities present in local populations.

The regional study area corresponds to the wildlife management unit (WMU) within which the Project is located. The Terrestrial Ecology RSA is bounded by Highway 11 to the south, Highway 17 to the east, the Turtle River to the west and the Rainy River/Kenora judicial district boundary to the north and includes the protected areas of Side Lake Conservation Reserve and Campus Lake Conservation Reserve. This allows for an assessment of regional and population scale effects on wide ranging animals such as moose and black bear, as well as cumulative effects.

3.2.10.2 Methods

A terrestrial biophysical inventory of the Project Site was carried out to characterize and evaluate the existing environment. The process consisted of consultation with regulatory agencies, Aboriginal engagement, a review of existing data sources, and terrestrial ecology field surveys, which were conducted during the spring and summer of 2010, 2011 and 2012. The development of a study plan included consultation with CEAA, Environment Canada, the Ontario Ministry of Northern Development and Mine, the Ontario Ministry of Natural Resources and the Ontario Ministry of the Environment. The study program included:

- Migratory bird surveys.
- Wetland evaluation surveys.
- Upland vegetation surveys.
- Wild rice survey.
- Wildlife surveys.
- Reptile and amphibian (turtle) surveys.
- Remote camera surveys.

Details on survey methods are provided in the Terrestrial Environment TSD.

3.2.10.3 Results – Vegetation

3.2.10.3.1 Land Cover Types

Version 3 Update: Reference to the 'Resolute Forest Management Unit', should be considered as reference to the 'Crossroute Forest Management Unit' and Reference to the 'Rainy Lake Tribunal Forest Management Unit', should be considered as reference to the 'Sapawe Forest Management Unit'

The Terrestrial Ecology RSA is classified into 14 land cover types and is located mainly within the Resolute Forest Management Unit but is also partially within the Rainy Lake Tribunal Forest Management Unit (Figure 3-38; Table 3-34). The majority of soils are shallow coarse loamy soils over bedrock. The shallow soils are conducive to the regeneration of Jack Pine through seeding or planting. The organic soils between the bedrock hills are conducive to the growth of wetland communities dominated by cedar, black spruce and tamarack.

MNR produced the Ontario Land Cover data using interpretation of satellite remote sensing image data recorded on a range of dates between 1986 and 1997, the majority in the early 1990s. The forest cutovers and burns were updated in 1996 for most of the Boreal forest region of Ontario. As an overall comparison, the pie charts in Figures 3-39 through 3-41 illustrate the relative amounts of different land cover classifications in the Terrestrial Ecology RSA, from the MNR data versus the Terrestrial Ecology LSA and MSA land cover which were classified through field data observations.

The majority of the MSA and Terrestrial Ecology LSA are contained within the Resolute Forest Management Area with the eastern portion lying within the Rainy Lake Tribunal Forest Management Area. The Terrestrial Ecology LSA consists of a forest types in various stages of succession that are dominated by common boreal species such as jack pine, white and black spruce, balsam fir, white birch, and aspen along with some typical Great Lakes forest species such as white pine, red pine and cedar. Mature stands of trees are typically restricted to the margins of drainages and wetlands, and isolated patches of upland. Drainages and depressions in the Project Site support a mix of marshes, swamps and fens, which are composed of black spruce, tamarack, ericaceous shrubs (e.g., leatherleaf), tall shrubs (e.g., willows and alders), sedges and mosses.

The Terrestrial Ecology LSA has been subject to large-scale anthropogenic changes in the past which has had an impact on some of the natural landscape. Activities such as power generation, logging, mining and mineral exploration, aggregate extraction and other human uses such as campsites and cutovers have created disturbances in vegetation communities which are at varying degrees of naturalization and succession.

3.2.10.3.2 Ecosite Classification

The distribution of upland and wetland vegetation ecosites in the MSA and Terrestrial Ecology LSA is provided in Table 3-35. Approximately 67% of the Terrestrial Ecology LSA is forested versus wetlands and open water. Approximately 78% of the MSA contains upland ecosites versus wetland and open water. The ecosite occupying the most area in the Terrestrial Ecology LSA is ES-F, a Fir-Spruce Mixedwood. In the MSA, the ecosite occupying the most area is ES-E, a Hardwood-Fir-Spruce Mixedwood.

Upland Ecosites (Forests and Rock Barrens)

There are 10 different terrestrial/upland ecosites identified within the MSA/Terrestrial Ecology LSA (Table 3-35). Mapping of ecosites in the MSA/Terrestrial Ecology LSA are provided in the Terrestrial Ecology TSD. The predominant upland ecosites based on areal extent are ES-B (Black Spruce-Jack Pine), ES-E (Hardwood-

Fir-Spruce Mixedwood), ES-F (Fir-Spruce Mixedwood) and ES-H (Spruce-Pine/Feathermoss). Detailed descriptions of all upland ecosites are located in the Terrestrial Ecology TSD.

Wetland Ecosites

There are 28 different wetland ecosites identified in the MSA and an additional two wetland ecosites within the Terrestrial Ecology LSA as described and shown in the Terrestrial Ecology TSD. Wetland ecosites represent 24.86% of the Terrestrial Ecology LSA and 26.61% of the MSA. Wetland ecosite classifications are provided in Table 3-36.

The predominant wetland ecosites based on areal extent are W31 (Rich Conifer Swamp: Cedar-Tamarack-Black Spruce) followed by W12 (Meadow Marsh: Tall Sedge), W13 (Meadow Marsh: Blue-joint Grass) and W14 (Open Graminoid Shore Fen: Wire Sedge). A full description of all wetland ecosites identified in the Terrestrial Ecology LSA is provided in the Terrestrial Ecology TSD.

3.2.10.3.3 Plant Species

Plant Species Diversity

The rolling landscape also gives way to wetlands varying in morphology, nutrient content and species richness. Fens and bogs are present where there is isolation from groundwater; and swamps and marshes are in closer proximity to groundwater or the shallows of lakes and rivers. The richer wetlands support more species diversity, while some of the poor, acidic wetlands support few species, those of which are specially adapted to restricted nutrients. A variety of species were observed throughout the Terrestrial Ecology LSA reflecting this variability of habitat types. A detailed list of the species observed and the associated ecosites is located in the Terrestrial Ecology TSD. In total, there were 265 plant species identified in the Terrestrial Ecology LSA (126 vascular species and 131 non-vascular species) were identified within the Terrestrial Ecology LSA. This includes 49 woody species (trees and shrubs), 59 forbs, 18 graminoids, 63 mosses, 44 terrestrial lichens and 24 epiphytes.

The compiled plant species list for the Terrestrial Ecology LSA with their associate global, federal and provincial ranks and local rarity are presented in the Terrestrial Ecology TSD.

A majority of the upland habitat is mature conifer and mixedwood forest of varying soil depth and canopy cover. A large proportion of the habitat has undergone some disturbance at varying times in history, allowing for varying stages of succession within ecosites. The mixedwood ecosites ES-E, ES-F, ES-G and ES-H (details are provided in the Terrestrial Ecology TSD for ecosite descriptions) are generally the richest of the forested ecosites and therefore can support the highest amount of species.

Black spruce, white spruce, jack pine, trembling aspen, white cedar and white birch were the most common tree species and were observed throughout the Terrestrial Ecology LSA. Common tall shrubs include mountain maple, green alder, speckled alder, and mountain ash (American and showy). The most common shrubs observed are all ericaceous shrubs with Labrador tea, leatherleaf, meadowsweet and blueberry (velvet leaved and lowbush). Understory species such as herbs, graminoids (grasses, rushes and sedges), ferns, groundpines, lichens and mosses were diverse with many being observed in or have the potential to exist in more than one ecosite.

The disturbance has also allowed for species, especially those exotic or competitive, that thrive on disturbed soils to invade areas of the Project. Most of these species have been limited to the roadsides and other boundaries of the disturbance area, but a few have been documented in the dominant natural communities.

Rare Plants

Some of the disturbed sites which have been left to naturalize have supported species listed as locally rare for the ecoregion 4W. The rest of the species were found in wetlands of varying species and nutrient richness. Species of flora observed in the Terrestrial Ecology LSA and their respective ecosites and rarity ranks can be found in Appendix 3.VI. All of the locally rare species and their habitat characteristics are listed in Table 3-37.

Species at Risk

No federally or provincially listed (threatened, endangered or special concern) species of flora were observed in the Terrestrial Ecology LSA.

Traditional Plants

A list of traditional plants applicable to the Project is provided in Table 3-38. This list also includes the ecosite types associated with these species that represent the most probable habitat types where these plant species will occur with sufficient abundance for traditional use. Many traditional use plants such as black spruce, willow (*Salix* spp.), bog cranberry (*Vaccinium vitis-ideae*), Labrador tea (*Ledum groenlandicum*), and blueberry (*Vaccinium myrtilloides)* are common in a number of different ecosite types. However, there are a few traditional use species that are more restricted in their distribution and tend to only be associated with a single ecosite type, though they may be locally abundant within that ecosite type.

Traditional berries identified during interviews for the Project included the following:

- Blueberries *(Vaccinium myrtilloides and Vaccinium angustifolium)*.
- Cranberries (high bush *[Viburnum opulus var. americanum]* and low bush *[Vaccinium oxycoccos]*).
- Strawberries (*Fragaria virginiana*).
- Blackberries (*Ribes hudsonianum*).

Wild rice (*Zizania palustris*) has been raised as a species of Aboriginal value. First Nations harvest this plant for food. Wild rice grows as a tall aquatic grass along the shores of slow flowing rivers, lakes and open water wetlands. It is an important traditional use plant as well as a food source for ducks and other aquatic wildlife. There was no wild rice observed in the Terrestrial Ecology LSA during field surveys conducted in 2012.

3.2.10.4 Results – Avifauna

The range of vegetation communities in turn is a major determinant of the wildlife communities that occur in the areas within and around the Project footprint. The following section presents the results of the avifauna investigations carried out for the Project, including breeding bird surveys.

3.2.10.4.1 Upland Breeding Bird Surveys

One hundred and ten point count stations were surveyed among habitat types within the MSA and Terrestrial Ecology LSA. The stations were distributed among habitat types with 22 in conifer swamp, 21 in dense coniferous forest, 10 in dense deciduous forest, 20 in dense mixed forest, 10 in edge habitat, three in marsh, seven in open fen, four in thicket swamp, two in treed bog and 11 in treed fen. A summary of most frequently detected birds is provided in Table 3-39.

A total of 82 bird species were identified during all breeding season field surveys throughout the MSA and Terrestrial Ecology LSA. The majority of bird species were detected during morning breeding bird point counts. White-throated sparrow (*Zonotrichia albicollis*), a habitat generalist (Falls and Kopachena 2010), was the most abundant species observed. Additional common species included mixed/deciduous forest species such as red-eyed vireo; coniferous forest species such as Swainson's thrush (*Catharus ustulatus*) and wetland (e.g., bog and fen) species such as yellow-bellied flycatcher (*Empidonax flavienventris).* The species composition and density is typical of a boreal hardwood forest bird community, with a diversity of warblers, thrushes, sparrows and vireos. Species at risk (SAR) observed during the breeding bird surveys were the Common nighthawk (*Chordeiles minor*) and Canada warbler (*Wilsonia canadensis*). These species are discussed further in the SAR section below.

Landbird Priority Species: Of the 82 bird species observed during the breeding bird point counts, 21 are identified as priority species in the *Ontario Landbird Conservation Plan: Boreal Hardwood Transition, North American Bird Conservation Region 12* (PIF 2008). This plan was developed through the collaborative efforts of Partners in Flight (PIF), the Ontario Ministry of Natural Resources (OMNR), Bird Studies Canada (BSC), and Environment Canada (EC) and is intended to help guide conservation efforts in the boreal hardwood transition zone. The following 21 Priority Landbird Species for BCR 12 were observed within the Terrestrial Ecology LSA: bald eagle (*Haliaeetus leucocephalus)*, common nighthawk (*Chordeiles minor)*, broad-winged hawk (*Buteo platypterus)*, Connecticut warbler (*Oporornis agilis)* , belted kingfisher (*Ceryle alcyon)*, ruffed grouse (*Bonasa umbellus)*, Canada warbler (*Wilsonia Canadensis)*, blackburnian warbler (*Setophaga fusca)*, purple finch (*Carpodacus purpureus)*, chestnut-sided warbler (*Setophaga pensylvanica)*, bay-breasted warbler (*Setophaga castanea)*, least flycatcher (*Empidonax minimus)*, yellow-bellied sapsucker (*Sphyrapicus varius)*, veery (*Catharus fuscescens)*, black-throated green warbler (*Setophaga virens)*, mourning warbler (*Oporornis Philadelphia)*, common yellowthroat (*Geothlypis trichas)*, swamp sparrow (*Melospiza Georgiana)*, northern flicker (*Colaptes auratus)*, Nashville warbler (*Oreothlypisa ruficapilla)*, white-throated sparrow (*Zonotrichia albicollis)*.

Relative Abundance across all Habitat Types

Table 3-40 shows the relative abundance of species by habitat type in the local study area. The species found to have the highest overall relative abundance within the MSA as a whole was the white-throated sparrow, which accounted for 12.24% of all birds observed within 50 m of the observer. The Nashville warbler was found to have the second highest relative abundance within the study area as a whole, accounting for 11.33% of all birds observed within 50m of the observer. White-throated sparrows and Nashville warblers are common in the region and were both recorded at 87.27% of all point counts. The swamp sparrow was ranked a distant third in relative abundance accounting for 1.95% of birds within 50 m. No other priority species accounted for more than 2% of relative abundance.

The white-throated sparrow has priority status within BCR 12 because a high percentage of its global population breeds with this BCR and due to range-wide population declines of this species. The Nashville warbler has priority status within BCR 12 because of its high relative density, its small wintering range and because a high percentage of its global population breeds within the BCR.

During crepuscular and nocturnal point counts, four additional species, not observed during other surveys, were detected. This includes the species American woodcock (*Scolopax minor*), Long-eared owl (*Asio otus*), Northern saw-whet owl (*Aegolius acadicus*) and Great-horned owl (*Bubo virginianus*). Based on the results of the field investigation, information from a local naturalist (D. Elder personal communication), and background data, Eastern whip-poor-will was not observed during these surveys or any other surveys within the MSA or Terrestrial Ecology LSA.

Marsh Bird Species

No secretive marsh birds were identified during the Marsh Bird Surveys. However, 11 species were observed including wetland species such as Wilson's snipe, Eastern kingbird (*Tyrannus tyrannus*), and Ring-necked duck (*Aythya collaris*). The only potential Least bittern habitat (e.g., large emergent marshes) was located on Snail Bay in Marmion Lake. However habitat was marginal and no Least bitterns were observed or responded to playback. Table 3-41 summarizes the species observations during these surveys in the MSA/Terrestrial Ecology LSA.

During lake watch surveys, three additional species were detected. These were American black duck (*Anas rubripes*), Common merganser (*Mergus merganser)* and Hooded merganser (*Lophodytes cucullatus*). Adult and juvenile Bald eagles (*Halieaeetus leucocephalus*) were also observed during these surveys, flying along the shoreline of the lake. Though not observed during the lake watch surveys, Osprey (*Pandion haliaetus*) was also detected as an incidental observation in Sawbill Bay. Table 3-42 summarizes the species observations during these surveys in the MSA/Terrestrial Ecology LSA.

There were a total of nine raptor species observed during the field surveys. An additional six species could potentially occur within the MSA/Terrestrial Ecology LSA. Table 3-43 summarizes the observed and potential raptor species in the MSA/Terrestrial Ecology LSA.

Species of Conservation Concern

The EIS Guidelines outline agency expectations for considering effects to *species of conservation concern (i.e., COSEWIC-listed species, species listed under the Species at Risk Act and/or the Endangered Species Act, 2007) that may occur in potential habitats in the Project Site during critical life stages* (CEAA 2011).

Through a review of available data sources and liaison with the Fort Frances District SAR Biologist (J. Vandenbroeck, personal communication 2011) a list of SAR with reasonable potential to be in the Project Site was compiled. Species with ranges overlapping the Project Site and/or recent occurrence records in the vicinity of the MSA, Terrestrial Ecology LSA and Terrestrial Ecology RSA were considered to have a reasonable potential to be in the area. For bird species, the range maps used were from the Ontario Breeding Bird Atlas and thus reflect their breeding ranges only and do not include species that are migrants in the Project Site.

The resulting list of species of conservation concern (SOCC) for the Project included two mammals, 10 birds, one arthropod, a reptile and a vascular plant. Less than half of these species are listed as either endangered or threatened in Ontario and thus receive legal protection under Ontario's ESA. All federally listed species of conservation concern are listed provincial as well (at least special concern). However, there is one species that is endangered in Ontario but not at risk federally and that is Eastern cougar. The MNR undertook a study of this species in Ontario which confirmed through DNA evidence that there is a wild population inhabiting parts of Ontario. This four year study (2006-2010) collected DNA evidence (hair and scat) from locations across the province but specifically near Sudbury and Kenora. The limited physical evidence of the wild population of this species in Ontario, however, suggests that the population is extremely low in Ontario (MNR 2011).

The compiled SOCC list was then screened by comparing SOCC habitat requirements to habitat conditions on and in the vicinity of the Project Site. The results of the SOCC screening provide each SOCC with a ranking of low, moderate or high probability of occurrence on and in the vicinity of the MSA and Terrestrial Ecology LSA. A ranking of "low" indicates no suitable habitat availability for that species in the Project Site and no specimens identified. "Moderate" probability indicates more potential for the species to occur, as suitable habitat appeared to be present in the MSA/Terrestrial Ecology LSA, but no occurrence of the species recorded. "High" potential indicates a known species record in the MSA/Terrestrial Ecology LSA (including during field surveys or background data review) and good quality habitat is present in the MSA/Terrestrial Ecology LSA.

Species at Risk

Bald Eagle

Five bald eagle (*Haliaeetus leucocephalus*) observations were made during 2010-2012 surveys conducted in the MSA/Terrestrial Ecology LSA. One adult and two juvenile bald eagles were observed during Lake Watch surveys at stations LW02, LW04 and LW05 in Sawbill Bay, one bald eagle was observed during Breeding Bird Surveys at station #18, and one incidental bald eagle observation was made on Sawbill Bay (Figure 3-42). A potential bald eagle nest was observed on a cliff along the shoreline of Turtle Bay (Figure 3-42). Based on the structure of the nest and expert opinion, the potential for the observed nest to belong to a bald eagle is considered to be high however; it is rare for a bald eagle to nest on cliffs with a dense cover of trees.

Nesting habitat for bald eagles typically consists of forested areas adjacent to large water bodies. Nests are typically built in large super-canopy trees within mature and old growth forests containing some edge habitat. Distance from water body varies depending on the quality of the foraging habitat and degree of shoreline development (Buehler 2000, Armstrong 2007).

The habitat in the Terrestrial Ecology LSA provides opportunity for bald eagle nesting however there is substantial similar habitat in the immediate vicinity.

Winter habitat typically contains open water providing food availability, sheltered roost sites, and the absence of human disturbance. Large numbers of individuals can congregate in over wintering areas (Buehler 2000). Habitat suitability for winter foraging in the Terrestrial Ecology LSA is low because there are no know open water areas.

Canada Warbler

Ten observations of Canada warbler (*Cardellina canadensis*) were made during field work completed in the MSA/Terrestrial Ecology LSA in 2010-2012 (Figure 3-42). Eight observations were recorded during Breeding Bird Surveys and two observations were incidental. The observations were made at stations located primarily within dense mixed and dense deciduous habitat types, and at one station located in marsh habitat. The stations are located within the particular upland ecosites ES-F, ES-E, ES-G, ES-H and one wetland ecosite, W12. Three observations were recorded in the MSA, and seven in the Terrestrial Ecology LSA.

Canada warblers breed in deciduous, coniferous and mixed forest and are most abundant in mixed forest with a well-developed understory and complex ground cover (Reitsma et. al., 2010). The presence of nearby standing water and a stratified complex canopy structure are characteristic of good Canada warbler habitat. Nests are built on the ground and are difficult to locate (McLaren 2007).

Common Nighthawk

Three observations of Common nighthawk (*Chordeiles minor*) were recorded, one during a Breeding Bird Survey, one during nocturnal Whip-poor-will surveys and one was incidental. The observations were at stations located within conifer swamp and coniferous forest habitat types, in the particular upland ecosite ES-D and wetland ecosite W18 (Figure 3-42).

The Common nighthawk is an open country breeder that nests on the ground in open areas such as gravel beaches, woodland clearings, rocky outcrops, burned-over woodlands, flat gravel roofs, bogs and alvars. Eggs are laid in the open and no nests are constructed (Brigham et. al., 2011, Sandilands 2007).

Other bird species of concern that were considered included:

- **Trumpeter Swan** (*Cygnus buccinators*): This species has benefitted from reintroduction efforts in Ontario and Minnesota and although it is expanding its breeding range in northwestern Ontario it is still only present in very small numbers. It was not recorded in the OBBA atlas square containing the Project Terrestrial Ecology LSA. It breeds in marshes or floodplains of creeks (Cadman et. al. 2007). Due to the trumpeter swan low numbers, there is a low probability that it will occur in the Terrestrial Ecology LSA. The trumpeter swan is not listed under ESA or SARA and has a provincial rank of S4.
- **Tundra Swan** *(Cygnus columbianus):* This species is exclusively a tundra breeder in Ontario (Cadman et al. 2007). The only time it could occur in the Terrestrial Ecology LSA is on migration. Therefore, no critical habitat of this species occurs in the Terrestrial Ecology LSA. The tundra swan is not listed under ESA or SARA and has a provincial rank of S4.
- **Great Gray Owl** *(Strix nebulosa):* This species breeds in bogs across the boreal forest. Its breeding distribution is closely tied to prey availability which may be locally abundant in some years and nearly absent in others. Nesting habitat is further constrained by the need for abandoned raptor nests that the great gray owl uses for nesting (Bull et. al. 1993). It was recorded in the OBBA atlas square containing the Project Site. There is a moderate probability that this species will occur in the Project Site. No nesting sites were recorded in the Terrestrial Ecology LSA although there are two nesting sites to the northwest of the Terrestrial Ecology LSA. The great gray owl is not listed under ESA or SARA and has a provincial rank of S4.
- **Great Blue Heron** *(Ardea herodias):* This species is usually a colonial nester although it can breed singly. It nests in wet or dry forest, sparsely treed islands, beaver ponds and marshes (Cadman et al. 2007). There is a moderate to high probability of this species occurring in the Terrestrial Ecology LSA although no known or recorded colonies are present. The great blue heron is not listed under ESA or SARA and has a provincial rank of S4.

3.2.10.5 Results – Mammals

A total of 12 mammal species were observed either during targeted surveys or incidentally during the conduct of other baseline studies completed between 2010 and 2012. Based on range maps and knowledge of current distribution, an additional 35 species of mammals potentially occur in the Terrestrial Ecology LSA. Table 3-44 summarizes the mammals occurring and potentially occurring in the study area.

A brief discussion of the occurrence of a number of important mammals in the Terrestrial Ecology LSA is provided in the following paragraphs. Additional information is provided in the Terrestrial Environment TSD. Of the observed and potentially occurring mammal species, one is classified as a Species at Risk, Gray fox. However, no Gray foxes were observed in the Terrestrial Ecology LSA, nor is suitable habitat available in the Terrestrial Ecology LSA for this species. A detailed account of species at risk is provided in the Terrestrial Ecology TSD.

Moose (*Alces alces*): Currently in Ontario, moose are managed primarily by controlling the hunting season for residents and non-residents (MNR 2009). The Project Site is located within Wildlife Management Unit (WMU) 12b. In WMU 12b, the cervid strategy is to manage moose as the primary cervid species and maintain moderate to high moose populations. The moose aerial inventory completed within WMU 12b in 2009 indicates that numbers of moose in the area are increasing. The Terrestrial Ecology LSA appears to provide quality habitat for moose, with abundant moose sign (tracks, fecal pellets). Incidental observations of moose (sightings and sign) were observed during all field campaigns. Moose were observed directly during fieldwork and tracks and droppings were common observations especially during the wetland evaluation field studies.

Black Bear (*Ursus americanus*): Black bear are widely distributed across northern Ontario. Signs of black bears were evident during the MSA and Terrestrial Ecology LSA baseline studies, and photographic observation was obtained from the remote camera surveys in 2012. In 2006, the bear density for WMU 12B was estimated at 0.40 bears/km^2 with local densities varying considerably. Forested areas with a mixture of clearings, lakes and deciduous forest can provide the supply and variety of foods required by bears throughout the active time of year (Taylor 2006). The study site does not appear to provide higher than average habitat quality. The majority of the study area contains hardwood dominated mixedwood forest with a rich understory. However, most of the forest is mature with little recent natural disturbance and limited forest openings except in rocky areas, wetlands and watercourses. Bear density in the study site is likely comparable to those in the surrounding landscape and lower than those in more disturbed areas.

Grey Wolf (*Canis lupus*): Gray wolf presence in the MSA and Terrestrial Ecology LSA was recorded through anecdotal evidence (TUS survey, Osisko staff observations). Wolf densities and trends in the immediate vicinity of the MSA and Terrestrial Ecology LSA are not known but hunter surveys indicate a steady increase in their numbers regionally, throughout the 2000s (Patterson and de Almeida, 2011). Generally, the increase in wolf numbers is thought to be in response to increase moose and deer numbers.

Furbearers and Small Mammals: A number of furbearers are known to inhabit the study areas, although some species are not likely to be present due to uneven distribution and lack of habitat. Incidental field observations and remote wildlife camera surveys revealed the presence of furbearers in the study areas including marten, fisher, otter, mink, hare, lynx and red squirrel.

There are six trap lines in the Terrestrial Ecology LSA. The data obtained for these trap lines from 2006-2010 indicated the largest catch of muskrat, marten, and beaver followed by weasel, mink and otter. The marten is one of the most sought after furbearers. Although harvest numbers cannot be assumed to directly reflect the population, it appears that the medium sized furbearer, marten is more heavily trapped than other furbearers of similar size such as fisher and Canada lynx.

Marten: Marten habitat is being managed for in the forest management plans (FMP).

The identification of marten habitats based on the suitability of certain forests was undertaken based on the FMPs in the Terrestrial Ecology RSA. Marten core 10-year deferral is identified on Abitibi Consolidated maps for the Resolute's Forest Management Area including in and around the MSA/Terrestrial Ecology LSA.

Bats: Range maps indicate that six species of bats have known home ranges that encompass the LSA and MSA (Bat Conservation International, 2013). These include hoary bat (*Lasiurus cinereus*), silver-haired bat (*Lasionycteris noctivagans*), big brown bat (*Eptesicus fuscus*), red bat (*Lasiurus borealis*), little brown myotis and northern myotis. All of these species were recorded during the 2013 bat field surveys of the MSA. An additional species, small-footed myotis (*Myotis leibii*) was also recorded during the 2013 field surveys. Detailed results of the 2013 bat surveys including an effects assessment on bats are provided in the Terrestrial Ecology TSD Supplemental Information package.

3.2.10.6 Results – Amphibians and Reptiles

The reptiles and amphibians in the Terrestrial Ecology LSA and MSA (Table 3-45) are generally those considered typical of the boreal forest. There is no indication that the species or habitats at the study site are unique relative to the surrounding area.

There are eight species of amphibians common to this area including boreal chorus frog (*Pseudacris maculate)* American toad (*Bufo americanus*), spring peeper (*Pseudacris crucifer*) and Gray tree frog (*Hyla versicolor*). The range of only three reptile species encompasses this area and these are Common snapping turtle (*Chelydra serpentine)*, Western painted turtle (*Chrysemys picta belli*), and Eastern garter snake (*Thamnophis sirtalis sirtalis*) (Oldham and Weller 2000). The Common snapping turtle is considered to be of special concern federally (COSEWIC 2010) and provincially (COSSARO 2010).

Species at Risk – Snapping Turtle

One incidental Snapping turtle (*Chelydra serpentina*) and one shell fragment was observed in the Terrestrial Ecology LSA (Figure 3-42). These observations were recorded in the upland ecosite ES-E and the wetland ecosite W18.

Preferred Snapping turtle habitat consists of shallow, slow moving water with dense aquatic vegetation and a substrate of soft mud. Populations are found in wetlands such as ponds, shallow bays, river edges and slow streams. Nesting occurs in gravelly or sandy areas often adjacent to water bodies (COSEWIC 2008).

3.2.10.7 Results – Invertebrates

During various field surveys, 28 species of dragonfly and butterfly species have been identified in the MSA and Terrestrial Ecology LSA as listed in the Table 3-46. All the species observed are common to the area and there are none designated under provincial or federal legislation.

3.2.10.8 Results – Wildlife Corridors

The MSA and Terrestrial Ecology LSA are occupied by large tracts of forested landscape interspersed with wetlands. With few barriers to wildlife movement, it is expected that the majority of the MSA and Terrestrial Ecology LSA provide movement corridors. Other than the obvious stream corridors and valleys that animals use for movement, there are no previously identified movement corridors in the MSA or Terrestrial Ecology LSA. Wildlife will also use cleared roads and trails for ease of movement and such features occur quite regularly throughout the MSA and Terrestrial Ecology LSA. Obvious barriers to landscape level movement of wildlife (i.e., large mammal) are the waterbodies in and around the Terrestrial Ecology LSA. In general, the waterbodies trend in a southwest-to-northeast direction (e.g., Lizard Lake, Sawbill Bay). Therefore, it is likely that main movements through the Terrestrial Ecology LSA occur along the same trajectory and movement from the southeast to northwest is somewhat limited at a broad landscape scale.

3.3 Socio-economic Environment

The Project is located 30 km north of the Town of Atikokan (population of approximately 2,800), within the Rainy River District in Northwestern Ontario. The City of Thunder Bay (population of approximately 120,000) is located approximately 170 km east and the Town of Fort Frances (population of approximately 8,000) is located 150 km to the west.

The Town of Atikokan is a beautiful community, dubbed the Canoe Capital of Canada. The Town is known regionally for its popular fishing tournament, the Atikokan Bass Classic. The Town also has a history of resource development including mining and forestry. In 2011, the Town Council passed a resolution in support of the Hammond Reef Gold Project. The potential influx of workers to the Town of Atikokan could affect housing, services and infrastructure. The Project also represents potential business opportunities for community members.

The City of Thunder Bay acts as the centre for regional mining activity. Thunder Bay could potentially provide a large amount of goods and services required by the Project and may also have a pool of qualified specialized workers that are not necessarily available locally. The Town of Fort Frances is the main public service and infrastructure hub of the Rainy River District and may also be a source of goods and services for the Project.

3.3.1 Study Areas

The Rainy River, Thunder Bay Districts, as well as a portion of Kenora district south of the Far North boundary have been identified as the regional study area. Census data are available and presented for the Kenora District as a whole. About 90% of the population of this District live below the Far North boundary, and therefore, for the purposes of this assessment, data for the District as a whole are taken to be representative of the portion included in the Socio-economic Environment RSA. The urban and rural communities within these districts will provide some of the labour force and some goods and services required to construct and operate the mine and are therefore likely to experience Project-related effects.

The local study area for socio-economics has been defined as the town of Atikokan and an area centred on Atikokan with a radius of 50 km (7,850 km^2). The Socio-economic Environment LSA covers a geographical area that will experience principal Project effects in relation to population and employment, economics, and services and infrastructure (Figure 3-43). This Socio-economic Environment LSA includes as shown on Figure 3-43, a number of smaller communities exist along Highway 11 within the Local Study Area. Census data are not reported by Statistics Canada for these smaller communities. Population and demographic data for the Town of Atikokan are used to represent the Socio-economic Environment LSA.

The Socio-economic Environment LSA was modified for the purpose of the land and resource use assessment. The modified Socio-economic Environment LSA corresponds to the LSAs selected for the aquatic environment (Aquatic Environment TSD) and terrestrial biology (Terrestrial Ecology TSD), which represent the primary linkages between direct Project-related effects and potential effects on land and resource use, including outdoor tourism and recreation, hunting, trapping, fishing, mining, and forestry. For the purposes of the assessment of effects on the socio-economic environment, the MSA and LISA are considered as part of the Socio-economic Environment LSA.

3.3.2 Methods

Both primary and secondary data were collected in the completion of the baseline studies. A review of existing (secondary) is the principal source of information for the baseline. Data sources include publicly available information (i.e., books, reports, and websites). A desktop study was conducted to review census data, regional and local community and economic development plans and policies, land use plans and policies, mining reports, and community profiles of the study areas.

Primary data collection was conducted in the form of informant interviews and traffic studies. Interviews were held with key stakeholders to verify and refine information and emerging observations obtained through the desktop study, and provide qualitative information on characteristics of potentially affected communities and on community needs and aspirations. Data were also collected through an economic assessment report and a traffic impact study.

3.3.3 Results

3.3.3.1 Population and Demographics

The population and demographics VEC is described using four indicators: population change, mobility, age and gender, and dependency ratios.

3.3.3.1.1 Population Change

The total population of the Socio-economic Environment RSA is 224,034 (StatsCan 2012) (Table 3-47). The Thunder Bay District represents more than half of the Socio-economic Environment RSA population, with the majority of the District's population concentrated in the City of Thunder Bay. The second largest population centre in the Socio-economic Environment RSA is the City of Kenora with 15,348 followed by the Town of Fort Frances (7,952) and the City of Dryden (7,617).

The population of the Socio-economic Environment RSA has decreased, compared to 235,046 in 2006, 234,771 in 2001, and 244,117 in 1996 (StatsCan 2007; StatsCan 2012). This population fluctuation has resulted in an overall decrease of 8.2% since 1996.

In 2011, the population of Atikokan was 2,787, representing a 31% decline since 1996 and a 15.4% decline from 2006 to 2011. This decline can be attributed mostly to the downturn of the local economy resulting from the closure of a number of mining and forestry-related employers in the town.

Comparatively, the population of Ontario has demonstrated a growing trend since 1996, with a population increase of 19.5% over this period.

The population density in the Socio-economic Environment RSA is low at 0.4 persons/km^2 compared to 8.7 persons/km^2 in Atikokan and 14.1 persons/km^2 for the Province.

It is projected that the population of the Socio-economic Environment RSA will experience a decrease in population from 2013 to 2015 (-0.03% per year) and from 2016 to 2030 (-0.04% per year), as compared to the projected increases for the province as a whole over these periods. This projected population decline appears to be a conservative estimate compared to the observed population decline over the past five years. Kenora District is expected to be the only district within the Socio-economic Environment RSA to potentially experience population growth over the period to 2030.

The anticipated population decrease in the Socio-economic Environment RSA will be due to the aging of the largest population cohorts (45-60), especially in regions where natural increase and net migration are projected to become or remain negative. In 2011, the median age of the Socio-economic Environment RSA was 42.4 and of Atikokan it was 48.5, compared with the provincial median age of 40.4 years.

3.3.3.1.2 Age and Gender

Figure 3-44 shows the age and gender characteristics of the Socio-economic Environment RSA. The most distinct features of this figure compared with a similar figure for the Province as a whole are:

- Lower percentage of children (0 – 14-year cohorts).
- Lower percentage of younger working-age adults (20 – 44-year cohorts).
- Higher percentage of retired persons (60 – 85-year cohorts).

Figure 3-45 presents the age and gender characteristics of the Socio-economic Environment LSA. The smallest cohorts are the 20-34-year categories, as well as the 70-85+ categories. The largest cohorts are between the ages of 40 and 64. This reflects the declining population of Atikokan and the loss of youth following secondary education. Without in-migration of younger individuals, the population can be expected to decrease further over the next 20 to 40 years.

The fact that the largest cohort is nearing retirement age will be a challenge to labour force supply province-wide, but this problem may be exacerbated in the Socio-economic Environment RSA and Socio-economic Environment LSA where, due to the lack of post-secondary educational and employment opportunities, young people may leave the region to pursue career and job training elsewhere.

3.3.3.1.3 Dependency Ratios

Dependency ratios for the Socio-economic Environment RSA and Socio-economic Environment LSA are presented in Table 3-48. Dependency ratios consist of the ratio of children (0 to 14 years of age) to the working age population (15 to 64 years of age) and the ratio between the elderly (65 and older) to the working age population. In 2006, the dependency ratio for Atikokan was higher than Ontario as a whole mainly due to the higher percentage of elderly in Atikokan as compared to the province. Due to the aging population of the Socio-economic Environment LSA, it is anticipated that dependency ratios will increase in the future, potentially putting social and financial strain on income earners and their families, as well as on the municipal tax base, community services and infrastructure, including senior’s care, healthcare and childcare (StatsCan 2007).

3.3.3.2 Labour Market

The labour market is described using five indicators: regional and local supplier base; labour force by industry and occupation; employment and unemployment rates; median income; and education and training. The labour force indicators presented in this section illustrate the overall economic performance of the Socio-economic Environment RSA and Socio-economic Environment LSA and reflect overall status of the labour market with respect to the availability of workers.

The economy of Northwestern Ontario has been declining over the past decade. The Gross Domestic Product for Northwestern Ontario declined by 6.7% between 2001 and 2006, while it increased by 3.5% and 13.6% for Northeastern Ontario and the rest of Ontario respectively over the same period of time (Rosehart 2008).

The economy of Northwestern Ontario has traditionally been dominated by a small number of large companies that hire large numbers of workers, which in turn has created service industries dependent on large employers and their employees (Rosehart 2008). Approximately 76% of employment in Northwestern Ontario (excluding Thunder Bay) is in the service sector (Northwest Training and Adjustment Board 2010). The decline of the forestry sector in Ontario in recent years and the subsequent closures of pulp and paper and lumber mills have had a negative effect on the region's economic conditions.

Ongoing mineral exploration activities and discoveries of substantial mineral reserves in the "Ring of Fire" area in the Northeastern part of the Kenora District may open up new economic opportunities for increased exploration, mining services and aggregate exportation. Aside from the direct employment opportunities and income that new mining construction and operations entail, there are many indirect economic effects associated with mining.

Historically, the Town of Atikokan developed around the mining and forestry industry, and remained heavily dependent on these sectors. With the closing of the community's most recent mines in 1979, major economic downturn followed in the 1980s and the forestry sector became the primary employer in the community. However, with the recent downturn in regional forestry, only one firm, which manufactures fuel pellets, remains active in the Town of Atikokan.

Nevertheless, the local economy is based on mining, forestry, as well as the Atikokan Generating Station, government and retail services, light manufacturing, and tourism (OMEDT 2010). In 2010, the main employers in Atikokan were Ontario Power Generation, the Rainy River Board of Education, and Atikokan General Hospital, with each organization employing between 80 and 100 people. Additionally, each year Quetico Provincial Park employs 100 people in the summer and eight people year-round.

A 2007 Municipal Economic Development Plan identifies tourism, small manufacturing (particularly wilderness-related), and the forestry and mineral development sector as the targeted sectors for economic development (OMEDT 2010). Tourism has come into particular focus since the closure of major mine and forestry operations. The Proposed Growth Plan for Northern Ontario (2009) also identifies several plans of action related to tourism, including nature-tourism promotion and investments in public infrastructure.

The Atikokan Economic Development Commission has also noted a recent increase in activity in the mining and energy generation sectors, and is optimistic that this activity will aid in the stabilization of the local economy. Plans are proceeding to convert OPG's Atikokan Generating Station generating station from coal to wood-fibre biomass, which represents a $170 million project and an estimated 200 construction jobs for the community. The project began in October 2012 and will be completed in 2014.

3.3.3.3 Regional and Local Supplier Base

As of 2006, there were 13,217 businesses registered in the Socio-economic Environment RSA, including 176 with 100 or more employees (NWTAB 2012), representing a slight decrease of 0.5% since 2001. As of 2011, there were 152 businesses associated with Construction, Mining and Utilities in the Rainy River District; with just three of these providing support activities for mining (NTAB 2012).

The Town of Atikokan has 83 businesses (AtikokanOnline 2012), only 30 of which would be able to support the mining industry if the Project and other initiatives are realized (AEDC 2011).

3.3.3.4 Labour Force by Industry and Occupation

In 2006, the Socio-economic Environment RSA had an experienced labour force of 117,865 (1.8% of the provincial labour force). In 2006, other services, health care and social services, business services, and retail trade represented the largest employment sectors in the Socio-economic Environment RSA. Manufacturing, construction and resource-based employment comprise 22% of the workforce (StatsCan 2007).

In 2006, the Socio-economic Environment LSA had an experienced labour force of 1,650. Figure 3-46 presents a breakdown of employment by industry for the Socio-economic Environment LSA. Manufacturing, other services, health care and social services, agriculture and other resource-based industries represented the largest employment sectors in the Socio-economic Environment LSA (StatsCan 2007). The percentage of workers employed in manufacturing has declined since 2006 with forestry closures, but the proportion of the labour force employed in agriculture and other resource-based industries is higher in the Socio-economic Environment LSA than in the Socio-economic Environment RSA (7.2%) and the province as a whole (2.9%) (StatsCan 2007). This indicates importance of resource-based industries such as mining and forestry to the local and regional economy. Primary industries of employment are still forestry and mining; however, many workers are employed outside of Atikokan while their families still reside in Atikokan. Tourism constitutes approximately 15% of Atikokan's employment (G. McKinnon personal communication 20 October 2011).

3.3.3.5 Employment and Unemployment Rates

Table 3-49 indicates that while participation and employment rates in the Socio-economic Environment RSA were lower than those of the Province in 2006, the unemployment rate was higher, particularly in terms of male unemployment rate (3.6% higher than the provincial rate).

Although the unemployment rate in Atikokan was greater than the provincial average in 2006, it shows reductions to the unemployment rates recorded in 2001 (11.9%) and 1996 (13.2%). The labour force participation rate was low compared to the province, a continuing trend since 1996.

In 2007, approximately 350 Atikokan residents were laid off due to the closures of Fibratech and from Atikokan Pulp and Paper (AEDC 2008). This represents a loss of 23% of the local jobs at that time. Due to this event, the employment rates for Atikokan have changed significantly since the 2006 census.

3.3.3.6 Median Income

The median personal income for persons 15 years and over in the Socio-economic Environment RSA in 2006 was $26,410, slightly lower than the provincial median of $27,258. In Atikokan, the median 2006 income was $25,718, also slightly below the provincial median. Median income for women stood at $18,791 compared to $39,133 for men. This is due in part to the heavy influence of the resource based industries in the region, which tend to be male-dominated and higher paying, while support, service and retail jobs secured by women tend to pay less.

In 2006, 13.8% of persons residing in Atikokan were deemed of low income status compared to 14.7% in the Province.

3.3.3.7 Education and Training

The level of education within a community helps characterize its socio-economic status and reflects the potential pool from which future workers are drawn.

Figure 3-47 illustrates educational attainment in the Socio-economic Environment RSA and Socio-economic Environment LSA for the population over 15 years of age in 2006. The Socio-economic Environment RSA has a greater proportion of persons with no certificate, diploma or degree than the province, which may be indicative of the reduced skills training required for the predominant industries in the Socio-economic Environment RSA. In 2006, the percentage of those with college certificate/diploma and apprenticeship and trades certificates in Atikokan was higher than the provincial average, however there were a lower percentage of individuals holding university degrees. The level and type of educational attainment in Atikokan reflects the importance of resource-based industries and tourism industries in the community which often do not require a college or university level of education.

Out of 24 colleges of applied arts and technology in Ontario, only one is located in the Socio-economic Environment RSA (Confederation College in Thunder Bay) and out of 20 publicly funded universities in Ontario, only one is within the Socio-economic Environment RSA (Lakehead University in Thunder Bay). This may contribute to lower education levels compared to the provincial average, and contribute to out-migration of students. However, Confederation College, as well as other universities and colleges, offer courses remotely in Atikokan through Contact North.

3.3.3.8 Local Government Finances

The government revenues and expenditures VEC is characterized by a single indicator which describes the municipal government revenues and expenditures for the Town of Atikokan.

The amount and source of municipal government revenues and expenditures for Atikokan is shown in Tables 3-50 and 3-51. Property taxes are the largest contributor, contributing 47% of total revenue. Provincial and federal government grants were the second largest contributors to municipal revenue (36%). The largest government expenditures were for transportation and utilities, and constituted 33% of total expenditures. More recent figures and discussions with municipal government officials indicate that the declining tax base will place increasing burden on maintaining aging infrastructure.

3.3.3.9 Public Services and Infrastructure

This VEC is characterized by seven indicators: protection and emergency services, health services, social services, education, recreation, water, wastewater and waste management, and utilities. Each of these indicators is described below.

Each district in the Socio-economic Environment RSA has a services board responsible for overseeing the provision of services to areas outside organized municipalities, with provincial funding provided for educational, health and social programs. In the Socio-economic Environment RSA:

- The Rainy River District School Board is responsible for delivery of primary and secondary education.
- Northwest Catholic District School Board provides Primary/Junior education program at St. Patrick's School (primary/junior school) in Atikokan.
- The Rainy River Social Services Area Board is responsible for delivery of social services.
- The NorthWest Health Unit is responsible for delivery of health services to Kenora and Rainy River Districts.

The Town of Atikokan provides a range of services to residents and property owners such as sewer and water, road maintenance, building inspection and fire protection within the municipal boundaries. Operational funding for these services is generated mainly through municipal property taxes, while capital works are typically funded through provincial and federal grants.

3.3.3.9.1 Protection and Emergency Services

3.3.3.9.1.1 Police

The policing of Atikokan is provided by the Ontario Provincial Police (OPP). There is one OPP detachment in the municipality (Ontario Provincial Police 2009), and no service or capacity issues with respect to policing in the Socio-economic Environment RSA or Socio-economic Environment LSA have been reported.

The Atikokan Detachment provides policing services to the Town of Atikokan as well as some of the surrounding unorganized territory (e.g., Quetico Provincial Park and Provincial Highways 11, 622, 623 and 633). The Detachment provides 24-hour service and employs 12 provincial constables and one sergeant.

Trends in offenses are consistent with other communities located in Northern Ontario.

3.3.3.9.1.2 Ambulance

Provincial ambulance services are provided by the Land Ambulance Services Branch of the Ministry of Health and Long-term care. Within the Rainy River region, including Atikokan, land ambulances are administered by the Rainy River District Social Services Administration Board (RRDSSAB), with an ambulance base in each municipality (RRDSSAB 2010). Currently, 24-hour land ambulance service is provided to Atikokan using two vehicles. Emergency air service is provided by Ornge, through helicopter landing pads at Atikokan General Hospital and at the Project Site (D. McCormick personal communication 21 October 2011).

3.3.3.9.1.3 Fire Protection

Municipal fire protection in Atikokan is provided by one fire station, which is operated by a fire chief, and 25 volunteer fire fighters. The volunteer fire Department at Niobe Lake responds to calls in the unorganized territory and has responded to the OHRG Mine Site. It has one pumper, a tank truck and approximately 10 volunteers (P. Brown personal communication 13 July 2012).

Support for Atikokan's fire protection service is provided by The Mutual Aid Fort Frances Fire and Rescue Service. They are equipped for both land, and water rescue (Fort Frances Fire and Rescue 2010).

3.3.3.9.2 Health Services

In Ontario, the Ministry of Health and Long-term Services is responsible for providing public health services. Health service delivery is offered primarily through regional health units. The Northwest Health Unit (NWHU) is designated to deliver health services to residents of Kenora and Rainy River Districts.

Thunder Bay Regional Health Sciences Centre (TBRHSC) provides service to Thunder Bay and Northwestern Ontario. This facility has 375 acute care beds, and its emergency room treats 95,000 patients per year (260 per day) (TBRHSC 2010). Mental health and addiction programming for all ages are also available. Atikokan residents travel to Thunder Bay for routine child birth, surgery, cardiac and dialysis services which are not offered in Atikokan (Atikokan Family Health Team personal communication October 20, 2011).

Atikokan and the surrounding area are serviced by the Atikokan General Hospital. This facility provides emergency and acute care and is fully accredited, with a total of 41 beds. Currently, services are provided to approximately 6,000 outpatients per year. Acute care occupancy operates at approximately 60% capacity (W. Smith personal communication 24 February 2012). Expansion of the hospital is expected to take place between 2012 and 2014, and will increase capacity of the hospital to service a population of 7,000 (Grupi 2012).

Twenty-four hour on-call community medical service is provided at the Medical Clinic, which staffs physicians, registered nurses, registered practical nurses, a mental health worker, dietician, pharmacist and support staff. Approximately 800 patients per month are seen by a doctor and 1,000 per month are seen by a nurse; however, accessibility and space issues have been identified.

Atikokan is designated as underserviced for general/family practitioners by the Ministry of Health and Long-Term Care, and are subsequently receiving grants for additional funding and recruitment of physicians. Atikokan currently has 5.25 doctors and a vacancy for 1.75 doctors (Ontario Ministry of Health and Long-Term Care 2008).

3.3.3.9.3 Social Services

The Rainy River Social Services Area Board provides social services for Atikokan, including Ontario Works and Social Housing (RRDSSAB 2010). Funding is provided by each of the 12 municipalities in the District. In Atikokan, other services are provided by the Atikokan Municipal Non-Profit Housing Corporation, and the Atikokan and District Association for Developmental Services including family and children's services and a women's shelter (Immigration Northwestern Ontario 2010). Atikokan has two daycare and preschool facilities which have additional capacity due to the declining population (D. McCormick personal communication 21 October 2011). Child care is subsidized for low-income families through the RRDSSAB.

Social housing programs, administered by the RRDSSAB, include Atikokan Family Housing, Atikokan Native Non-Profit Housing, and two seniors housing complexes. Currently, there are vacancies in available family housing, however seniors housing is operating at capacity.

3.3.3.9.4 Education

The Ontario Ministry of Education oversees the planning and implementation of education services in the province, although school districts play a lead role in planning and implementing services at the local level.

Atikokan has two publically-funded elementary schools and one secondary school, which are administered by the Rainy River District School Board (RRDSB). The Northwest Catholic District School Board operates the one school in Atikokan.

Between 1998 and 2006, total school enrolment in Atikokan decreased by 21% from 619 students to 486 students. Atikokan High School has experienced the greatest decline since 2006 (33%). Overall, schools in Atikokan are operating at approximately 39% capacity. No capacity issues have been identified for elementary or secondary education in the Socio-economic Environment LSA.

No post-secondary educational institutions exist in the Town of Atikokan; however, distance education is offered by Contact North and Lakehead University (Thunder Bay) (OMEDT 2010).

3.3.3.9.5 Recreation

Recreation in this section refers to the services and facilities offered by Atikokan and focused on urban activities inside municipal boundaries.

Recreation infrastructure is shown on Figure 3-48. Atikokan is home to a recreation centre, a community centre, library and seniors' facilities. Athletics facilities and cultural facilities (theatre, museum, Native Friendship Centre and a Gallery and Arts Centre) exist, but recreation infrastructure is showing its age and is in need of repair (N.Halaz personal communication October 2011).

3.3.3.9.6 Water, Wastewater and Waste Management

Table 3-52 presents the status, remaining capacity and improvement plans of the Town of Atikokan for water, wastewater and solid waste management (Meridian 2012). Currently, there is significant capacity for increased demand of water treatment and wastewater treatment services, while the local landfill, which is approaching capacity, will be supported by a new landfill in the coming years.

3.3.3.9.7 Utilities

Electricity is supplied by Atikokan Hydro Inc. The current hydroelectric system, at 3,000 KW is below its capacity, indicating that there is capacity to deal with increased electricity demand. Natural Gas is supplied from western Canada by Enbridge and/or Union Gas through a connection to the provincial pipeline system; no constraints have been identified.

3.3.3.10 Housing and Accommodation

Although accommodation needs for the Project will primarily be met through the construction of a camp near the Project location, it is anticipated that some proportion of the workforce and their families will seek housing and accommodation in the Socio-economic Environment LSA. The housing and accommodation VEC is characterized by three indicators: housing supply, occupancy rates, and housing costs and listings. Each of these indicators is discussed below.

3.3.3.10.1 Housing Supply

In 2006, single-detached houses formed 88.7% of permanently occupied housing in Atikokan and 79% in the Socio-economic Environment RSA, compared to 56.1% for the Province. There is a marked shortage of rental housing in Atikokan.

Nearly all homes in Atikokan were built prior to 1986 (96.8%), most during the mining boom in the 1950s. Consequently, homes generally require more maintenance than homes elsewhere in the Socio-economic Environment RSA and the province.

A shortage of seniors housing and rental housing in Atikokan has been identified. The Township of Atikokan has also surveyed three subdivisions and laid-out 532 lots for residential growth (AEDC 2005).

There are four hotels and motels in Atikokan with a total of 94 rooms. There are also four bed and breakfasts in the area. The main type of temporary accommodation – focused on supporting the recreation tourism industry – includes over 20 outfitters, resorts, and lodges, and camps.

3.3.3.10.2 Occupancy Rates

In 2006, the occupancy rate of private dwellings in Atikokan was 92.4%, compared to 82.4% in the Socio-economic Environment RSA. There is a shortage of available rental housing units in Atikokan, particularly in the form of apartments (Grupi 2012).

3.3.3.10.3 Housing Costs and Listings

In 2006, the value of houses in Atikokan was much lower that the Socio-economic Environment RSA or the Province. In February 2011, the 16 residences for sale in Atikokan ranged from $29,500 to $135,000, compared to 69 residences for sale in Thunder Bay ranging from $149,900 to $579,900. The average value of single family detached homes in Atikokan was $58,014 in 2008.

In 2011, housing was being purchased at a much greater rate than previous years, with property listings declining from 85 to 15 from October 2010 to October 2011, signifying a tight market.

3.3.3.11 Transportation Valued Ecosystem Component

This VEC is characterized by two indicators: the existing network and traffic volumes and levels of services. Each of these indicators is described below.

3.3.3.11.1 Existing Network

The major highways utilized by the Project and region are under the jurisdiction of the Ontario Ministry Transportation, subject to the provisions of the *Highway Traffic Act*.

Figure 3-49 shows transportation infrastructure in the Socio-economic Environment RSA. Highway 11 is one of only two highways that connect Northern Ontario to Southern Ontario and provinces to the east and west. The Canadian National Railway Company (CN) rail line also crosses the area. Highway access to the United States (a one-hour drive) is provided by Highway 61.

The Thunder Bay International Airport, Fort Frances Airport and Thunder Bay Port Authority are located in the Socio-economic Environment RSA. The Atikokan Municipal Airport allows for charter and personal flights to the area, and is mainly utilized by private aircraft and for emergency services (AEDC 2010).

Transportation infrastructure for the Socio-economic Environment LSA is shown in Figure 3-50. The main access to and from the Project site for goods, products and employees is via Highway 622, Hardtack Road, Sawbill Road and Reef Road.

3.3.3.11.2 Traffic Volumes and Levels of Services

The existing transportation network was studied in 2012 to evaluate existing traffic conditions, illustrated on Figure 3-51. All of the intersections studied in Figure 3-51 received an “A” designation, representing the best conditions in terms of Level of Service (LOS), operating well below capacity.

Mainline analysis of highway segments was carried out using Highway Capacity Software (HCS). The results indicate that all of the highway segments operate at level of service “B” or better for Hardtack Rd, Highway 11B and Highway 11.

3.3.3.12 Land and Resource Use

The following sections provide information about land uses in the Socio-economic Environment RSA and Socio-economic Environment LSA.

Land use planning in the Socio-economic Environment RSA is shared by various authorities. The Rainy River District Planning Board coordinates future growth and land use planning activities and can adopt official plans and pass zoning by-laws in planning areas without municipal organizations in their jurisdiction. The Minister of Municipal Affairs and Housing defines planning areas and initiates zoning controls in some areas without municipal organization or planning boards. The Ministry of Natural Resources manages Crown land and provincial parks (through Ontario Parks) on behalf of the public. The Ministry of Northern Development and Mines (MNDM) advocates on behalf of Ontario's northern region, and delivers programs and services related to economic development in this region. The vision of MNDM is a Northern Ontario economy and provincial minerals sector that are healthy, competitive and sustainable.

The Project Site is located in, or in close proximity to, three MNR General Resource Areas: Finlayson, Marmion and Greytrout (2006). The Atikokan District Land Use Guidelines provide policy direction for the use of lands and resources within these areas, which allows for exploration and extraction activities. The Mine Site Study Area is located within the Finlayson and Marmion General Resource Areas, while the Linear Infrastructure Study Area is located within the Finlayson and Greytrout Areas.

Existing land uses within the Finlayson Area include tourism, recreation, trapping, commercial bait fishing, mineral exploration, aggregate extraction and logging. Recreational use for angling and hunting is intensive. Future commercial outpost camps are proposed for Finlayson and Lizard Lake (MNR, 2006).

The Marmion General Resource Area consists of Marmion Lake, which has a 120 m modified management area around it. Angling, boating, canoeing and camping by residents and visitors occur throughout the open water season. Other activities include trapping, commercial bait fishing, mineral exploration and logging (MNR, 2006).

3.3.3.12.1 Outdoor Recreation and Tourism Valued Ecosystem Component

Figure 3-52 illustrates tourism and recreation infrastructure in the Socio-economic Environment RSA. Parks and recreation play a key role in the tourism industry in Northern Ontario. There are numerous national and provincial parks in the Socio-economic Environment RSA, which offer activities camping, hiking, fishing, paddling and boating; although many do not offer visitor facilities and are accessible only by air. Quetico Provincial Park (~50 km to the south) and the Turtle River – White Otter Lake Provincial Park (~200 km to the northeast) are both in the general vicinity of the Project.

Quetico Provincial Park occupies 475,782 hectares and includes an intensive network of canoe routes. Motorized boats are not permitted within the park, which hosted 75,502 visitors in 2010. Overall park capacity meets demand; during peak season (July-August) the park had a 38% occupancy rate.

Turtle River – White Otter Lake Provincial Park occupies 49,294 hectares north-west of the Project. The park is only accessible by water, and visitor statistics are not kept. Main uses include backcountry canoeing and fishing.

The Ministry of Tourism and Culture provides tourism industry statistics for the Rainy River District, but not for Atikokan alone. Total visits in 2009 were 455,000, 210,000 of which were overnight visits. Visitors were predominantly from the United States, Ontario and elsewhere in Canada, and visited primarily for "any outdoor/ sports activity" (206,000), followed by "fishing" (140,000) (MTC 2009).

Tourism and recreation infrastructure in the Socio-economic Environment LSA is shown on Figure 3-53. Outdoor tourism and recreation is an integral component of the economics and character of Atikokan. The Town's Municipal Cultural Plan (2012), identifies outdoor recreation as the basis for the community's cultural identity.

The map data layer provided by the MNR identifies three operating tourism outfitters within the LSA. The data also identifies approximately eight access points used by anglers and boaters, possible camping locations and four cottages within the LSA. Access points on Finlayson Lake, Marmion Lake and Sawbill Bay are important local recreation and tourism areas.

Outdoor recreational tourism operators in the Socio-economic Environment LSA host remote camping, hunting and fishing vacations. These tourism outfitters provide a variety of services including remote fly-in, and drive in wilderness retreats, guided fishing tours, hunting expeditions, and trapper cabins, as well as accommodations. The Atikokan Tourist Bureau tracks Atikokan visitors during peak season (May-September). In 2011, 3,697 tourists visited the Tourist Bureau, 30 percent of which were only passing by. The most popular reasons for visiting Atikokan were recreation (approximately 20 percent), followed by fishing, and visiting friends or family (approximately 10 percent each).

3.3.3.12.2 Hunting

Hunting and trapping are managed provincially by the Ministry of Natural Resources (MNR). Recreational bear, moose, elk and deer hunting by residents is managed by Wildlife Management Units (WMUs). The Socio-economic Environment LSA is located predominantly in Wildlife Management Unit 12B, with a small portion of the Socio-economic Environment LSA in WMU 12A. Figure 3-54 shows the WMUs for hunting in the Socio-economic Environment LSA. Within each WMU there are a number of Bear Management Areas. There are four Bear Management Areas within the Socio-economic Environment LSA operated by tourism operators. Between 2007 and 2010, a total of 73 bears were harvested from these four areas (MNR 2011).

Hunting licenses for moose, elk and deer are distributed by Wildlife Management Units managed by the MNR. Recent surveys show that moose numbers in WMU 12B have increased since 2000 (MNR 2009). In 2010, there were an estimated 1,646 active residential moose hunters in this area and 190 moose harvested (Stewart and Dix-Gibson 2011). The number of hunters has fluctuated since 2006, from a low of 1,494 in 2008 to a high of 1,775 in 2006. The total number of moose harvested ranged from 132 in 2009 to 276 in 2006. White-tailed deer (in summer and fall), rabbits, foxes and wolves, as well as game birds such as partridge, ducks, geese, duck, and ruffed and spruce grouse are also hunted in this area.

3.3.3.12.3 Trapping

Trapping areas in the Socio-economic Environment LSA are identified is shown on Figure 3-55. These traplines are classified as Crown Land registered, and have corresponding regular registered licenses. The Socio-economic Environment LSA includes part of five trap lines (AT025, AT032, AT039, AT040 and AT041) and contains two trapper cabins, with several other cabins located just outside the Socio-economic Environment LSA. The primary species trapped are muskrat, marten and beaver during the typical October-May season. Minimum and maximum quota for beaver and fisher are set by the MNR. Over a five-year period (2006-2010), total harvest data for the six traplines above illustrate that muskrat (1,154), marten (1,092) and beaver (991) were the most commonly harvested animals. Black bears, coloured fox, coyote, fishe, lynx, mink, otter, racoon, red squirrel, timber wolf and weasels were also harvested from these lines.

3.3.3.12.4 Fishing

Recreational fishing licenses in the Province are permitted by the MNR. Licenses authorize anglers to fish anywhere in Ontario in accordance with the Ontario Fish Regulations. In 2005, a total of 1,426,384 recreational anglers' licenses were issued: 919,455 for residents and 506,929 for non-residents (Kerr 2010).

The Socio-economic Environment LSA (Figure 3-56) is located within Fisheries Management Zone 5. Commercial bait harvesting is licensed separately through Bait Harvesting Areas, each approximately 100 km^2. As shown on Figure 3-56, there are 10 Bait Harvesting Areas located within the Project Site, and two additional areas (FF0174 and FF0085) are included in the aggregate data provided by MNR for the years 2006-2011. Over this period 2,069 gallons of baitfish were harvested from these 12 areas. These values under-represent total harvest as 28% of baitfish reports were not submitted (MNR 2012).

Partly within the Socio-economic Environment LSA (Figure 3-56), Marmion Reservoir is particularly known for its wilderness fishing experience, where small-mouth bass, northern pike and walleye are commonly caught. There are a number of access points to the lake from Highway 622. The lake is utilized by several tourism operators to sustain their business activities, and residents for recreation purposes. It is also the site of the Atikokan Bass Classic, one of the Town's most important events. The Bass Classic is estimated to bring in approximately one million dollars in spin-off economic activity to the community. In addition to Marmion Lake, Sawbill Bay, Lynxhead Narrows and Hawk Bay are also common destinations. (G. McKinnon personal communication 20 October 2011).

3.3.3.12.5 Mining

Areas within the Socio-economic Environment RSA concentrated with mining claims are shown in Figure 3-57. There are numerous active claims, dispositions (claims under transfer) and withdraws (Crown land for which prospecting or staking claims have been withdrawn) across the Socio-economic Environment RSA. The region is experiencing increasing mineral exploration activity as long-term global commodity prices have increased.

The Local Study Area is located entirely on Crown Land. Mining claims in the Socio-economic Environment LSA are shown in Figure 3-58. In addition to the Project, there are several other active claims in the area.

3.3.3.12.6 Forestry

Version 3 Update: *Reference to the 'Resolute Forest Management Unit', should be considered as reference to the 'Crossroute Forest Management Unit' and Reference to the 'Rainy Lake Tribunal Forest Management Unit', should be considered as reference to the 'Sapawe Forest Management Unit'.*

Reference to 'Atikokan Forest Products', should be considered as references to 'Rainy Lake Tribal Resource Management Inc.'

The MNR licenses the use of Crown forests through Forest Management Units, two of which fall within the Socio-economic Environment LSA; specifically, the Resolute Forest Management Unit and the Rainy Lake Tribunal Forest Management Unit. The Resolute Forest is part of operations licensed to Resolute Forest Products, while Rainy Lake Tribunal Forest Management Unit is part of operations licensed to Atikokan Forest Products, as shown on Figure 3-59.

Both companies have created Forest Management Plans as required by the *Crown Forest Sustainability Act*, which identify current and potential forest land usage over a 10-year period.

Resolute Forest Management Unit's planned harvest area is 69,659 ha for the first five-year term and 68,901 for the second five-year term (Abitibi-Consolidated 2011), while the planned harvest area for Rainy Lake Tribunal Forest Management Unit is 20,224 ha over the ten-year (2010-2020) term (Atikokan Forest Products 2009).

3.3.3.13 Water Use and Access Valued Ecosystem Component

Relevant water use is described for navigable waterways and other hydrological features in the Project Site of the Hydrology TSD, as well as those potentially affected by the Project. Figure 3-60 displays the main surface waterbodies, and the locations of the primary water users, namely waterpower facilities, as well as water crossings and water control dams in the Local Study Area.

3.4 Physical and Cultural Heritage Resources

Version 3 Update: Supplemental detail and photographic documentation of the existing physical and cultural heritage resources is provided in the responses to MTCS-4B and MTCS-5, in Appendix A of the Heritage Impact Assessment in Part 4 of the Addendum to the Version 3 EIS/EA; and in MTCS-6, MTCS-6B, MTCS-7 and MTCS-7B (archeological survey conducted). Details regarding historic mines within the Project area are provided in response to MTCS-4, MTCS-4B, MTCS-5, MTCS-5B, MTCS-6 and T-63.

The assessment of cultural heritage resources was undertaken to determine whether there were cultural heritage resources within the Project Site.

3.4.1 Study Area

The assessment of physical and cultural heritage resources was confined to the Cultural Heritage Resources LSA. The Cultural Heritage Resources LSA encompasses all Project components and the Linear Infrastructure Study Area, including a buffer around the mine site access road and the project transmission line.

3.4.2 Method

The methods used in the assessment included a screening for known archaeological, built heritage and cultural heritage landscape resources and desktop (background) research in and surrounding the Project Site, as well as a property inspection and an archaeological survey. The screening for archaeological, built heritage and cultural heritage landscape resources was conducted using the Ministry of Tourism, Culture and Sport's (MTCS) Standards and Guidelines for Consultant Archaeologists and the Archaeological Checklist for Evaluating Archaeological Potential (Government of Ontario 2011a, 2011b) as well as the Standard Checklist for Identifying Potential Heritage Sites (Government of Ontario 2010).

The cultural heritage resource existing conditions characterization was also conducted in compliance with the *Canadian Environmental Assessment Act's* Reference Guide on Physical and Cultural Heritage Resources (1996). In accordance with the reference guide, the framework for evaluating the potential environmental effects of a project on cultural heritage resources consists of the following steps:

- Consideration of all terrestrial and aquatic areas containing features of historical, archaeological, paleontological, architectural or cultural importance.
- Identification of cultural heritage resources located on and off site which potentially could be affected by the project.
- Assessment of the potential for the presence of cultural heritage resources first through site survey or inspection, then identify and evaluate them.
- Development of mitigation measures for any adverse effects to cultural heritage resources.
- Recommendation of appropriate strategies for additional assessment, if applicable.

The assessment was based on a secondary data review that included:

- Review of relevant archaeological, historic and environmental literature pertaining to the Project Site.
- Review of an updated listing of provincial and federal archaeological and sites within 1 km of the Project Site (MTCS).

- Review of conservation easements and municipally or provincially designated historical sites (MTCS, Ontario Heritage Trust).
- Review of the Canadian register of Heritage Properties and lists of national parks, national historical sites and historic canals (Parks Canada).
- Review of historic maps of the Cultural Heritage Resources LSA.

Based on the secondary data review a property inspection of the site layout for the Project was conducted. The initial property inspection for the Cultural Heritage Resources LSA was conducted from October 18 to 21, 2011. An additional assessment was conducted between July 17, 2012 and August 9, 2012. Both assessments were conducted by licensed archaeologists according to the requirements as set out in the MTCS Standards and Guideline for Consultant Archaeologists.

3.4.3 Results

The findings based on the initial property inspection concluded that the following areas for the Project Site have archaeological potential and will require further archaeological assessment:

- Small pockets of land on the east side of Mitta Lake for the proposed Open Pit Mine (A).
- Relatively flat, dry lands along the bay, higher flat lands that are not classified as bedrock, as well as areas with pockets of sandy soil, indicative of relic beach ridges for the proposed Open Pit Mine (A1).
- The northern end of the Transportation Route where it crosses a waterway.
- The higher elevation at the bend in the river in the western section of the proposed TMF.

An inventory of any potential Euro-Canadian built heritage or cultural landscape resources was also recorded for the Project Site. Further consideration of Aboriginal cultural heritage resources is included in the Aboriginal Interests TSD.

A total of two archaeological sites – cultural heritage landscapes associated with 20th century mining activities were identified during the secondary property survey and are discussed further below.

Location 1 – Hammond Gold Reef Mine

Location 1 is situated in an area operated as the Hammond Gold Reef Mine in the late 19th and early 20th centuries. Location 1 comprises a 20 m east/west by 15 m north/south surface scatter of artifacts. as well as two artifact yielding test pits in the centre of the scatter. The sparse ground cover in the area allowed for artifacts to be identified on the surface. Location 1 consists of 64 pieces of 20th century historic material. This material includes 46 glass artifacts, nine ceramic artifacts, seven metal artifacts and two wire drawn nails. The recovered glass artifacts include 41 pieces of bottle glass (16 amber, 22 clear and 2 green) and five window glass shards, all measuring greater than 1.6 mm in thickness. Thick window glass is commonly found in the late 19th century and into the 20th century. The recovered ceramics include six pieces of ironstone and three pieces of semi-porcelain, both of which are ceramics that were manufactured from the late 19th century into the 20th century. The metal assemblage includes a mix of metal handles, miscellaneous fragments and piece of a cast iron stove.

The remains of the road to the former mine site are visible as an area of compact earth covered in scrub tree growth bordered by mature forest. A section of the trail has recently been subject to reforestation. Test pitting of the road area revealed the surface soil to be only 3 to 5 cm in depth overlaying compact grey clay. In addition to the artifacts recovered from the test pits and surface scatter two large iron rings were identified. These were not recovered and were left in situ on site.

The Stage 2 assessment also identified the remains of the Hammond Gold Reef Mine reservoir; this included the ruins of two dams, one wood and one earth and a channel flowing from the dam to the former location of a stamp mill and a saw mill, of which no remains exist today.

Location 2 – Sawbill Mine

Location 2 is situated in an area operated in the late 19th and early 20th centuries as Sawbill Mine. Within this area, a concentration of artifact yielding test pits were excavated; as well a small surface scatter was identified, exposed by the construction of an ATV trail. Location 2 is located in association with the historically documented position of the Sawbill Mine. The area comprising the five artifact yielding test pits and the surface scatter is approximately 25 m east/west by 35 m north/south. Location 2 consists of 54 pieces of 20th century historic material. This material included 48 wire drawn nails, two ceramic insulators, two components of a light bulb, one piece of porcelain and one complete bottle. Wire drawn nails were popular from about 1890 into the 20th century. The porcelain fragment is a 20th century piece stamped “MADE IN JAPAN.” The complete bottle is a small, clear medicine bottle with measurements embossed on the sides; other than that there are no distinguishing markings. In addition to the recovered artifacts, the surface scatter contained the remains of a large cast iron stove that was photographed but left in situ.

In addition to the artifact scatter, the remains of a Keighley Gas and Oil Engine Co engine dating to the early 20th century and the remains of the original tramway that was used in the transport of oar from the mine to the processing plant located on the shores of Sawbill Bay were identified.

3.5 Aboriginal Interests

Version 3 Update: *Supplemental information regarding Aboriginal land use is provided in the responses to T(3)-02, T(3)-03, and T(3)-04. Details on the consultation with First Nation communities are provided in response to T(2)-15 and T(3)-03.*

An Aboriginal Interests assessment was carried out to provide a description of the existing conditions as they are relevant to the assessment of the likely effects of the Project on Aboriginal Interests. The analysis focuses on the identification of potential adverse effects of the Project on the ability of future generations of Aboriginal people to pursue traditional activities, including:

- A description of asserted or established Aboriginal and treaty rights in the study areas.
- An identification of the lands, waters and resources of specific social, economic, archaeological, cultural or spiritual value to Aboriginal people in the study areas.
- Description of traditional activities for food, social, ceremonial and other cultural purposes in relation to the study areas.
- Description of traditional dietary habits and dependence on country foods and harvesting for other purposes, including harvesting of plants for medicinal purposes.

3.5.1 Study Areas

The existing conditions for Aboriginal Interests are described in terms of the Regional Context. The Project is located within Treaty 3 lands. The Treaty 3 area covers approximately 55,000 square miles in Ontario west of Thunder Bay running along the Canadian/American border to the south, and extending slightly into Manitoba in the west (Grand Council of Treaty 3, 2010). Treaty 3 lands include 28 First Nations communities and the Towns of Atikokan, Fort Frances, Dryden and Kenora.

The First Nations group governing these lands is the Grand Council of Treaty 3, the historic government of the Anishinabe Nation of Treaty 3.

The Project is also located within an area recognized by the Métis Nation of Ontario as the Treaty 3/Lake of the Woods/Lac Seul/Rainy River/Rainy Lake traditional harvesting territories, also named Region 1.

A RSA and a LSA were also identified as they relate to Aboriginal Interests. The RSA is defined as the Rainy River District, extended to include Lac de Mille Lacs First Nation. The RSA was chosen because it is the area governed by the regional First Nations group, the Fort Frances Chiefs Secretariat (FFCS). In December 2010, OHRG signed a Resource Sharing Agreement with the member nations of the FFCS and the Lac de Mille Lacs First Nation. As part of OHRG’s commitment to honour this agreement, an encompassing approach has been taken to consultation activities throughout the Project planning process and potential effects to all signatory communities have been considered.

The Aboriginal Interests LSA is defined as the area likely to be affected by the direct environmental effects of the Project, focussed specifically on land use. The Aboriginal Interests LSA selected for Aboriginal Interests represents the combined local study area for the terrestrial and aquatic biology components, which captures the area within which the Project has the potential to have environmental effects.

3.5.2 Methods

The description of the existing conditions relevant to Aboriginal Interests was developed through a review and synopsis of the following general information and Project-specific studies:

- Review of secondary data, including previous or similar EIS studies and existing information published by Aboriginal communities, organizations, universities and government.
- Aboriginal Engagement throughout the Project planning process.
- Traditional Use Studies conducted for the Project.

3.5.2.1 Aboriginal Engagement

An extensive engagement program with Aboriginal communities and people was undertaken as part of the Project planning process. The results from this engagement provided valuable background and local cultural and environmental information for the assessment. Most importantly, it allowed OHRG to hear and understand Aboriginal issues and concerns.

Records of communication, including correspondence, meetings notes, workshops, site visits and telephone calls were reviewed. Full details regarding communication activities and feedback received are provided in Chapter 7 of the EIS/EA Report.

3.5.2.2 Traditional Use Study Design

OHRG conducted a Traditional Use Study (TUS) to better understand how Aboriginal people and communities use the land that could be directly affected by the Project. The methods for the TUS were developed based on:

- Principles outlined under the Canadian Environmental Assessment Agency guide "Considering Aboriginal traditional knowledge in environmental assessments conducted under the *Canadian Environmental Assessment Act* – Interim Principals."
- Input from First Nations Chiefs and elders, including those most likely to be affected by the Project as detailed in Chapter 7 of the EIS/EA Report.
- Academic Review and critique by Professor McPherson of Lakehead University

3.5.2.3 Community Open Houses

A community open house was organized for each of the seven member nations of the Fort Frances Chiefs Secretariat and the Lac de Mille Lacs First Nation. The primary goals of the open houses were to provide information about the Project through the use of posters and a Project Overview video and to gather land use information to support the TUS. Information was gathered through community surveys, which were designed to be consistent with the larger discussions that took place at the Elders workshops. This approach was consistent with Professor McPherson's recommendations and allowed further assessment and analysis of the country foods indicator for the Traditional Land Use VEC.

3.5.2.4 Individual Interviews

Three individuals were identified as Aboriginal resource users in the Aboriginal Interests LSA. These individuals were identified by community leaders and interviewed because they are trapline holders and wild rice harvesters in the Aboriginal Interests LSA. The purpose of the interviews was to document the current use of land and identify important biological features to assist in minimizing the impacts the Project may have on the Traditional Land Use VEC.

3.5.3 Results – Aboriginal Setting

The information sources identified above were used to:

1) Provide an overview of **Aboriginal and treaty rights** as they may be relevant to the assessment of the effect of the Project. Both Métis and First Nation treaties and rights are discussed.
2) A description of Aboriginal language and cultures
3) Identify **Aboriginal communities and people** who might be affected by the Project. Both Métis and First Nations communities are discussed.

The description of existing conditions provides a context within which the assessment is based.

3.5.3.1 Aboriginal and Treaty Rights

The *Constitution Act, 1982,* defines Aboriginal people as the Indian (also referred to as First Nations), Métis and Inuit peoples of Canada. Section 35 of the *Act* recognizes and affirms the Aboriginal rights of the Aboriginal peoples of Canada.

When considering the definition of an Aboriginal “right” or “interest,” the Supreme Court of Canada in *R v. Van der Peet* (1996) has provided some direction. In this decision, the Court stated that an Aboriginal right is an activity that is an element of a practice, custom or tradition integral to the distinctive culture of the Aboriginal people asserting the right.

Treaty rights are those rights expressly set out in treaties and agreements between Aboriginal peoples and the Crown, or subsequently inferred as a result of judicial interpretation. The courts have found that oral promises made at the time of the written treaty can also be part of a treaty right (Coyle 2005). Treaties often included money or goods in return for which many Aboriginal peoples ceded the land they traditionally used and occupied.

The Project is located within the Treaty 3 lands. Treaty 3 is a written agreement between the Saulteaux Tribe of the Ojibway Indians and Her Majesty the Queen of Great Britain and Ireland signed in 1873 (Chiefs of Ontario 2005).

Upon signing, each Chief received a British flag and a treaty medal. Treaty 3 includes an 1875 adhesion (addition to the Treaty) that extends all rights and benefits to the “Half-breeds” (Métis) of Rainy River and Rainy Lake. The Métis were absorbed into the Little Eagle Band and are now part of the Couchiching First Nation (Chiefs of Ontario 2005).

Treaty 3 outlined many rights and benefits for signatories, in exchange for the cessation of rights, titles and privileges to 55,000 square miles of land, currently understood as the Treaty 3 lands. Hunting and fishing rights, Reserve lands and annual payments were the main benefits to Treaty 3 signatories, but additional promises included: maintaining schools on Reserve; providing agricultural implements; and providing a new suit of clothing for each Chief and his subordinates every three years (Chiefs of Ontario 2005).

In addition, the Treaty stated that Reserve lands may be appropriated for public works at any time with proper compensation.

The Métis assert harvesting and trapping rights throughout most of Ontario. Their hunting and harvesting activities are organized by territories that represent large areas within which the Project is situated.

Each territory has a Captain of the Hunt, designated by the Métis Nation of Ontario (MNO). The Captain of the Hunt has authority over Métis hunts, issues harvesting certificates and gathers information on the number, species and location of animals taken. The RSA includes part of two hunting territories, the Rainy Lake/Rainy River and the Lake of the Woods/Lac Seul. The Aboriginal Interests LSA includes a small part of the Rainy Lake/Rainy River harvesting territory.

The 2004 “Powley” Supreme Court Ruling, which upheld a Métis person’s constitutional right to hunt in their traditional territory, is very important to Métis – especially in Ontario. Based on this court decision, the MNO concluded an Interim Harvesting Agreement with the Ontario Ministry of Natural Resources (MNR) which recognized, to some extent, their right to self-government and to take an active role in natural resource management (MNO, 2012). The Agreement allowed the MNO to issue up to 1,250 harvesting cards per year in Ontario, which would be recognized by the Government of Ontario, through the MNR. The limit of 1,250 Métis harvesting cards was reached in 2008, and the MNO is currently in negotiations with MNR to increase that number (MNO, 2012).

3.5.3.2 Language and Culture

Treaty 3 was signed with the Saulteaux Indians, Algonkian people known to the Americans as Chipewas and the British as Ojibwa, Ojibway, Ojibwe or Ochipwe. The name Saulteaux was given to this group of people by the French and means "people of the rapids." The name Algonkian people give themselves is Anishinaabeg, the plural of Anishnabe, meaning "original man." The Anishnabe Nation was traditionally made up of four tribes: Potawatomi, Ottawa, Mississauga and Saulteaux. Much of the Saulteaux population lived in the present-day United States, however the Canadian tribe traditionally occupied lands extending from Lake Superior in the east to the edge of the Prairies in the west, south to Rainy River and Lake of the Woods, and north to the height of land from which the rivers flow into Hudson Bay (Daugherty, 1986).

The traditional language of the Anishnabe Nation is Ojibway, although English is also a predominant language. Knowledge of their Aboriginal language is still present in close to 40% of the population in many communities within the RSA. The Fort Frances Chiefs Secretariat has been working on an Education Jurisdiction Transfer that will create a separate school board and enable a culturally-focussed curriculum, including an Ojibway immersion program. The Ojibway language continues to be used during prayers, oral history and traditional story telling.

Throughout consultation, OHRG has heard from Aboriginal communities that Aboriginal culture is important. OHRG has addressed cultural concerns by providing capacity and allowing time for traditional protocols at each of our Project meetings. Traditional drumming, singing and prayers often take place throughout meetings and Elder's forums. Two pipe and drum ceremonies, as well as a fall ceremony and a spring ceremony have taken place at the Project Site.

Throughout the construction and operations phases of the Project, the established OHRG Social and Cultural Committee will provide oversight and direction for appropriate ceremonies that should take place during Project meetings. The committee will also promote cross cultural awareness and bring forward suggestions for cultural investment opportunities.

Traditional knowledge has been incorporated into the environmental assessment through the provision of capacity for traditional protocols during the consultation process and the consideration of information provided into the Project design. OHRG has routinely followed advice provided by elders to include drumming and dancing in Project meetings. Information provided by Aboriginal communities have allowed OHRG to avoid placing infrastructure in areas that are recognized as being special or sacred sites. The effluent treatment plant discharge location and tailings management facility location have both been adjusted to minimize potential impacts to areas with environmental value as identified by Aboriginal communities. OHRG also plans to use traditional knowledge to inform the development of an appropriate fish relocation plan for Mitta Lake and other fish-bearing water bodies that will be affected by the Project.

OHRG recognizes that speaking and hearing the Ojibway language is an important part of Aboriginal culture in the identified Aboriginal communities. OHRG is committed to incorporating Ojibway information materials into our consultation program for the Project. OHRG engaged Ojibway translators for the Elders forums, including traditional use study meetings, and worked with the several individuals from First Nations communities to translate a Project Overview into Ojibway. This Ojibway-language video has been shared with the First Nations in community meetings and workshops.

3.5.3.3 Aboriginal Communities

First Nations people have Aboriginal and treaty rights that may be affected by the Project. The identified communities are the communities with which OHRG has an agreement. Although direct Project activities only have the potential to affect a few members of Seine River and Lac des Mille Lacs First Nation (those with traplines directly in the Project area), communities within the RSA have the opportunity to benefit because of OHRG's communication efforts and community investments.

Aboriginal engagement for the Project focussed on nine identified First Nations communities. These nine communities have been identified by the Crown as having an interest in the Project and having triggered the duty to consult on the Project.

As shown in Table 3-53, the closest reserve land is the Lac des Mille Lacs First Nation (LDMLFN), however their lands have been flooded for decades and the majority of the population lives off reserve. Lac La Croix and Seine River First Nation are both located less than 100 km away from the Project and the rest of the communities are located between 100 and 200 km away from the Project Site.

The Métis people emerged out of the relationship between European men and First Nations women. With increased contact and the mixing of cultures, including marriage, a distinct society with distinct communities was created. As the fur trade continued to grow, distinct Métis communities continued to emerge.

The Métis people and their communities were connected through the highly mobile fur trade network, seasonal rounds, extensive kinship connections and a collective identity. The Métis, as a distinct Aboriginal people, assisted in the shaping of Canada's expansion westward through their on-going assertion of their collective identity and rights.

In Ontario, Métis communities are represented by the MNO. The MNO was established in 1993 to represent those individuals and communities that are a part of the Métis Nation.

In March 2012, OHRG signed a Memorandum of Understanding (MoU) with the MNO, including four identified Métis community councils (Kenora, Sunset Country, Northwest and Atikokan). The agreement includes the formation of a consultation committee with specific deliverables. Signatories to the agreement agreed that fulfillment of the deliverables constitutes adequate consultation.

The Project is located in MNO Region 1. Region 1 includes four Métis communities that may be affected by the Project through employment, business, and education and training opportunities. The communities and their approximate distance from the Project Site are provided in Table 3-54.

3.5.4 Results – Aboriginal Valued Ecosystem Components

The information sources and the Aboriginal context described above were used to:

1) Describe the existing conditions at the identified **Aboriginal communities** based on the indicators identified in Table 2-3, namely employment, business, and education and training.
2) Identify **Aboriginal heritage and resources** that might be affected by the Project.
3) Describe **traditional land use** in the Aboriginal Interests LSA.

The description of existing conditions provides the baseline against which changes as a result of the Project are predicted, described and assessed.

3.5.4.1 Aboriginal Communities Characteristics Valued Ecosystem Component

The Aboriginal community characteristics VEC is described for communities within the Regional Study Area in terms of three defined indicators: employment levels, business activities and education attainment. The information presented is largely based on census data, which has not been fully collected for each identified community. Some communities have chosen not to participate in the census (Lac La Croix FN), and others have dispersed memberships that are not currently located on reserve (Lac de Mille Lacs FN).

Although Aboriginal people considered for the Project include both First Nations and Métis, Métis people are fully integrated into the broader community and they may be expected to participate in the economic benefits of the Project in a manner similar to members of the broader community. Notwithstanding the difficulty in predicting specific employment, business opportunities or education and training, OHRG is committed to including Métis people in the economic initiatives targeted for Aboriginal communities and people.

Employment has consistently arisen as a key issue to Aboriginal communities throughout the consultation process. When the President of the MNO attended a community feast hosted by OHRG, he gave a speech which emphasized the importance of employment for Métis youth. Although the Wabigoon Lake Ojibway Nation have confirmed they are not currently harvesting rice within the Aboriginal Interests LSA, they stated that employment for youth from the Project remains a key interest to them.

Current unemployment rates reported by the identified First Nations communities are all higher than the unemployment rate for the Province of Ontario. Seine River has the highest reported unemployment rate, at 25%, compared to the Provincial average of 6.4%. Couchiching, Lac La Croix and Nigigoonsiminikaaning all have lower unemployment rates than the average for Aboriginal people in Northwestern Ontario, but are still above the rates for the general population of Northwestern Ontario.

The high unemployment rate in identified First Nations communities illustrates that community members could have an opportunity to benefit from the Project. OHRG is committed to sharing employment information and providing targeted employment opportunities to Aboriginal youth, such as the Summer Experience Program that was carried out on site in 2011 and 2012. Although the Project is not within commuting distance for most of the identified communities, it could offer a good opportunity for workers that are willing to live at site on a rotational basis. This type of work can be beneficial to allow Aboriginal people to continue some of their traditional practices such as hunting and fishing.

The median incomes reported by the identified First Nations communities, are all lower than the median income for Northwestern Ontario and the Province of Ontario. Couchiching is the only community that reported a higher median income ($20,752) than the median for Aboriginal people in Northwestern Ontario ($16,084), but the community is still below the median income of the general population of Northwestern Ontario ($26,410).

OHRG aims to promote the utilization of Aboriginal enterprises whenever possible in supplying goods and/or services required during each phase of the project. The criteria used for the evaluation and awarding of all contracts by OHRG include cost competitiveness, continuity of supply, quality of work and timeliness.

There are a number of Aboriginal businesses within the RSA that are engaged in activities required to supply goods and services to the Project. Examples of these businesses can be seen from the partnerships developed by OHRG in recent years.

OHRG is committed to continuing to work with Aboriginal enterprises. For example, OHRG currently has a relationship with the Aboriginal employment agency Seven Generations. Together, OHRG and Seven Generations have been working to increase Project employment opportunities for Aboriginal people in the Regional Study Area. This cooperation includes:

- OHRG provides information to Seven Generations about potential workforce.
- This information allows Seven Generations to apply for government funding for training.
- Should a contract be won and the Project move forward, OHRG would continue to work with Seven Generations for staffing support.

In addition, OHRG routinely provides funding and capacity for additional training to those Aboriginal enterprises that are awarded contracts to work on the Project.

The educational attainment for the identified First Nations communities is lower than the general population of Ontario, the general population of Northwestern Ontario, and the Aboriginal population of Northwestern Ontario.

The percentage of the population within the identified First Nations communities who have completed a high school certificate ranges from 13.9% (Seine River First Nation) to 20.0% (Naicatchewenin First Nation). This percentage is lower than the percentage of the population of Ontario, Northwestern Ontario and Aboriginal Northwestern Ontario which are all close to 26% (26.1 to 26.8). The lower high school completion rates in identified First Nations communities illustrates that education is an area where the communities could benefit from Project related opportunities.

The percentage of the population within the identified First Nations communities who have completed a University certificate, degree or diploma ranges from 0% (Seine River First Nation, Nigigoonsiminikaaning First Nation, Naicatchewenin First Nation and Mitaanjigamiing First Nation) to 8.7% (Wabigoon Lake Ojibway Nation). The percentages are all close to the percentage for Aboriginal Northwestern Ontario (5.8%) but are lower than the percentage for Ontario (20.5%) and Northwestern Ontario (19.3%). The lower percentage of University certificates, degrees and diplomas held by the population of the identified First Nations communities illustrates that education is an area where the communities could benefit from Project related opportunities.

The percentage of the population within the identified First Nations communities who have an apprenticeship or trades certificate ranges from 41.7% (Mitaanjigamiing First Nation) to 8.3% (Lac La Croix First Nation). The level of skilled trades in the communities are all above the percentage for Aboriginal Northwestern Ontario (7.6%) and most are also above the percentage in Ontario (8.5%) and Northwestern Ontario (11.2%). The high percentage of skilled trades in the population of the identified First Nations communities illustrates that the communities could benefit from Project related opportunities.

3.5.4.2 Aboriginal Heritage Resource Valued Ecosystem Component

Heritage resources were identified as being important to Aboriginal people. Heritage resources are defined as archaeological artefacts and culturally special sites. Archaeological resources and artefacts represent material evidence of past uses of the land. These resources could be destroyed or disturbed through any land clearing or construction activities associated with the Project. Culturally special sites represent areas that are currently used by Aboriginal people to practice cultural ceremonies or important traditions. These sites could also be disturbed through land clearing or construction. Additionally, the ability of Aboriginal people to reach these sites could be impacted through restriction of access during any phase of the Project.

A Stage 1 archaeological assessment was completed in the fall of 2011. The conclusions from the Stage 1 assessment are summarized as follows:

- A Stage 2 assessment should be undertaken in areas that will be disturbed and have been identified as retaining archaeological potential
- Stage 2 testing should consist of hand-excavated test pits placed at intervals of five and 10 m, following the standards identified in MTCS (2012).

A Stage 2 archaeological assessment was completed in the fall of 2012. No Aboriginal archaeological sites or artefacts were found within the Aboriginal Interests LSA; therefore, the Project does not have the potential to impact archaeological resources.

Special sites were identified through two separate Traditional Use Studies carried out with First Nations and Métis people. Special sites were identified for both First Nations and Métis. These sites were identified and locations were provided to allow OHRG to avoid disturbing any sites from land clearing activities or placement of Project infrastructure. Information about the nature of the special sites will be kept on file and reviewed regularly as part of the mine planning to ensure that new plans are not made which would encroach on these areas. Detailed mine plans will be shared with OHRG’s Aboriginal partners before construction begins to ensure special sites are not impacted.

3.5.4.3 Traditional Land Use Valued Ecosystem Component

Two Aboriginal land use studies were carried out for the Project. The OHRG led a study focussed on the identified First Nations communities, and the MNO led their own study. The First Nations land use study was carried out following the advice and direction of the Chiefs from the communities. The results of these two studies are summarized below, recognising the confidential nature of some of the material.

Elders Workshops

In the summer and fall of 2012 OHRG conducted a series of Elders workshops to better understand traditional land use in the Aboriginal Interests LSA. The workshops determined that First Nations participate in a variety of land use activities including hunting, trapping, fishing, plant harvesting and collection of natural items.

The detailed findings of the Elders workshops remain confidential and will not be published at this time. The information was shared with OHRG to facilitate the Project planning process and Golder Associates to facilitate the environmental assessment work. A terrestrial biologist, aquatic biologist, culture heritage specialist attended the workshop.

Habitat with the potential to support traditional use plants was identified in the Terrestrial Ecology LSA. These habitats include forested ecosites and rich conifer swamps. The Project will result in a predicted loss of approximately 14% of the forested habitat available in the Aboriginal Interests LSA that could support traditional use plant species. The Project will result in a predicted loss or disturbance of approximately 21% of conifer swamps with a moderate to high number of traditional use wetland plant species in the Aboriginal Interests LSA.

- Workshop participants stated that harvesting of traditional use plants occurs in a vast area, comparable to the RSA and beyond. Therefore, the loss of forested ecosites and conifer swamps with a high potential to support traditional use plants in the RSA would be <1% and, therefore, the effect is assessed as negligible.
- Several individuals use the Upper Marmion Reservoir for fishing (both subsistence and commercial). These individuals use both modern and aboriginal methods of fishing to obtain fish that may be distributed among local clans.
- An important concern for this area, in terms of Aboriginal values, is the maintenance of healthy, robust fish populations, particularly those species that have cultural significance. Locations in Upper Marmion Reservoir and its vicinity that are known spawning areas for walleye, are important. A detailed assessment of the potential effects of the Project on the aquatic habitat and species is provided in the Aquatic Biology TSD. While some adverse effects are identified, mitigation and compensation measures are also identified to ensure the effects are not significant overall.
- There is interest among Aboriginal peoples in giving ceremonial recognition to the loss of Mitta Lake. OHRG has facilitated several spiritual ceremonies at the Project site, including a Pipe and Drum Ceremony at Mitta Lake. These ceremonies will continue throughout the Project development. First Nations people will also be given the opportunity to participate in the planning and implementation of the fish relocation plan at Mitta Lake.

Individual Interviews

Three individuals were identified as Aboriginal resource users in the Aboriginal Interests LSA. The purpose of the interviews was to learn and document the current use of land, trapping and other important biological features to assist in minimizing the impacts the Project may have on the land. These individuals were identified because they are trapline holders and wild rice harvesters.

The results of the individual interviews showed that trapping, hunting and fishing are important in the area. Some plant harvesting also occurs.

Beaver are generally considered the most important animal trapped on the lines. Beaver fur is sold at auction and beaver carcasses are used for baiting other animals. Some report eating beaver and muskrat meat, others do not eat meat from trapped animals. Quotas on the traplines range from 60 to 120 beavers, but trappers do not often meet the quotas. Interviewees reported a period of 5 to 15 years since full quota for beaver were met.

Interviewees indicated that they primarily travel to the area by truck using Premier Lake Road. Motor boats, canoes and skidoos are also used to travel throughout the area. The cabins in the area are used regularly, especially during the warmer months. It was stated that trappers stay in their cabins a few times per month in the summer and fall. Trappers may also stay in nearby outfitters cabins that provide more amenities.

Drinking water is normally carried in to the area from Town, but interviewees also stated that they drink water from any of the lakes in the area. Drinking from beaver ponds is avoided.

Interviewees stated that they hunt opportunistically while setting traps or fishing. Most of the hunting is carried out in the fall. Animals that are hunted in the area include deer, moose, rabbit, partridge and duck. Moose is the primary meat that is eaten from the area.

Sawbill Bay was identified as the best place for fishing in the area. Small lakes near trappers' cabins are also used for fishing. Fishing occurs throughout the year. Fish in the area include walleye, northern pike, bass and trout. Suckers and whitefish are caught and used for bait. It was stated that there are no sturgeon in the area.

Interviewees stated that some plant harvesting occurs in the area. Blueberry picking is important seasonally, however the area is not currently producing blueberries and it was stated that adjacent areas are preferred. Up to 100 pails of blueberries may be picked and sold every year.

Interviewees stated that wild rice is not harvested in the area. Some efforts have been made to plant wild rice without success, likely because of the rocky environment and fluctuating water levels. Although the wild rice plant can be found, it is not abundant enough to warrant the effort of harvesting.

Community Surveys

Community land use surveys were administered to each of the seven First Nations who invited OHRG into their communities. Sixty-seven individuals completed a land use survey. The results of the community surveys showed that fishing, hunting and harvesting berries and medicinal plants and visiting spiritual sites are practiced within the Project Site. As shown in Figure 3-61, more than half of the respondents (65%) stated that they fish in the area, whereas less than one third (31%) stated that they harvest medicinal plants in the area.

Survey respondents were asked how often they eat fish that they've caught. This question was asked to determine the level of dependence on country foods in the area. The majority of respondents (30%) stated that they ate fish caught in the area about once a month. A small percentage (9%) stated that they eat fish caught in the area more than once a week, and 15% stated that they do not eat fish caught in the area.

Survey respondents were asked how often they eat animals that they've caught. This question was asked to determine the level of dependence on country foods in the area. The majority of respondents (36%) stated that they ate animals caught in the area a couple times a year. A small percentage (12%) stated that they eat animals caught in the area more than once a week, and 18% stated that they do not eat animals caught in the area.

Survey respondents were asked how often they eat plants they've harvested. This question was asked to determine the level of dependence on country foods in the area. The majority of respondents (55%) stated that they do not eat plants harvested in the area. A small percentage (12%) stated that they eat plants harvested in the area more than once a week.

In summary, although fishing, hunting and plant harvesting does take place in the area, it does not represent a substantial portion of most community members diet. Fishing is the most popular land use activity, and the least popular activity is harvesting plants.

Métis Traditional Knowledge Study

In the spring of 2012 the MNO retained the services of Symbion Consultants to conduct a Land Use and Occupancy Study of the Treaty # 3/Lake of the Woods/Lac Seul/Rainy River/Rainy Lake. Individual interviews with local Métis community members focussed on historic and current land use. The MNO Study determined that Métis people participate in a variety of land use activities in the area including hunting, trapping, fishing, plant harvesting, and collection of natural items.

Information provided to OHRG was sufficient to allow an understanding of the traditional harvesting practices of the Métis and to determine if the current practices are likely to be affected by the Project.

The detailed findings of the MNO Study remain confidential and will not be published at this time. The information was shared with OHRG to facilitate the Project planning process and portions of the information were also shared with Golder Associates to facilitate the environmental assessment work.