



NUCLEAR WASTE MANAGEMENT ORGANIZATION SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Phase 1 Desktop Assessment, Environment Report

TOWNSHIP OF NIPIGON, ONTARIO



APM-REP-06144-0066

OCTOBER 2014

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PHASE 1 DESKTOP ASSESSMENT

Environment Report - Township of Nipigon, Ontario

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REPORT



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1.0 INTRODUCTION

The Township of Nipigon in northwestern Ontario expressed interest in continuing to learn more about a facility to manage Canada's Used Nuclear Fuel through the Nuclear Waste Management Organization's (NWMO) Adaptive Phased Management Site Selection Process (NWMO, 2010). This process is seeking to find a site for a deep geological repository that will provide safe long-term containment and isolation of used nuclear fuel within an informed and willing host community. The process is presently at an early stage.

Part of the process is focussed on determining if there are environmental features that would preclude the potential for a facility to be constructed and operated in the vicinity of Nipigon. To this end, this report provides a general description of the environment in the Township of Nipigon and surrounding area. It is complemented by reports prepared in parallel which characterize the geoscientific conditions and community well-being profile of this area. These reports are summarized, with other information, in an integrated Preliminary Assessment Report.

This report is not an environmental assessment. Its purpose is to provide a high level description of the current human and natural environment based on readily available sources of data. Additional detailed information for specific locations would be sought at subsequent phases of the work.

The Nipigon area here is the same as that used for the Phase 1 Geoscientific Desktop Assessment for Nipigon. This area is shown on Figure 1, and includes the Township of Nipigon and surrounding area.



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2.0 COMMUNITIES AND INFRASTRUCTURE

2.1 Communities

The Township of Nipigon is 115 km² in size¹ and is located on the western shore of Lake Superior’s Nipigon Bay, approximately 120 km northeast of Thunder Bay. The Town of Nipigon is shown on Figure 1, immediately south of Highway 17 (Trans-Canada Highway). Figure 2 presents satellite imagery for the area taken in 2006. Table 1 summarizes the total population and population density for the Township of Nipigon and District of Thunder Bay.

Table 1: Population Statistics for the Nipigon Area

Political Boundary	Population	Population Density per km ²
Township of Nipigon	1,631	14.9
District of Thunder Bay	146,057	1.4

Source: 2011 Census of Population (Statistics Canada, 2013)

The Township of Nipigon maintains a municipal government (MMAH, 2009). Land ownership within the Nipigon area, including areas of Crown land², Crown Reserve³ lands, parks and reserves and private lands, is shown on Figure 3. Figure 3 shows areas of private land, including much of the eastern half of the Township of Nipigon.

There are a number of First Nation and Métis communities and organizations in the Nipigon area including the following First Nations: Animbiigoo Zaagi’gan Anish (Lake Nipigon Ojibway) First Nation, Biinjitiwaabik Zaaging Anishnabek (Rocky Bay) First Nation, Bingwi Neyaashi Anishinaabek (Sand Point) First Nation, Fort William First Nation, Kiashke Zaaging Anishinaabek (Gull Bay) First Nation, Opwaaganisining (Red Rock Band / Lake Helen) First Nation and Whitesand First Nation. Métis Councils in the area include the Greenstone Métis Council (Geraldton and Area), the Superior North Shore Métis Council and the Thunder Bay Métis Council.

Further information on Nipigon and its surrounding communities, including First Nations and Métis communities, is provided in the Community Well Being profile report for Nipigon.

2.2 Infrastructure

Figure 1 shows the location of the primary infrastructure corridors in the Nipigon area. The main transportation routes include the Trans-Canada Highway (Highway 17), which passes along the shore of Lake Superior, and Highway 11, which runs south to north from Highway 17 along the eastern shore of Helen Lake, passing through the Lake Helen Indian Reserve. Highway 585 also runs north to south, west of Nipigon Bay and the Nipigon River. Local logging roads cover much of the Nipigon area. A Canadian Pacific (CP) rail corridor line passes through the Nipigon area, approximately parallel to Highway 17 to Nipigon and then south towards Red Rock.

There are two hydroelectric generating stations within the Nipigon area: the Cameron Falls and Alexander stations (OPG, 2005). A number of electrical transmission lines pass through the Nipigon area including a 230 kV transmission line, running from west to east in the southern part of the Nipigon area, roughly following the

¹ Area calculated using Geographic Information System (GIS) municipal boundaries from the Ministry of Municipal Affairs and Housing (MMAH, 2009).

² Crown land is divided on the Figure into Crown Acquired Land, Non-freehold Disposition Public and Unpatented Public Land. Crown Acquired land is acquired by the municipality presumably for some sort of future development. Non-freehold Dispositions Public are a tenure holding, usually for a set term and a specific purpose (e.g., Lease, Licence of Occupation, Land Use Permit, Beach Management Agreement and Easement), excluding permanent disposition in the form of a patent. Unpatented Public Land is generally land that has never been granted or sold by the Crown to people or organizations for their private use and are under the mandate or management of the MNR.

³ Crown Reserves are Crown lands that have been withdrawn from dispositioning under Section 21 of the Crown Minerals Act.



Trans-Canada Highway and a network of 115 kV lines. There are no airports in the Nipigon area. There are two natural gas pipelines in the Nipigon area. The north-south pipeline runs west of Lake Helen and Nipigon Bay. An east-west pipeline branches off the north-south line to the west of Polly Lake (NRCan, 2009a). There is one operating landfill (MOE, 2013a) and a wastewater treatment plant within the Nipigon area.

2.3 Protected Areas

2.3.1 Parks and Reserves

There are two provincial parks, four conservation reserves and two forest reserves in the Nipigon area. Figure 4 shows the location of these eight protected areas. There is also one proposed national park, the Lake Superior National Marine Conservation Area, including the lakebed, overlying waters and some islands in Lake Superior that are partially located within the Nipigon area (Government of Canada, 2014). The Black Sturgeon River Provincial Park, partially located within the Nipigon area, covers 237 km² and is located along the Black Sturgeon River to the west of the Township of Nipigon. It is classed as a waterway park, which is used for angling, hunting and canoeing (MNR, 2013a). The Ruby Lake Provincial Park is located along the north shore of Nipigon Bay and covers an area of 27 km²; it is classed as a natural environment park and contains extensive hiking trails, wetlands and extensive cliff environments with ravines (MNR, 2013a).

Conservation and forest reserves are lands set aside by the government (municipal, provincial or federal) to protect ecosystems that are representative of a natural region, protect significant elements of natural and cultural heritage, and maintain biodiversity. The four conservation reserves in the Nipigon area are the Nipigon River Conservation Reserve, the Kama Cliffs Conservation Reserve, the Seahorse Lake Conservation Reserve and the proposed Lake Superior Archipelago Conservation Reserve (MNR, 2013a). The Nipigon River Conservation Reserve is located in the north-central part of the Nipigon area, along the Nipigon River, covering an area of about 27 km²; it is an important recreational waterway and is also developed for hydroelectric generation. The Kama Cliffs Conservation Reserve is located 18 km east of the Town of Nipigon along the north shore of Lake Superior. It covers an area of 37 km² and its most prominent feature is the vertical bedrock exposure with heights exceeding 200 m. There is also a small Forest Reserve located within this Conservation Reserve. The Seahorse Lake Conservation Reserve is located 30 km northeast of the Town of Nipigon in an isolated area accessible only by aircraft. It covers an area of 6.6 km² and contains lakes designated for lake trout (*Salvelinus namaycush*) management (MNR, 2013a). One of the islands of the proposed Lake Superior Archipelago Conservation Reserve is also located in the Nipigon area. The second Forest Reserve in the Nipigon area is located within the Ruby Lake Provincial Park (MNR, 2013a).

The Nipigon Bay Remedial Action Plan (RAP) area, including Nipigon Bay and Helen Lake is also partially located in the Nipigon area. The RAP was established in 1987 by Environment Canada, the Ontario Ministry of the Environment (MOE) and the Ontario Ministry of Natural Resources (MNR) to address water quality issues in the area (NSLSRAP, 2014).

2.3.2 Heritage Sites

The cultural heritage screening examined known archaeological and historic sites in the Nipigon area, using the Ontario Archaeological Sites Database, the Ontario Heritage Trust Database, the Parks Canada Database and the National Historic sites Database. There are seven known archaeological sites in the Nipigon area (von Bitter, 2013). There is one provincially designated historic site (OHT, 2013) and a series of federally identified trading posts within the Nipigon area (MTCS, 2013; Parks Canada, 2013; Voorhis, 1930).



Of the seven archaeological sites, two contain no information about the nature of the site recorded (time period or cultural affiliations are not provided), three are identified as pre-contact (prior to European arrival) Aboriginal sites and the remaining two are historic Euro-Canadian sites. Of the three pre-contact Aboriginal sites, two have been identified as pre-contact Aboriginal findspots. The other site is a pictograph. The historic Euro-Canadian sites include a Hudson's Bay Company post and the remains of a railway lodge.

A search for Provincial Historic Sites through the Ontario Heritage Trust resulted in one location where a plaque has been placed to commemorate a historic event of provincial significance within the Nipigon area. This plaque is located at the Nipigon River lookout along Highway 11/17, commemorating the Jesuit Mission to the Nipissings in 1667 (OHT, 2013). A search for National Historic Sites in the Nipigon area determined that there are a series of French trading posts from the mid to late 17th century along the Nipigon River (MTCS, 2013; Parks Canada, 2013; Voorhis, 1930). They were designated in 1944 but there are no plaques commemorating these posts and there is no current mapping showing the location of these posts.

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. In archaeological potential modeling, a distance to water criterion of 300 m is generally employed for water sources, including lakeshores, rivers and large creeks (Government of Ontario, 2011). The potential for archaeological and historical sites along the Nipigon River and its associated tributaries as well as Nipigon Bay and Helen Lake is considered to be high as these water sources were used as part of a major transportation route for both Aboriginal and Euro-Canadian people. The presence of local heritage sites would need to be further confirmed in discussion with the community and First Nation and Métis communities and organizations in the area.

2.4 Land Use

Land use described in this section refers to commercial land use such as forestry, mining, trapping and agriculture, but not recreation or Aboriginal spiritual use.

Forestry is a major industry in the Nipigon area, with forested areas supporting commercial timber harvesting, although recent commodity pricing has had a negative impact on this industry. Forest Management Units⁴ (FMU) in the Nipigon area are shown on Figure 5 (MNR, 2013b). The northern and eastern parts of the Nipigon area are located within the Lake Nipigon Forest (FMU 815). A southern strip of the Nipigon area, including the Township of Nipigon, is located within the Lakehead Forest (FMU 796). The northwest corner of the Nipigon area is located within the Black Spruce Forest (FMU 035). The Lake Nipigon Forest, managed by Lake Nipigon Forest Management Inc. (LNFMI), is 1,598,368 ha in total size, of which 85% is productive forest (GFMI, 2011). The Lakehead Forest is managed by Greenmantle Forest Inc. (GFI) (GFI, 2012). The Black Spruce Forest, managed by AbiBow Canada Inc. (AbiBow), is 1,339,940 ha in total size, of which 75% is productive forest (AbiBow, 2011). In total, the Nipigon area contains 117,001 ha of woodlands, which is 86% of the land coverage (LIO, 2013).

Within forested areas, such as those of the Nipigon area, there is a risk of forest fires. The four locations where forest fires have affected an area of greater than 200 ha within the Nipigon area between 1976 and 2010 are shown on Figure 5.

⁴ Ontario's Crown forest is divided into geographic planning areas, known as Forest Management Units. Most of these units are managed by individual forest companies who carry out various activities which are subject to the Ontario Ministry of Natural Resources (MNR) regulations and approvals. Activities include forest management planning, harvest, forest renewal, access road construction, monitoring and reporting.



There are currently no active mines in the Nipigon area, but this region of Ontario has a long history of mining and mineral exploration, which continues today. Further, there is no record of past metallic mineral production in the Nipigon area. A few mineral occurrences have been identified within the area, but their economic potential has not been proven.

Known non-metallic mineral resources within the Nipigon area include sand, gravel and stone. As shown on Figure 6, there are a number of small-scale sand and gravel pits in the area, primarily located in glaciofluvial and coarse-grained glacial lacustrine deposits. Quarrying for stone has been carried out in the Nipigon area, including at the Nipigon River Marble Quarry, shown on Figure 7.

Water from the Nipigon River has been used to produce electricity since 1924 (OPG, 2005). As shown on Figure 3, there are two hydroelectric generating stations (Cameron Falls and Alexander stations) located within the Nipigon area. These are owned and operated by Ontario Power Generation (OPG).

As noted in Section 3.3, other land uses include hunting and trapping. While the Township of Nipigon's draft official plan includes agriculture as a permitted land use in rural areas (MHBC, 2013), agriculture is not a major land use.



3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 Physiography

The Nipigon area lies in the Port Arthur Hills physiographic region of the Canadian Shield bedrock, which consists of ridges and cuestas produced by the underlying folded sequence of Proterozoic diabase sills and sedimentary rocks, with the flat-lying diabase sills on the hilltops responsible for shielding the underlying weaker rocks from erosion. The rocks in this region are frequently crosscut by fractures and faults (Thurston, 1991). Within this area, bedrock is typically either exposed at surface or shallowly covered with Quaternary⁵ glacial deposits or post-glacial organic soils (Thurston, 1991). In the Nipigon area, land surface elevations range from an elevation of 583 metres above sea level (masl) in the southeast in Kama Cliffs to a low of about 183 masl along the shore of Lake Superior. Some of the most prominent topographic features in the Nipigon area include the Black Sturgeon River canyon, and the Kama Cliffs along the Jackpine River, with cliff faces greater than 200 m in height.

Figure 8 presents the topography of the Nipigon area as a digital elevation model (DEM).

3.2 Geology

3.2.1 Bedrock Geology

The bedrock geology of the Nipigon area is shown on Figure 7. There are five distinct geologic units in the Nipigon area: metasedimentary rocks of the Quetico Subprovince, sedimentary rocks of the Sibley Group, Nipigon diabase sills, small granitic intrusive bodies and the ultramafic Hele intrusion. Geologically, the Township of Nipigon is located on the boundary between metasedimentary rocks of the Quetico Subprovince of the Superior Province and the sedimentary rocks of the Sibley Group of the Southern Province of the Canadian Shield. The Canadian Shield consists of 3 to 2.6 billion year old rocks that form the core of the North American continent. The Superior Province has been divided into various subprovinces, based on lithology, age, genesis and metamorphism and covers an area of approximately 1,500,000 km², stretching from northern Quebec, through northern Ontario, eastern Manitoba and extending into South Dakota. The younger Proterozoic Southern Province borders the Superior Province on the south from the Sudbury area through to Thunder Bay (Thurston, 1991).

Archean metasedimentary rocks and migmatites of the Quetico Subprovince comprise the bedrock surface over the majority of the Nipigon area east of the Black Sturgeon River Fault Zone. The western and southern portions of the Nipigon area (west and south of the Black Sturgeon River Fault Zone) the sedimentary rocks of the Sibley Group lie unconformably on top of the metasedimentary rocks of the Quetico Subprovince. A number of small granitic intrusive bodies occur along the western boundary of the Nipigon area. These include elongate or lensoid bodies mapped as massive granodiorite to granite located in the west central portion of the area and further to the northwest along the east side of the Black Sturgeon River fault within the Quetico Subprovince. In a number of places in the Nipigon area there are localized outcrops of mafic intrusions, diabase sills and dykes, including the Nipigon sill complex, which intrude and overlie both Archean metasedimentary rocks and the Mesoproterozoic sedimentary rocks of the Sibley Group. Nipigon sills occur at surface along the southern and western margins of the Nipigon area. Immediately west of the Black Sturgeon River fault zone, approximately 1 km southwest of the Township of Nipigon, is the ultramafic Hele intrusion. Other major mapped fault zones

⁵ Quaternary refers to the last 2.6 million years of Earth's history.



include the Gravel River fault located just beyond the southwest corner of the Nipigon area and the northeast-trending Jackpine River fault located in the eastern part of the Nipigon area. There is also an unnamed fault located to the east of Mound Lake.

3.2.2 Quaternary Geology

The Quaternary geology of the Nipigon area is shown on Figure 6. The Quaternary deposits in the Nipigon area include tills, glaciofluvial sands and glaciolacustrine sediments laid down during the late Pleistocene Wisconsin glaciations, as well as more recent fluvial and organic deposits (Barnett, 1992). Most of the area is mapped as bedrock terrain with either exposed outcrop or a thin mantle of unconsolidated material. Glaciofluvial deposits of sand and gravel occur in areas within the Township of Nipigon and north along the Nipigon River, as well as along the Black Sturgeon River and the southern portion of the Jackpine River. Fine textured glaciolacustrine deposits of silt and clay occur along Highway 17 east of Nipigon, in the north-central and southwestern parts of the Nipigon area. There are a few pockets of till in the Nipigon area in the northeast between Meat Axe Lake and Cull Lake in the northwest along Scooper Creek and in the southwest around Fog Lake and to the south.

3.3 Natural Environment

3.3.1 Natural Environment Overview

The Nipigon area is located along Highways 11 and 17, south of Lake Nipigon, but including a small portion of the north shore of Lake Superior, Ontario. The town of Nipigon has a long history of trade due to its position on the north shore of Lake Superior dating back to the first lease of the Nipigon District to the company of 100 Associates for Fur Trade in 1665 (Township of Nipigon, 2013). The Nipigon area is depicted on Figure 1. The Nipigon area includes a variety of small inland lakes and large water bodies connected to Lake Superior. Forested areas support commercial timber harvesting, although recent commodity prices have had a negative impact on this industry. The natural environment associated with the Nipigon area contains an abundance of plant and animal communities, some of which have special status or designations. The following sections describe the protected natural areas, and terrestrial ecology and aquatic ecology, with a focus on rare species that may be most sensitive to impacts from alterations or changes to the landscape.

3.3.2 Natural Areas

As discussed in Section 2.3.1, there are two provincial parks, four conservation reserves and two forest reserves within the Nipigon area. As shown by the stars on Figure 9, the Nipigon area also contains two Life Science sites, one Earth Science Area of Natural or Scientific Interest (ANSI) and one Earth Science site. There is also an enhanced management area⁶ (EMA) located within the Nipigon area, along the north shore of Lake Superior. The Life Science sites include the Nipigon River (1) and Nipigon Marshes (2). The Earth Science ANSI is Kama Hills (3), located within the Kama Cliffs Conservation Reserve. The Earth Science site is the Red Rock Cuesta – Rossport Formation (4). A Draft Official Plan (OP) for the Town of Nipigon was posted on the Town of Nipigon website on September 26, 2013 (MHBC, 2013). This draft OP identifies several small Environmental Protection Areas (EPAs) within the Nipigon area; however, as the OP is draft, these EPAs have not been included on Figures 9 and 10.

⁶ Enhanced Management Area is a land use designation that permits logging, but places restrictions to accommodate other values and priorities such as wilderness qualities.



There are no Provincially Significant Wetlands (PSW) identified within the Nipigon area, but some unclassified wetlands are present. Wetlands identified in the Land Information Ontario (LIO) natural resources data layers (LIO, 2013) have been depicted on Figure 10. The Nipigon area contains 2,089 ha of wetlands, which is 1.5% of the land coverage according to LIO data. The Ontario Ministry of Natural Resources (MNR) periodically updates their LIO information and wetland areas and boundaries are subject to change. Field studies conducted at the appropriate times are able to provide ground truthing and sensitivity/significance analysis for existing wetlands. If wetlands have the potential to be affected by a proposed activity, they would typically require evaluation of significance according to the Ontario Wetland Evaluation System (OWES).

3.3.3 Terrestrial Features and Wildlife

The Nipigon area lies within the Great Lakes – St. Lawrence Forest Region. As noted in Section 2.4 and shown on Figure 5, this area contains portions of three FMUs. Typical forest types in the area include: black spruce (*Picea mariana*), white spruce (*Picea glauca*), jack pine (*Pinus banksiana*), red pine (*Pinus resinosa*), white pine (*Pinus strobus*), balsam fir (*Abies balsamea*), trembling aspen (*Populus tremuloides*), white birch (*Betula papyrifera*) and other mixed hardwoods (AbiBow, 2011; GFMI, 2011; GFI, 2012). The Nipigon area occurs within Wildlife Management Units⁷ (WMU) 13, 14, 15B and 21A (MNR, 2013c). This area is considered important for the trapping of furs and hunting of game. Management of woodland caribou (*Rangifer tarandus*), moose (*Alces alces*), marten (*Martes americana*) and pileated woodpecker (*Dryocopus pileatus*) along with other sensitive wildlife populations are a particular concern to the MNR. The entire Nipigon area is within the Lake Superior Uplands Linkage of woodland caribou habitat within the discontinuous zone (Figure 9), as identified in Ontario's Woodland Caribou Conservation Plan (MNR, 2009). Documented feeding, wintering and calving sites for moose are depicted on Figure 9. Concentration and nesting areas for raptors, herons and waterfowl are also considered an important management concern; known locations are also shown on Figure 9.

3.3.4 Aquatic Features and Fish

As discussed in more detail in Section 3.5, the Nipigon area spans across several watersheds. The Nipigon area falls within Fisheries Management Zones⁸ (FMZ) 6, 7 and 9 for which the MNR has a Fisheries Management Plan (MNR, 2013d). Fish that are commonly harvested include walleye (*Sander vitreus*), northern pike (*Esox lucius*), lake trout (*Salvelinus namaycush*), brook trout (*Salvelinus fontinalis*), smallmouth bass (*Micropterus dolomieu*) and yellow perch (*Perca flavescens*) as well as larger fish that are found in Lake Superior and its river estuaries (MNR, 2013d). Water bodies present are mainly warm and cool water classified, interspersed with the occasional smaller cold water body (Figure 10). Water bodies comprise 9,085 ha, which is 7% of the Nipigon area according to LIO data. Many small lakes are popular destinations for sport fishing and tourism, and fish populations are managed to maintain and maximize their size and availability to anglers.

Fish and fish habitat are managed by the MNR and the Department of Fisheries and Oceans Canada (DFO). General information is available publicly for each FMZ, but more detailed information must be obtained directly from these agencies for further investigations. Publicly available data for each FMZ may not be consistent for each area. Although there is consistency in the types of data collected by MNR for each area,

⁷ Wildlife Management Units are geographic units of land on which the Ontario Ministry of Natural Resources (MNR) bases the sustainable management of species, hunting seasons and harvest limits.

⁸ Fisheries Management Zones are the units of management for lakes in Ontario. Fish are monitored and assessed at the zone level and fishing regulations, such as catch limits, are based on these zones.



data deemed sensitive within the FMZ may not be reported or shown on mapping. Field verification will be required to determine the actual fish habitat and use by species across the landscape.

3.3.5 Endangered, Threatened and Special Concern Species

The Nipigon area covers a large geographic area consisting of diverse aquatic and terrestrial habitats, and is within many migratory corridors for birds, insects and mammals. The Natural Heritage Information Centre (NHIC) database (NHIC, 2013) shows the occurrence of species that are listed as Endangered (END), Threatened (THR) or Special Concern (SC) either under the provincial Endangered Species Act (ESA) (Government of Ontario, 2007), or the Federal Species at Risk Act (SARA) (Government of Canada, 2012). The Royal Ontario Museum range maps (ROM, 2013) indicate the potential for Species at Risk (SAR) to exist within the Nipigon area, based on the principals of range mapping. Habitats within the Nipigon area could directly or indirectly support the needs of 20 designated SAR. All potentially occurring SAR within the area are listed in Table 2.

Species listed as provincially or federally END are significant because these species and their habitats receive the highest level of protection afforded under applicable legislation. The five END species potentially occurring within the Nipigon area include provincially END eastern cougar (Puma concolor), little brown myotis (Myotis lucifugus) (bat), northern myotis (Myotis septentrionalis) (bat), golden eagle (Aquila chrysaetos) and Shortnose Cisco (Coregonus reighardi). Five species have been identified that are listed as THR in Ontario, with an additional two species THR federally and SC provincially. The remaining eight species are listed as SC either provincially or federally.

The ranges of SAR species are generally identified through a reference grid, noting detailed field study is required to confirm the extent that a listed species or its habitat occurs in a specific geographic area. Based on the available background information, the range of eastern cougar overlaps the area, but this species is extremely secretive and can cover a very large home range for each individual. The Nipigon area is at the edge of the currently known area where bats are impacted by a novel fungal disease that is causing major mortality. Little brown myotis and northern myotis were recently added to the ESA. Golden eagles are likely to pass through this area during migration, but typically nest much farther north (MNR, 2014).

The records identified here either represent known occurrences or are based on range mapping as published by the MNR, noting that the list is typically updated. In addition to species that are listed on the ESA and SARA, species of conservation concern including those that are considered regionally rare, uncommon or in significant decline would also be considered in the evaluation of wildlife of the area. Many of these species are not tracked in public databases, and therefore a complete list could be developed in future through specific data requests to agencies and field investigations.

With reference to Table 2, there were no species of amphibian or reptile or plants, mosses or lichens identified as END, THR or SC within the Nipigon area.

Table 2: Potential Endangered, Threatened and Special Concern Species in the Nipigon Area

Table with 5 columns: Common Name, Scientific Name, ESA Status, SARA (Schedule), Source. Row 1: Eastern cougar, Puma concolor, END, ROM.



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Common Name	Scientific Name	ESA Status ¹	SARA (Schedule) ²	Source ³
Little brown myotis	<i>Myotis lucifugus</i>	END		BCI, Mammal Atlas
Northern myotis	<i>Myotis septentrionalis</i>	END		BCI, Mammal Atlas
Wolverine	<i>Gulo gulo</i>	THR		ROM, Mammal Atlas
Woodland caribou (Forest-dwelling boreal population)	<i>Rangifer tarandus caribou</i>	THR	THR	ROM
Birds				
American white pelican	<i>Pelecanus erythrorhynchos</i>	THR		ROM, NHIC
Bald eagle	<i>Haliaeetus leucocephalus</i>	SC		OBBA
Black tern	<i>Chlidonias niger</i>	SC		ROM
Chimney swift	<i>Chaetura pelagica</i>	THR	THR	ROM
Common nighthawk	<i>Chordeiles minor</i>	SC	THR	ROM
Golden eagle	<i>Aquila chrysaetos</i>	END		ROM
Peregrine falcon	<i>Falco peregrinus anatum</i>	SC	THR	ROM, NHIC
Rusty blackbird	<i>Euphagus carolinus</i>	NAR	SC	ROM
Short-eared owl	<i>Asio flammeus</i>	SC	SC	ROM
Fish and other Aquatic Species				
Deepwater sculpin	<i>Myoxocephalus thompsoni</i>	SC	SC	NHIC
Kiyi (Upper Great Lakes Population)	<i>Coregonus kiyi kiyi</i>	SC	SC	ROM
Lake sturgeon (Great Lakes-Upper St. Lawrence and Northwestern Ontario population)	<i>Acipenser fulvescens</i>	THR		ROM, NHIC
Northern brook lamprey	<i>Ichthyomyzon fossor</i>	SC	SC	NHIC
Shortnose cisco	<i>Coregonus reighardi</i>	END	END	ROM
Invertebrates				
Monarch butterfly	<i>Danaus plexippus</i>	SC	SC	Butterfly Atlas

Notes:

blank: species not assessed; Not at Risk: species assessed to be not at risk; SC: special concern species; THR: threatened species; END: endangered species

¹ - Status on the Species at Risk of Ontario list of the *Endangered Species Act* (ESA) (Government of Ontario, 2007)

² - Status listed on the federal *Species at Risk Act* (Government of Canada, 2012)

³ - Data obtained from the Natural Heritage Information Centre (NHIC, 2013); Royal Ontario Museum (ROM, 2013) rangemaps; Ontario Herpetofaunal Summary Database (Herp Atlas) (Oldham and Weller, 2000); Atlas of the Breeding Birds of Ontario (OBBA) (BSC, 2006); Bat Conservation International Species Profiles (BCI, 2013a,b); Ontario Butterfly Atlas (Butterfly Atlas) (Jones et al., 2013); Ontario Odonata Atlas (Odonata) (NHIC, 2005); Mammal Atlas of Ontario (Mammal Atlas) (Dobbyn, 1994)

Species records for Lake Superior are not necessarily known to occur within the Nipigon area.



3.3.6 Aboriginal Interests and Traditional Knowledge

Traditional lifestyles, culturally significant wildlife and the extent of sacred and ceremonial locations important to First Nation and Métis communities and organizations are important factors to be considered when identifying potential repository locations for further detailed study.

For this phase of the work, the extent to which such information has been sought is that which can be found in publicly available sources. Known archaeological sites, many of which are Aboriginal, are noted in Section 2.3.2. Trapline License Areas, located in the southwestern corner of the Nipigon area, are shown on Figure 3. Figure 9 presents terrestrial ecology mapping and Figure 10 aquatic resource mapping.

It is recognized that this does not fully represent the environmental issues and concerns of First Nation and Métis communities and organizations in the area and that further information and discussion is required before a more complete picture can be developed. Discussions with First Nation and Métis communities and organizations would be undertaken in later phases of the work program to further enhance the environmental understanding of specific locations.

3.4 Background Environmental Conditions

3.4.1 Air Quality

Air quality monitors in northwestern Ontario indicate that ground-level ozone and particulate matter fall within normal values compared to the national average (EC, 2013a). Table 3 provides a list of industrial facilities that reported air and water emissions through Environment Canada’s National Pollutant Release Inventory (NPRI) database within the same postal code range as the Township of Nipigon (EC, 2013b). The list includes sites in Nipigon, Thunder Bay and Marathon, which have local air emissions. Additional sources that may affect background air quality include the Trans-Canada Highway, Highways 11 and 585, and rail operations, all of which traverse the area.

Table 3: NPRI Regional Sources of Air Emissions

Table with 3 columns: NPRI ID, Facility Name, and City. It lists 16 industrial facilities and their locations across Ontario, including Armstrong, Atikokan, Bearskin Lake, Gull Bay, Hemlo, Hillsport, Kenora District, Lansdowne House, Marathon, and Thunder Bay.



NPRI ID	Facility Name	City
203	City of Thunder Bay - Bare Point Water Treatment Plant	Thunder Bay
205	City of Thunder Bay - Water Pollution Control Plant	Thunder Bay
930	AbiBow Canada Inc. - Thunder Bay Operations	Thunder Bay
3048	Ontario Power Generation Inc. - Thunder Bay Generating Station	Thunder Bay
3836	Air Canada - Thunder Bay International Airport	Thunder Bay
5601	Bombardier Inc. - Thunder Bay Plant	Thunder Bay
5667	Rio Tinto Exploration Canada Inc. - Mineral Processing Lab	Thunder Bay
6980	Viterra Inc. - Thunder Bay Terminal A (AU) Viterra	Thunder Bay
7432	Canada Malting Co Ltd. - Canada Malting, Thunder Bay	Thunder Bay
11090	AbiBow Canada Inc. - Thunder Bay Sawmill	Thunder Bay
11144	ERCO Worldwide, A division of Superior Plus LP - Broadway Avenue Plant	Thunder Bay
11540	Nor-Shore Ready Mix Concrete Products Limited - Nor-Shore Ready Mix Concrete Products Limited	Thunder Bay
11586	Enerdry Constructors Ltd. - Thunder Bay Shop (Kingston Street)	Thunder Bay
11725	Cargill Limited - Cargill AgHorizons, Thunder Bay Terminal, ON	Thunder Bay
11819	City of Thunder Bay - City of Thunder Bay Solid Waste and Recycling Facility	Thunder Bay
18969	Richardson International Ltd. - Thunder Bay	Thunder Bay
10392	Hydro One Remote Communities Inc. - Webequie Diesel Generating Station	Webequie

3.4.2 Background Radiation

The source of background radiation in the Nipigon area is attributed to naturally occurring radioactive materials (NORM), specifically potassium, uranium and thorium-bearing minerals in the underlying granite and metasedimentary paragneisses and migmatites. The background radiation for the Nipigon area is presented on Figure 11. Statistically, the majority of the dose rates in the Nipigon area range from approximately 5 to 75 nGy/h, with an average of approximately 25 nGy/h. This range of dose rates and average are consistent with regional dose rates for northwestern Ontario.

A recent survey by Health Canada of radon gas concentrations in Canadian homes shows 88% of residences in the Thunder Bay District Health Unit tested below the national guideline of 200 Bq/m³, while 11% were between 200 and 600 Bq/m³ and the remaining 1% were above 600 Bq/m³ (Health Canada, 2013). Additional detailed information on background radiation is available in the geophysical interpretation report (PGW, 2014).

3.4.3 Soil Quality

A preliminary desktop review indicated that there is no specific information on background soil quality in the Nipigon area. Outside of industrial areas, soil concentrations are expected to be consistent with Ontario Typical Background ranges, as noted in Table 1 of Ontario Ministry of the Environment (MOE) Regulation 153/04, as amended (Government of Ontario, 2004).

3.4.4 Water Quality

The Township of Nipigon obtains its municipal water supply from the Nipigon River (MOE, 2013b). Under the Ontario *Safe Drinking Water Act* (O. Reg. 170/03) (Government of Ontario, 2003) municipalities are required to monitor water quality and compare it to the Ontario Drinking Water Standards, Objectives and Guidelines



(ODWS) (Government of Ontario, 2006); however, only municipalities with more than 10,000 people are required to make their annual report on drinking water quality available on their website. No information on water quality for the Nipigon Drinking Water System is publicly available on the Township’s website.

Surface water hydrology, groundwater and wells are further discussed in Sections 3.5 and 3.6.

3.4.5 Lake Sediment Chemistry

The Ontario Geological Survey (OGS) conducted a high-density lake sediment survey in the Nipigon and Beardmore areas during the summer of 2006 to investigate mineral potential in these areas (Dyer, 2009). This lake sediment survey included sampling from 1,935 lakes, some of which occur within the Nipigon area. These samples were analyzed for more than 50 major, minor and trace elements. Preliminary interpretation of these geochemical analyses indicated 17 areas with some concentrations of elements elevated above the typical crustal abundance. Within a few locations of the Nipigon area, anomalous geochemical patterns were observed in lake chemistry, relative to typical abundances as a result of natural mineralization. These areas included the following: the Blair Lake area with two weak gold anomalies and the East Moseau Lake - Hansi Lake area with cadmium and zinc anomalies (Dyer, 2009).

3.4.6 Potential Sources of Pollutants

There are a number of potential sources of pollutants in the Nipigon area including landfills, transportation corridors, domestic septic systems and local industries.

There is one operating landfill site, the Nipigon Waste Disposal Site, within the Nipigon area (Table 4). It is classified as a small landfill. As well, there are three other small, now closed, landfills within the area (MOE, 2013a).

Table 4: Registered Landfills in the Nipigon Area

Table with 4 columns: Certificate of Approval (C of A) Number, Site Name, Location, Status. It lists four landfill sites with their respective details and statuses.

Source: Ontario Landfills List (MOE, 2013a)

Transportation corridors, such as Highways 17, 11 and 585, secondary roads, logging roads and rail lines, traverse the Nipigon area, and are considered to be potential sources of pollution, as a result of salt application for de-icing and mobile air emissions from internal combustion. There is also a potential for chemical releases



along transportation routes as a result of spills or accidents. Local septic systems are a potential source of the release of pollutants, mainly as a result of septic waste and possibly as a result of chemical disposal into the septic system. Industrial operations in the area may be a source of pollutants, due to the potential release of chemicals as a result of spills or improper chemical handling practices. No specific releases of the above-named pollutants into the environment were identified in this review.

3.5 Surface Water Hydrology

The Nipigon area is located in the Great Lakes – St. Lawrence drainage basin, which drains into Lake Superior and eventually into the Atlantic Ocean through the St. Lawrence River. Surface water drainage for the Nipigon area is shown on Figure 12. Drainage is generally towards the south and southeast into Lake Superior. There are three tertiary watersheds; namely, the Black Sturgeon, the Nipigon and the Jackpine.

In the Nipigon area, the most prominent drainage features are the Black Sturgeon, Nipigon and Jackpine and Jackfish Rivers, which flow into Lake Superior. The Nipigon River drains the lake of the same name to the north of the Nipigon area from which it flows in a southerly course for approximately 50 km to Nipigon Bay in Lake Superior. The largest tributaries to the Nipigon River in this area are Frazer, Booth, Cash and Stillwater creeks. The settlement area of Nipigon is located along the west bank of the Nipigon River downstream from Lake Helen. The Black Sturgeon River flows in a southeasterly direction for a distance of approximately 100 km before entering Black Bay on Lake Superior. For most of its length, the river follows a meandering path within a river valley occasionally bounded by steep cliffs. A number of creeks, including Stillabeer Creek, Larson Creek, Scooper Creek, Mound Creek and Mouseau Creek are tributaries to the Black Sturgeon River in the Nipigon area. In the eastern portion of the Nipigon area, the Jackfish River and the Jackpine River flow in a southerly direction and discharge into Lake Superior. In addition to these larger drainage systems, much of the land bordering Lake Superior drains directly to the lake via a number of small and generally unnamed creeks.

3.6 Groundwater and Wells

Information concerning groundwater in the Nipigon area was obtained from the MOE Water Well Information System (WWIS) database (MOE, 2013c). The locations of known water wells are shown on Figure 12. While the Township of Nipigon obtains its municipal water supply from the Nipigon River (MOE, 2013b), a large number of wells exist in the Nipigon area serving individual private residences. Most of these are located along the Trans-Canada Highway and obtain water from the overburden or the shallow bedrock. The WWIS database contains a total of 143 water well records for the Nipigon area for which useful information is available (wells with no recorded depth are excluded). A summary of these wells is provided in Table 5 (Golder, 2014).

Table 5: Water Well Record Summary for the Nipigon Area

Water Well Type ^a	Number of Wells	Total Well Depth (m)	Static Water Level (m below surface)	Tested Well Yield (L/min)	Depth to Top of Bedrock (m)
Overburden	57	3 to 99	0 to 43.8	9 to 450	N/A
Bedrock	86	15 to 140.5	0 to 32.0	4.5 to 675	0 to 82

3.6.1 Overburden Aquifers

There are 57 water well records in the Nipigon area that can be confidently assigned to the overburden aquifer, which is generally found in the sand and gravel deposits above bedrock and at the base of the glaciolacustrine



deposits that form the most widespread surficial soil materials. The overburden wells are generally 3 to 50 m deep, but depths of up to 99 m have been recorded. Well yields are variable with recorded values ranging from 9 L/min to 450 L/min. These values reflect the purpose of the wells (private residential supply) and do not necessarily reflect the maximum sustained yield that might be available from the aquifer (Golder, 2014).

3.6.2 Bedrock Aquifers

No information was found on deep bedrock groundwater conditions in the Nipigon area at a typical repository depth of approximately 500 m. In the Nipigon area, there are 86 well records that can be confidently assigned to the shallow bedrock aquifer. These wells range from 15 to 140.5 m in depth, with most wells between 30 to 60 m deep. Measured pumping rates in these wells are variable and range from 4.5 L/min to 675 L/min with yields typically between 10 to 30 L/min. These values reflect the purpose of the wells (i.e., private residential supply) and do not necessarily reflect the maximum sustained yield that might be available from the shallow bedrock aquifers (Golder, 2014).

The MOE's WWIS indicates that there are no potable water supply wells which exploit aquifers at typical repository depth (at least 500 m) in the Nipigon area or anywhere else in northern Ontario (MOE, 2013c). Experience from other areas in the Canadian Shield has shown that active groundwater flow is generally confined to shallow fractured localized systems. In these shallow regions, flow tends to be dependent on the secondary permeability created by fractures. In deeper regions, hydraulic conductivity tends to decrease as fractures become less common and less interconnected. Increased vertical and horizontal stresses at depth tend to close or prevent fractures, thereby reducing permeability and resulting in diffusion-dominated groundwater movement.

3.7 Climate and Meteorology

The climate assessment for the Nipigon area is based on Environment Canada's Thunder Bay climate station 1971-2000 normals, as this is the closest station to the Nipigon area (the station is located approximately 100 km southwest of Nipigon). The Thunder Bay climate station has 23 years of data during the 1971-2000 climate normals period and the 30 year period from 1971-2000 is the most recent period for which climate normals are available from Environment Canada. Parameters measured at the Thunder Bay climate station include temperature, precipitation and wind.

The Nipigon area is within a temperate and sub-humid continental climate zone, with short mild summers and cold winters. The major drivers for precipitation are weather systems that cross the Canadian prairies, the American Midwest and deep south that move northward in to the region; these weather systems are responsible for transporting moisture from the Great Lakes and the Gulf of Mexico. Most precipitation falls in the summer into early fall in the form of showers and thunderstorms associated with traversing weather systems. In the winter, snowfall amounts are generally moderate with occasional extreme snowfalls associated with lake effect due to proximity to Lake Superior or blizzards rolling in from the west. Prolonged periods of extreme cold can also be experienced in the region during the winter.

3.7.1 Temperature

Temperature data were obtained from Environment Canada's 1971-2000 climate normals for the Thunder Bay meteorological station (EC, 2013c). Temperature in the Nipigon area can reach highs of 37°C in summer months and lows of -41°C in winter months. The annual average temperature is 3°C, where the average summer temperature is approximately 16°C and the average winter temperature is -13°C. Figure 13 shows



monthly temperatures for Thunder Bay, displaying daily average, maximum and minimum and extreme values over the calendar year.

3.7.2 Precipitation

As shown on Figure 14, the annual average precipitation in the Nipigon area is 747 mm, where one cm of snow is considered to be equal to one mm of equivalent rainfall. The region receives more precipitation in the summer and fall months (June through September), averaging over 80 mm each month during that period. Nipigon is on the north shore of Lake Superior but lake effect snow plays little role in average winter precipitation, although lake effect snow can occur resulting in rare but large snowfalls. Figure 14 presents monthly precipitation data obtained from Environment Canada’s 1971-2000 climate normals for the Thunder Bay meteorological station, including total rainfall, snowfall and all-time extreme values over the calendar year (EC, 2013c).

3.7.3 Wind

West and southwest winds prevail in the Nipigon area, changing to east in the spring and early summer. Table 6 presents the monthly wind data obtained from Environment Canada’s 1971-2000 climate normals for the Thunder Bay meteorological station (EC, 2013c). Wind speed and direction are an average for each month over the calendar year.

Table 6: Monthly Wind Normals for Thunder Bay, Ontario

Table with 13 columns: Parameter, Jan, Feb, Mar, Apr, May, Jun, Jul, Aug, Sep, Oct, Nov, Dec. Rows include Average Speed (km/hr) and Most Prevalent Direction (from).

3.8 Natural Hazards

3.8.1 Earthquakes and Seismicity

The Nipigon area lies within the Canadian Shield, where large parts have remained tectonically stable for the last 2.5 billion years (Percival and Easton, 2007). The Nipigon area has a low seismic hazard rating (NRCAN, 2009b). Since 1627, no earthquakes exceeding a magnitude mN 6 have been known to occur within 1,000 km of the Nipigon area. According to the National Earthquake Database (NEDB), no earthquakes larger than magnitude 3.0 were recorded for the period between 1985 and 2013 within the Nipigon area (NRCAN, 2013).

In summary, the available literature and recorded seismic events indicate that the Nipigon area is located within an area of low seismicity.

3.8.2 Tornadoes and Hurricanes

As noted in Table 6, average monthly wind speeds in the Nipigon area are low, ranging from 10 to 13 km/hr. The Nipigon area experiences thunderstorms in the summer and is located in an area with a low tornado frequency (<0.1 tornadoes per year / 10,000 km²), but where there is a potential for F0-F1 tornadoes (Sills et al., 2012). The Nipigon area is situated too far away from the Atlantic Ocean to be susceptible to hurricanes. The



National Building Code of Canada recommends a design 1/50 maximum⁹ hourly wind pressure for the Thunder Bay area of 0.39 kPa, which is a typical value for Ontario (NRC, 2010).

3.8.3 Drought and Flooding

According to precipitation climate normals for the region (Figure 14), the Nipigon area experiences on average between 30 and 90 mm of precipitation each month, and is therefore unlikely to experience drought conditions that would affect the viability of local water sources. The single day extreme rainfall and snowfall events on record at the Thunder Bay station (Figure 14) are 131 mm of rain and 52 cm of snow, respectively. In years where there is a high snowpack accumulation, the spring freshet can result in a nominal increase in water levels in local streams and rivers. As noted on Figure 12, the Nipigon area lies at the outflow of a number of watersheds, making the upstream catchment areas moderately large. This, in combination with some areas of rugged terrain, makes for a possible risk of flash flooding in some parts of the Nipigon area. The potential for flooding to affect a repository facility would depend on the specific location.

3.8.4 Snow and Ice

As noted on Figure 14, the Nipigon area receives on average about 190 cm of snowfall per year, primarily between the months of November and April. No single month receives an average snowfall greater than 45 cm. The highest single day snowfall accumulation on record is 52 cm, recorded on January 20, 1956. The National Building Code of Canada recommends a design 1/50 snow load ($S_s + S_r$)¹⁰ for the Thunder Bay area of 3.3 kPa, which is a typical value for northern Ontario (NRC, 2010). Local lakes and water bodies freeze over in the winter months in the Nipigon area, as average daily temperatures from November to March typically range from -15 to -3°C. Lake Superior partially freezes each year and freezes over completely approximately once every 20 years.

3.8.5 Forest Fires and Lightning

Within heavily forested areas such as the Nipigon area there is a risk of forest fires. Locations where forest fires have occurred in the vicinity of the Nipigon area between 1976 and 2010 affecting an area of greater than 200 ha are shown on Figure 5. These forest fires combine to comprise approximately 5% of the Nipigon area. Forest fires can be initiated by lightning strikes or human activity, particularly if dry conditions are present in the forest understory. As previously noted, thunderstorms occur in the Nipigon area and lightning strikes are not uncommon in the summer months.

3.8.6 Landslides and Tsunamis

There are areas of steep slopes in the Nipigon area, which are generally comprised of crystalline rock with a thin veneer of soil cover. The physical nature of these slopes, combined with a potential for high precipitation events, results in a possible landslide risk for some areas. There is a low risk of tsunamis in the Nipigon area along the immediate Lake Superior shoreline, owing to the very low seismicity.

⁹ Hourly wind speeds having the annual probability of occurrence of a 1 in 50 year return period.

¹⁰ The combined snow and rain load that has an annual probability of occurrence in a 1 in 50 year period.



4.0 SUMMARY

This report provides a high level description of the environment in the Township of Nipigon and surrounding area.

The Township of Nipigon is situated in the District of Thunder Bay on the western shore of Lake Superior's Nipigon Bay and is approximately 115 km² in size, with a population of 1,631 (Statistics Canada, 2013). Nipigon is about 120 km northeast of Thunder Bay, and the other settlements in the Nipigon area include the Lake Helen and Red Rock Indian Reserves and the settlement of Cameron Falls. The Nipigon area is within a temperate and sub-humid continental climate zone with short mild summers and cold winters. Nipigon receives most of its yearly precipitation as rainfall in the summer and into the early fall.

There are a number of First Nation and Métis communities and organizations in the Nipigon area including the following First Nations: Animbiigoo Zaagi'gan Anish (Lake Nipigon Ojibway) First Nation, Biinjitiwaabik Zaaging Anishnabek (Rocky Bay) First Nation, Bingwi Neyaashi Anishinaabek (Sand Point) First Nation, Fort William First Nation, Kiashke Zaaging Anishinaabek (Gull Bay) First Nation, Opwaaganising (Red Rock Band / Lake Helen) First Nation and Whitesand First Nation. Métis Councils in the area include the Greenstone Métis Council (Geraldton and Area), the Superior North Shore Métis Council and the Thunder Bay Métis Council.

Geologically, the Nipigon area straddles the boundary between the Quetico Subprovince of the Superior Province and the Sibley Group of the Southern Province of the Canadian Shield. There are five distinct geologic units in the Nipigon area: metasedimentary rocks of the Quetico Subprovince, sedimentary rocks of the Sibley Group, Nipigon diabase sills, small granitic intrusive bodies and the ultramafic Hele intrusion. Archean metasedimentary rocks and migmatites of the Quetico Subprovince comprise the bedrock surface over the majority of the Nipigon area in the area east of the Black Sturgeon River Fault Zone. Within the western and southern portions of the Nipigon area (west and south of the Black Sturgeon River Fault Zone) the sedimentary rocks of the Sibley Group lie unconformably on top of the metasedimentary rocks of the Quetico Subprovince. A number of small granitic intrusive bodies occur along the west boundary of the Nipigon area. In a number of places in the Nipigon area there are localized outcrops of mafic intrusions, diabase sills and dykes, including the Nipigon sill complex, which intrude and overlie both Archean metasedimentary rocks and the Mesoproterozoic sedimentary rocks of the Sibley Group. Nipigon sills occur at surface along the southern and western margins of the Nipigon area. Immediately west of the Black Sturgeon River fault zone, approximately 1 km southwest of the Township of Nipigon, is the ultramafic Hele intrusion.

There are currently no active mines in the Nipigon area, but the region has a long history of mining and mineral exploration, which continues today. There is no record of metallic mineral production in the past in the Nipigon area. A few mineral occurrences have been identified within the area, but their economic potential has not been proven. Known non-metallic mineral resources within the Nipigon area include sand, gravel and stone. Quarrying for stone has been carried out in the Nipigon area, including at the Nipigon River Marble Quarry.

Infrastructure within the Nipigon area includes the Trans-Canada Highway (Highway 17) which passes along the shore of Lake Superior and Highway 11 which runs south to north from Highway 17 along the eastern shore of Helen Lake, passing through the Lake Helen Indian Reserve. Highway 585 also runs north to south, west of Nipigon Bay and the Nipigon River. A Canadian Pacific (CP) rail corridor passes through the Nipigon area, approximately parallel to Highway 17 to Nipigon and then south towards Red Rock. There are two hydroelectric generating stations located along the Nipigon River (OPG, 2005). A number of electrical transmission lines pass



through the Nipigon area including a 230 kV transmission line and a network of 115 kV lines. There are no airports in the Nipigon area. There are two natural gas pipelines in the Nipigon area. The north-south line runs west of Lake Helen and Nipigon Bay. An east-west line branches off the north-south line to the west of Polly Lake (NRCan, 2009a). There is one operating landfill (MOE, 2013a) and a wastewater treatment plant within the Nipigon area.

There are two provincial parks, four conservation reserves, two forest reserves and one proposed National Park in the Nipigon area. The Black Sturgeon River Provincial Park, a waterway park, is located along the Black Sturgeon River to the west of the Township of Nipigon. The Ruby Lake Provincial Park, a natural environment park, is located along the north shore of Nipigon Bay and covers an area of 27 km². The four conservation reserves in the Nipigon area are the Nipigon River Conservation Reserve, the Kama Cliffs Conservation Reserve, the Seahorse Lake Conservation Reserve and the proposed Lake Superior Archipelago Conservation Reserve (MNR, 2013a). The Lake Superior National Marine Conservation Area, a proposed National Park, would include the lakebed, overlying waters and some islands in Lake Superior that are located within the Nipigon area.

The Nipigon area lies within the Great Lakes – St. Lawrence Forest Region. The northern and eastern parts of the Nipigon area are located within the Lake Nipigon Forest (FMU 815), managed by Lake Nipigon Forest Management Inc. (LNFMI). A southern strip of the Nipigon area, including the Township of Nipigon, is located within the Lakehead Forest (FMU 796), which is managed by Greenmantle Forest Inc. (GFI). The Black Spruce Forest (FMU 035), managed by AbiBow Canada Inc. (AbiBow), is located in the northwestern portion of the Nipigon area. In total, the Nipigon area contains 117,001 ha of woodlands, which is 86% of the land coverage (LIO, 2013). Typical forest types in the area include black spruce, white spruce, jack pine, red pine, white pine, balsam fir, trembling aspen, white birch and other mixed hardwoods (AbiBow, 2011; GFMI, 2011; GFI, 2012).

Trapping of fur bearing species and hunting of game are important activities in the Nipigon area. Management of woodland caribou, moose, marten and pileated woodpecker along with other sensitive wildlife populations are a particular concern to the MNR. Most of the Nipigon area is part of discontinuous woodland caribou habitat as identified in Ontario's Woodland Caribou Conservation Plan (MNR, 2009). There is one Area of Natural and Scientific Interest (ANSI), Kama Hills, within the Nipigon area. There are also two Life Science sites and an Earth Science site. No Provincially Significant Wetlands (PSW) have been identified in the Nipigon area.

The Natural Heritage Information Centre (NHIC) database (NHIC, 2013) shows the occurrence of species that are listed as Endangered (END), Threatened (THR) or Special Concern (SC) either under the provincial *Endangered Species Act* (ESA) (Government of Ontario, 2007), or the federal *Species at Risk Act* (SARA) (Government of Canada, 2012). The Royal Ontario Museum range maps (ROM, 2013) are based on range mapping and indicate the potential for Species at Risk (SAR) to exist within the Nipigon area. Habitats within the Nipigon area could directly or indirectly support the needs of 20 SAR species. These species include five mammals (eastern cougar, little brown myotis, northern myotis, wolverine and woodland caribou), nine birds (American white pelican, bald eagle, black tern, chimney swift, common nighthawk, golden eagle, peregrine falcon, rusty blackbird and short-eared owl), five fish (deepwater sculpin, kiyi, lake sturgeon, northern brook lamprey and shortjaw cisco) and one invertebrate (monarch butterfly). No END, THR or SC amphibian or reptile species or plants, mosses and lichens are known to occur within the Nipigon area based on available sources.

The Nipigon area lies mainly within three tertiary watersheds (Black Sturgeon, Nipigon and Jackpine) of the Great Lakes-St. Lawrence drainage basin. Within the Black Sturgeon tertiary watershed, located in the western



portion of the Nipigon area, water flows in a southeasterly direction. Within the central portion of the Nipigon area, the Nipigon River drains the lake of the same name to the north of the Nipigon area from which it flows in a southerly course for approximately 50 km to Nipigon Bay in Lake Superior. Within the Jackpine tertiary watershed in the eastern portion of the Nipigon area, the Jackfish River and the Jackpine River flow in a southerly direction and also discharge into Lake Superior. Within the Nipigon area, terrain includes wetlands, lakes and rivers that support a diversity of fish and wildlife. Water bodies are mainly warm and cool water classified, interspersed with the occasional smaller cold water body. Fish that are commonly harvested include walleye, northern pike, lake trout, brook trout, smallmouth bass and yellow perch, as well as larger fish that are found in Lake Superior and its river estuaries (MNR, 2013d).

Water wells in the Nipigon area obtain water from the overburden or the shallow bedrock. The Ontario Ministry of the Environment (MOE) Water Well Information System (WWIS) database contains 143 water well records in the Nipigon area for which useful information is available. There are no records of water wells sourcing potable water aquifers at typical repository depth in the Nipigon area or elsewhere in the Ontario part of the Canadian Shield. The Township of Nipigon obtains its municipal water supply from the Nipigon River.

Air, soil and surface water quality within the Nipigon area are expected to be within the normal range for north-central Ontario. Sources of background radioactivity in the Nipigon area are attributed to naturally occurring radioactive materials, specifically potassium, uranium and thorium-bearing minerals. The range of dose rates and averages are consistent with regional dose rates for northwest Ontario.

There are seven known archaeological sites in the Nipigon area (von Bitter, 2013). Of the seven sites, two contain no information about the nature of the archaeological site recorded, three are identified as pre-contact Aboriginal sites and the remaining two are historic Euro-Canadian sites. Of the three pre-contact Aboriginal sites, two have been identified as pre-contact Aboriginal findspots. The other site is a pictograph. The historic Euro-Canadian sites include a Hudson's Bay Company post and the remains of a railway lodge. There are a series of federally significant French trading posts from the mid to late 17th century along the Nipigon River. A provincial plaque is located at the Nipigon River lookout along Highway 11/17, commemorating the Jesuit Mission to the Nipissings in 1667. The presence of local heritage sites would need to be further confirmed in discussion with the community and First Nation and Métis communities and organizations in the area.





5.0 REFERENCES

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Report Signature Page

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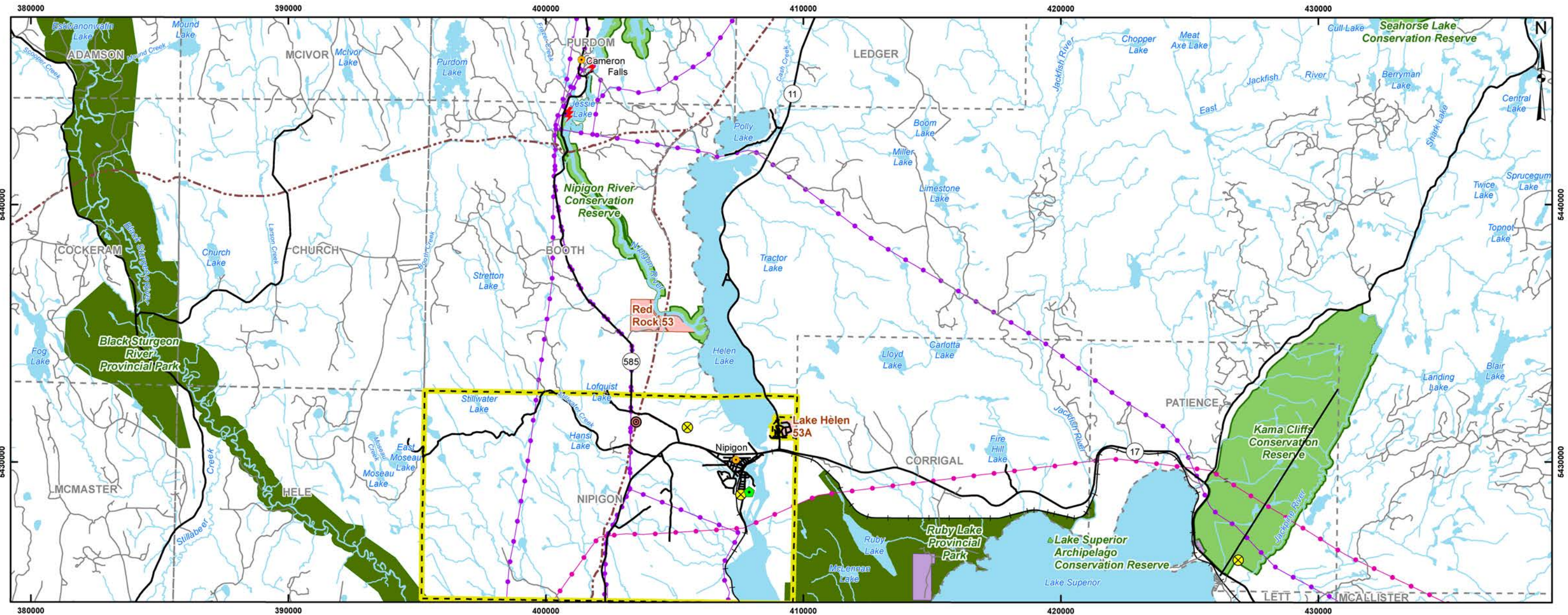
ENVIRONMENT REPORT - TOWNSHIP OF NIPIGON, ONTARIO



FIGURES



ENVIRONMENT REPORT - TOWNSHIP OF NIPIGON, ONTARIO



LEGEND

● Community	—+— Railway	■ Conservation Reserve
⊙ Domestic Waste Site (Operating)	—●— 230 kV Transmission Line	■ Forest Reserve
⊗ Domestic Waste Site (Closed)	—●— 115 kV Transmission Line	■ Provincial Park
⊕ Waste Water Treatment Plant	—●— Natural Gas Pipeline	■ Recommended Conservation Reserve
⚡ Hydro Station	—●— Watercourse	■ Federal Land - Indian Reserve
— Main Road	■ Waterbody	— Geographic Township
— Local Road		■ Municipal Boundary (Township of Nipigon)

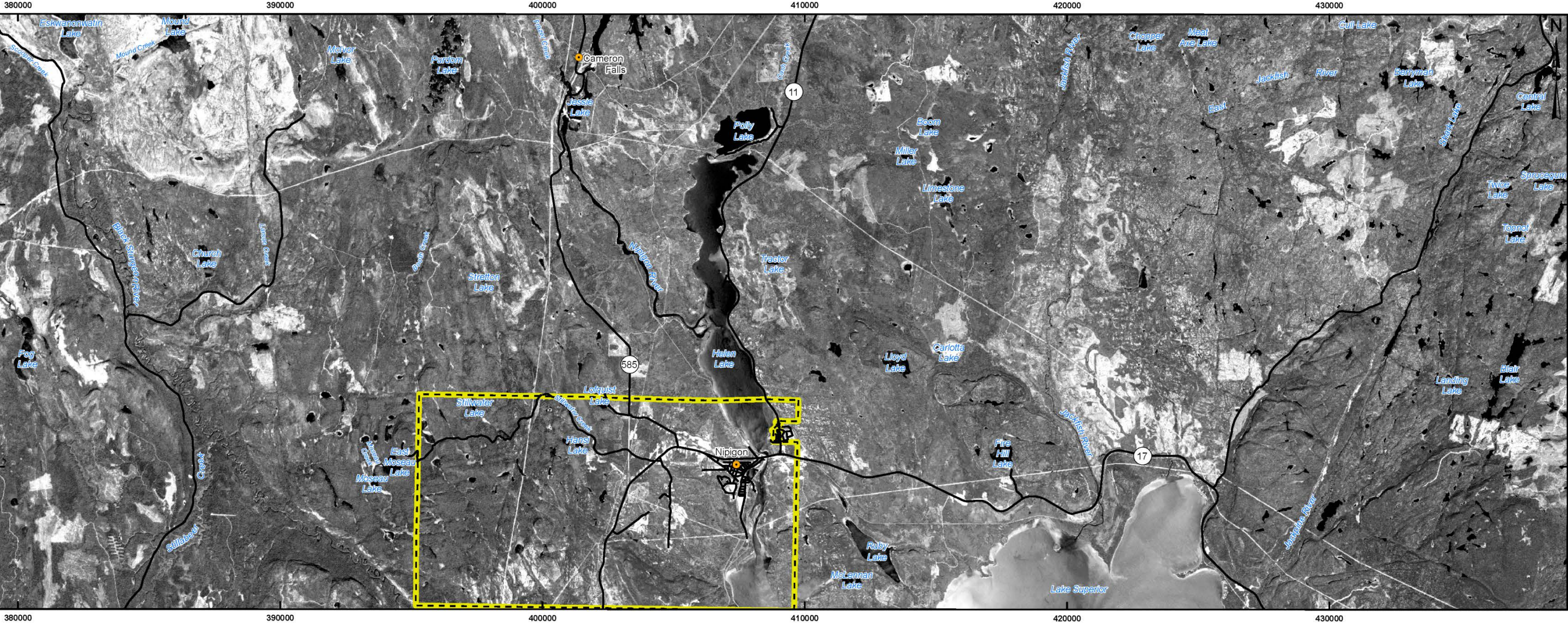
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Ontario Power Generation (OPG), 2005. Nipigon River System Water Management Plan. March 2005. 285p.
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 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Nipigon and Surrounding Lands		
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-02026	SCALE AS SHOWN
	DESIGN	PM 19 Aug. 2013	REV. 0.0
	GIS	PM/JB 21 May. 2014	FIGURE: 1
	CHECK	JH 21 May. 2014	
REVIEW	GWS 21 May. 2014		

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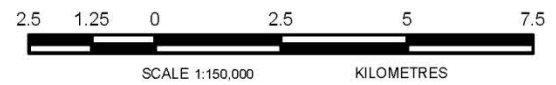


LEGEND

- Community
- Main Road
- Municipal Boundary (Township of Nipigon)

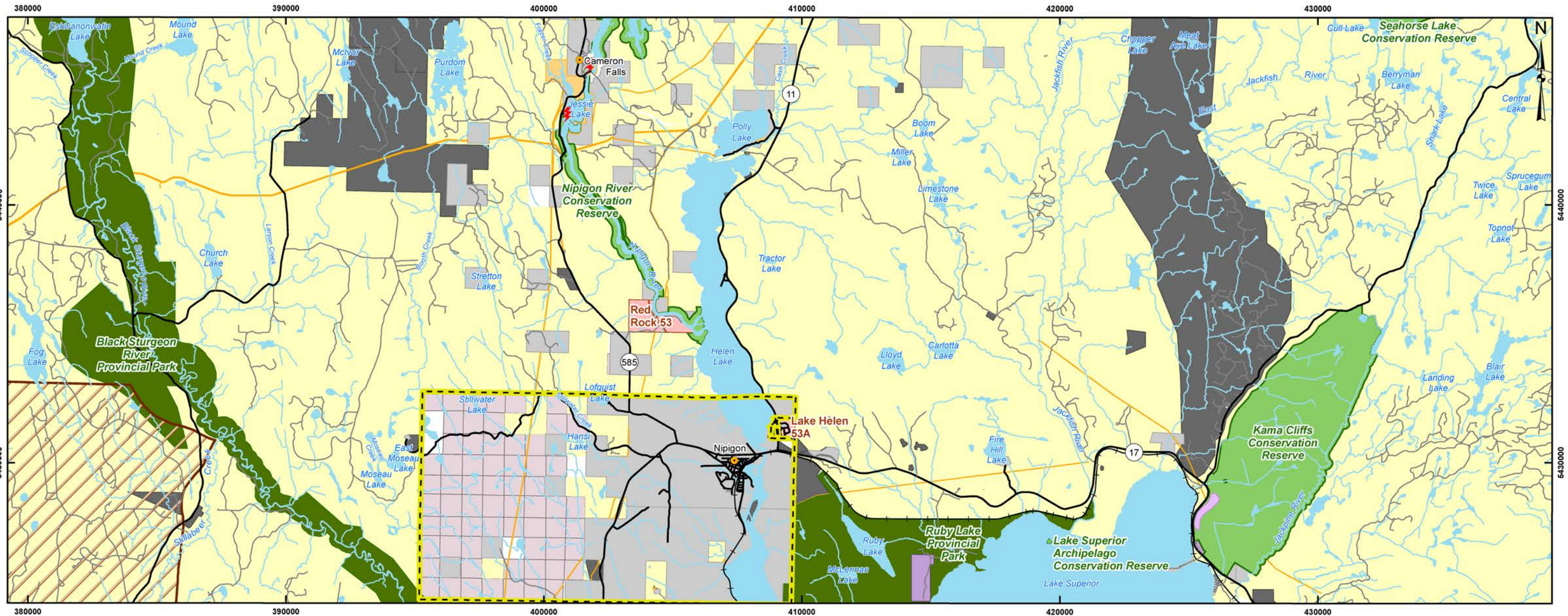
REFERENCE

Base Data - MNR LIO, obtained 2009-2013
 Imagery - SPOT 5, Obtained from Geobase (2006, 10 m resolution)
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Satellite Imagery of the Nipigon Area		
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 19 Aug. 2013	REV. 0.0
	GIS	PWJB 21 May. 2014	FIGURE: 2
	CHECK	JH 21 May. 2014	
REVIEW	GWS 21 May. 2014		

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LEGEND

- Community
- Hydro Station
- Main Road
- Local Road
- Railway
- Watercourse
- Waterbody
- ANSI, Earth Science
- Conservation Reserve
- Forest Reserve
- Provincial Park
- Recommended Conservation Reserve
- Private Land
- Federal Land - Indian Reserve
- Crown Land Acquired
- Crown Land - Non-Freehold Dispositions Public
- Crown Land - Unpatented Public Land
- Crown Reserves
- Regular Registered Trapline Area License
- Municipal Boundary (Township of Nipigon)

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
 Crown Reserves - Ministry of Northern Mines and Development (April 4, 2013)
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

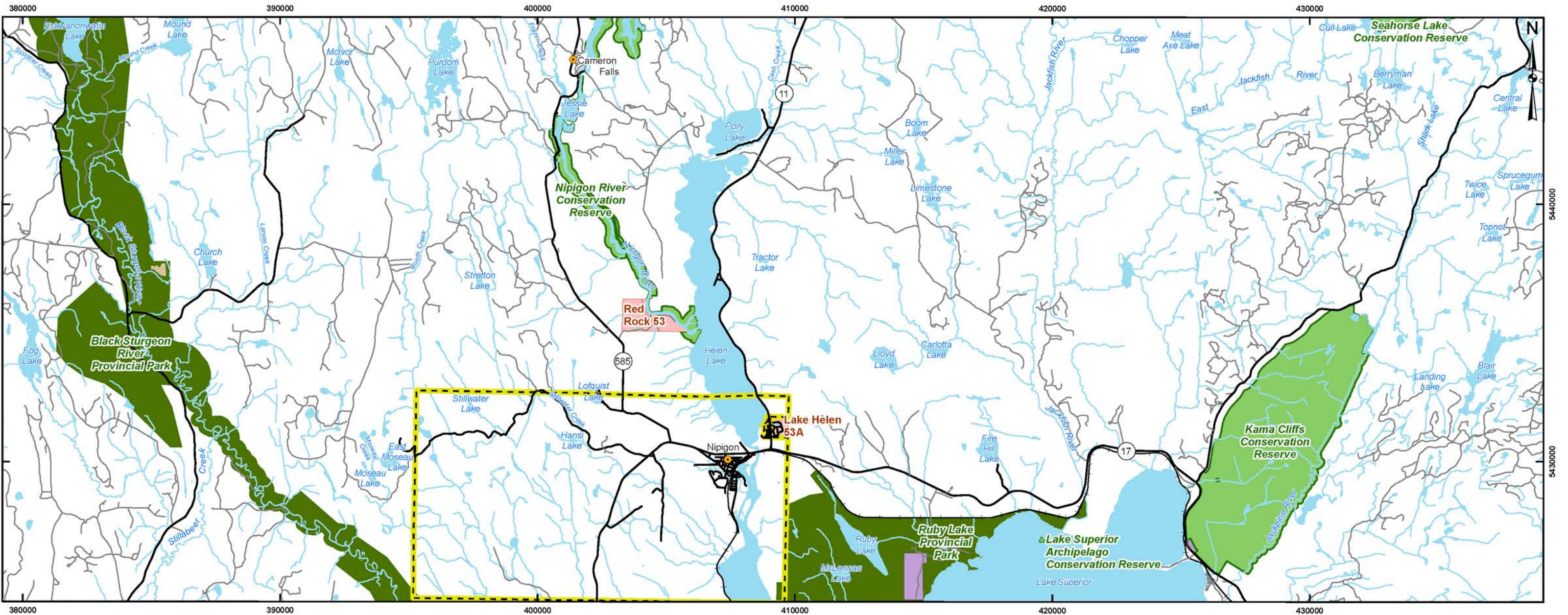


PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Nipigon Land Ownership		
PROJECT NO.	12-1152-0026	SCALE AS SHOWN	REV. 0.0
DESIGN	PM 19 Aug. 2013		
GIS	PM/JB 21 May. 2014		
CHECK	JH 21 May. 2014		
REVIEW	GWS 21 May. 2014		

FIGURE: 3



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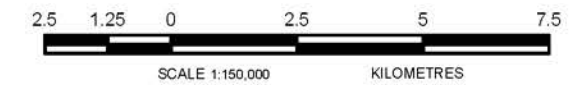


LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse
- Waterbody
- Federal Land - Indian Reserve
- Conservation Reserve
- Forest Reserve
- Provincial Park
- Recommended Conservation Reserve
- Significant Old Growth Forest
- Municipal Boundary (Township of Nipigon)

REFERENCE

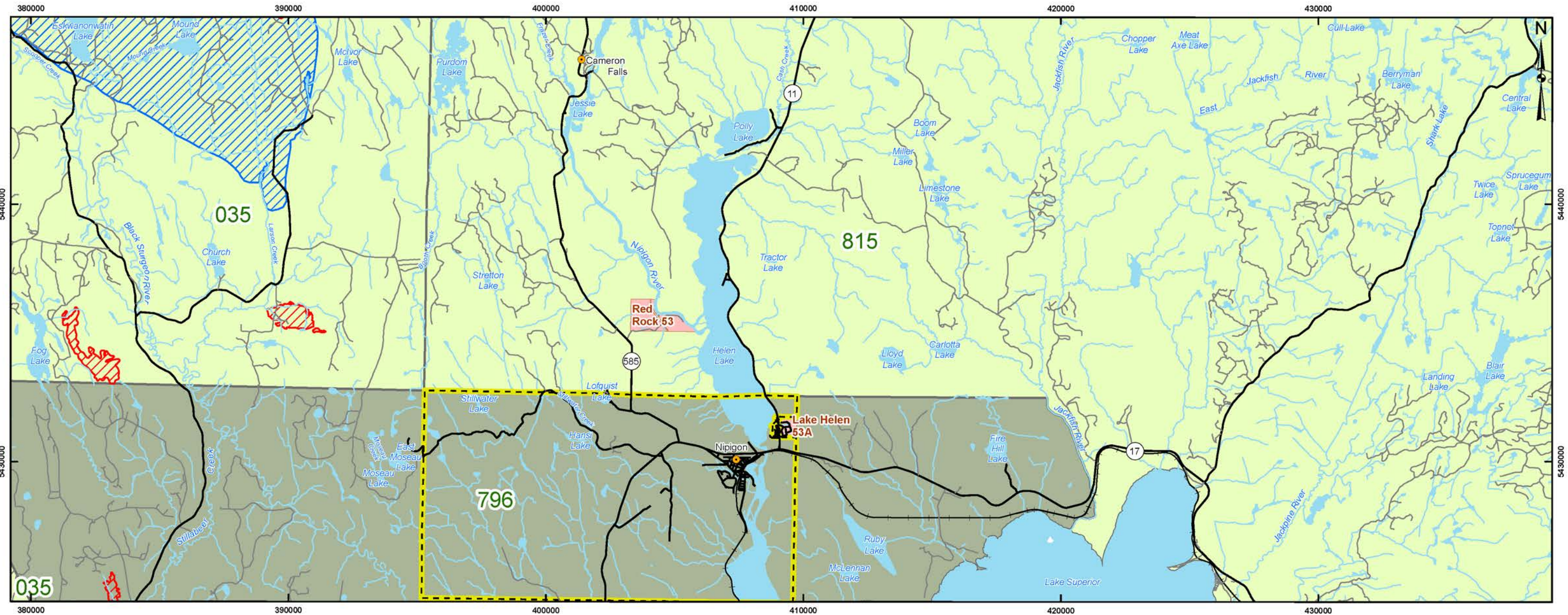
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 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Nipigon Protected Lands		
	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN PM 19 Aug. 2013		
	GIS PM/JB 21 May. 2014		
	CHECK JH 21 May. 2014		
	REVIEW GWS 21 May. 2014		

FIGURE: 4

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LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse
- Waterbody
- Federal Land - Indian Reserve
- Municipal Boundary (Township of Nipigon)

Forest Fire Areas (greater than 200 hectares)

- 1976 - 1980
- 1981 - 1990
- 1991 - 2000
- 2001 - 2010

Forest Plan Renewal Year

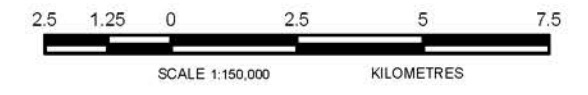
- 2013
- 2014
- 2015
- 2016
- 2017

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

FOREST MANAGEMENT UNITS

035 - Black Spruce Forest
 796 - Lakehead Forest
 815 - Lake Nipigon Forest



PROJECT

Environment Report
 Township of Nipigon, Ontario

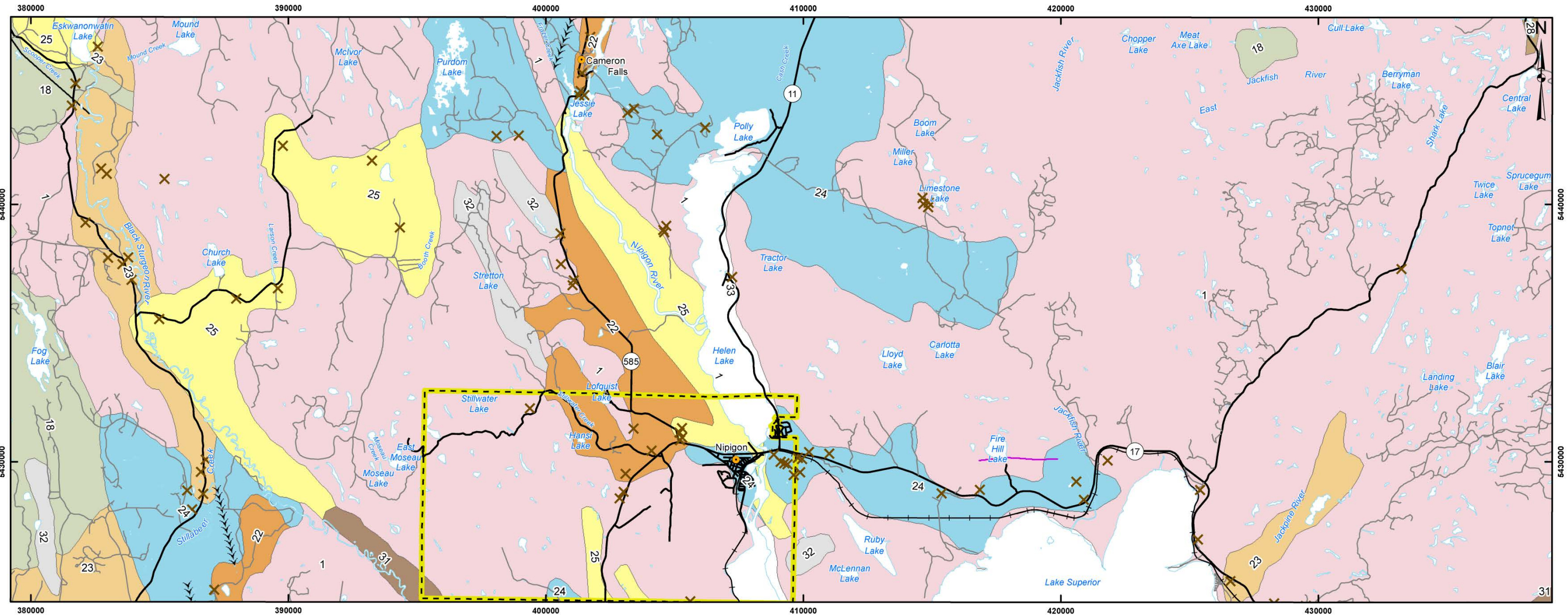
TITLE

Forest Management Units of the Nipigon Area

PROJECT NO.	12-1152-0026	SCALE AS SHOWN	REV. 0.0
DESIGN	PM 19 Aug. 2013	FIGURE: 5	
GIS	PM/JB 21 May. 2014		
CHECK	JH 21 May. 2014		
REVIEW	GWS 21 May. 2014		

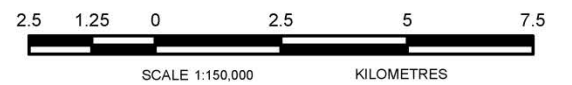
Golder Associates
 Mississauga, Ontario

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LEGEND

Community	Terrace Escarpment (Abandoned Shore Bluff)	24: Glaciolacustrine Deposits – Fine Grained
Main Road	Trend of End Moraine Crest	25: Glaciolacustrine Deposits – Coarse Grained
Local Road	1: Bedrock	28: Fluvial Deposits - Pleistocene
Railway	18: Till	31: Fluvial Deposits - Recent
Pit (Gravel)	22: Glaciofluvial Ice - Contact Deposits	32: Organic deposits
Esker or Area of Eskers	23: Glaciofluvial Outwash deposits	33: Water Area
	Municipal Boundary (Township of Nipigon)	



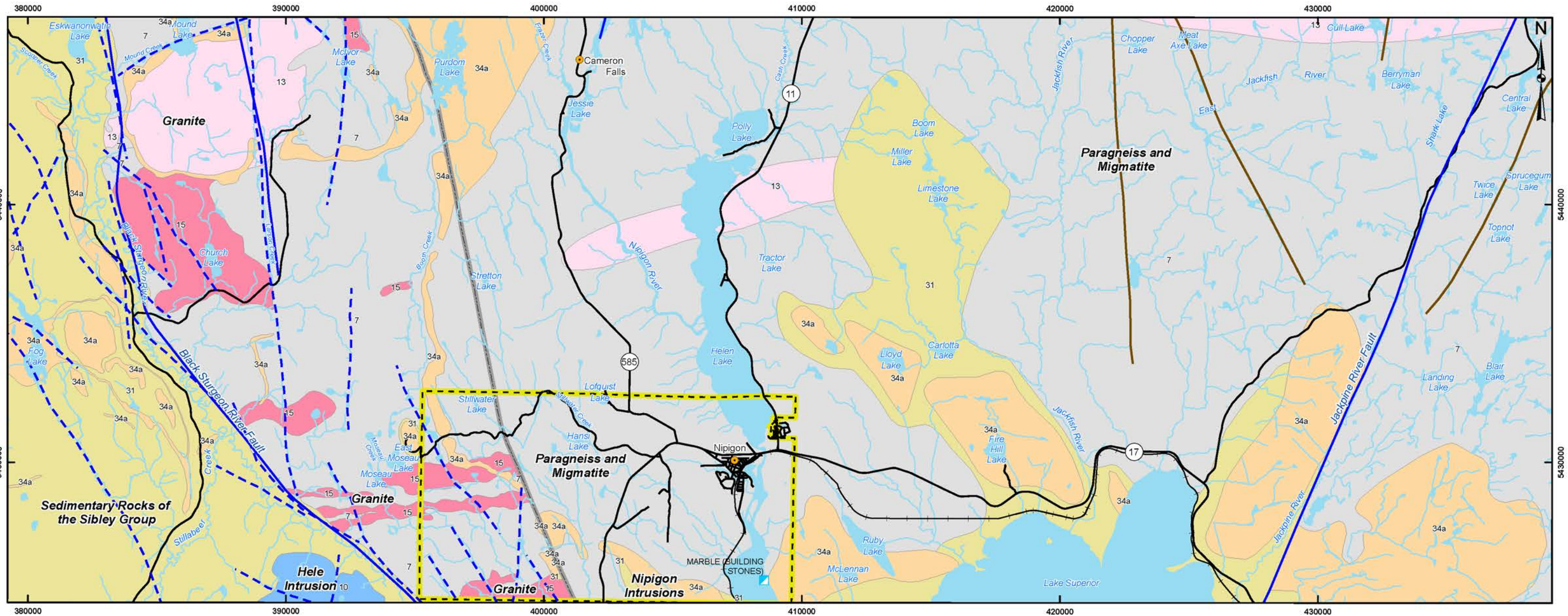
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 Geology - Modified EDS014-Surfacial Geology of Ontario 1:1,000,000, 2000
 Wells - Ministry of the Environment, 2013
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT		Environment Report Township of Nipigon, Ontario	
TITLE		Quaternary Geology of the Nipigon Area	
PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0	
DESIGN PM 19 Aug. 2013	 Mississauga, Ontario		
GIS PM/JB 21 May. 2014			
CHECK JH 21 May. 2014			
REVIEW GWS 21 May. 2014			
 Mississauga, Ontario		FIGURE: 6	

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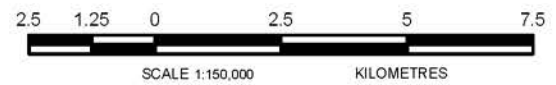


LEGEND

- Community
- Past Producing Mine with Reserves
- Main Road
- Railway
- Watercourse
- Waterbody
- Geological Fault
- Lineament / Fault (Hart, 2005)
- Mapped Dyke
- Revised Mapping (Hart, 2005)
- Bedrock Geology**
- 34 Mafic and related intrusive rocks (Keweenawan age)
- 34a Logan and Nipigon sills (1109 Ma): diabase sills
- 31 Sibley Gp.
- 15 Massive granodiorite to granite
- 15a Potassium feldspar megacrystic units
- 13 Muscovite-bearing granitic rock
- 10 Mafic and ultramafic rocks
- 7 Metasedimentary rocks (Paragneisses and Migmatites)
- Municipal Boundary (Township of Nipigon)

REFERENCE

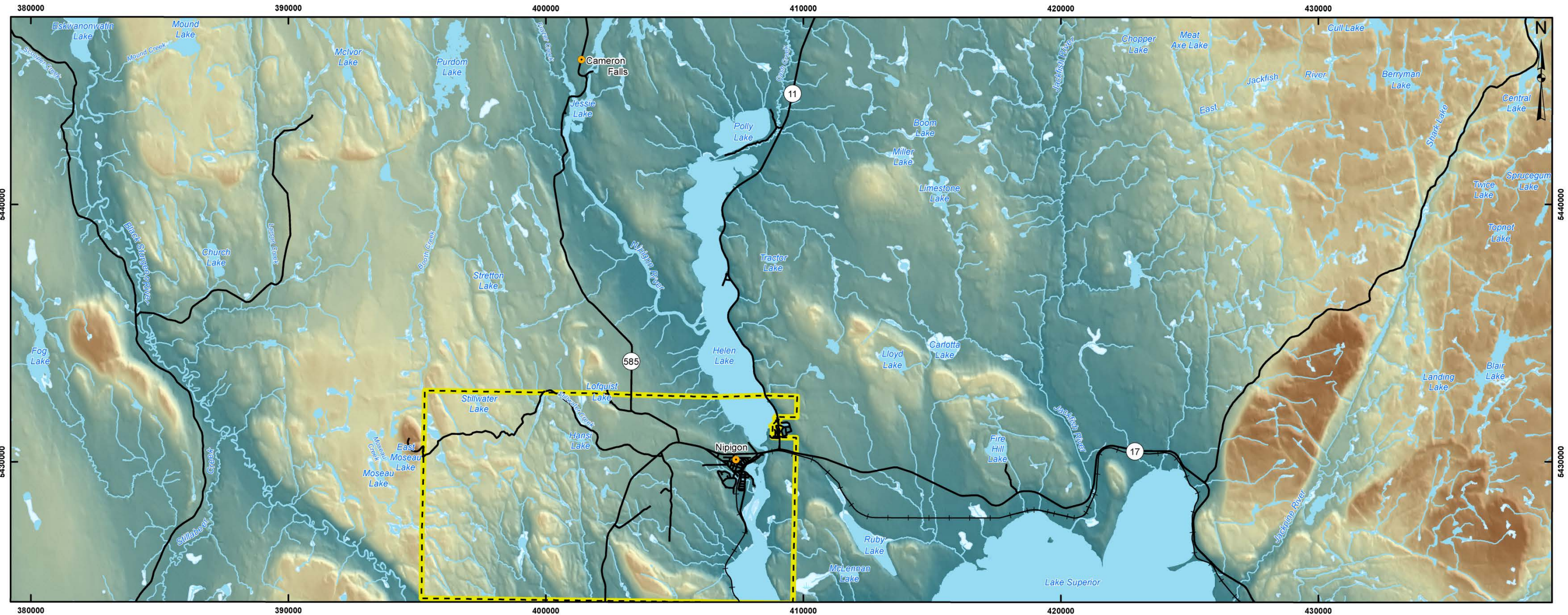
Base Data - MNR LIO, obtained 2009-2013
 Hillshade - GeoBase CDED 1:50,000
 Geology: Modified 1:250 000 Scale MRD126-Bedrock Geology of Ontario, 2011 - incorporating detailed mapping published by Hart (2005)
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Bedrock Geology of the Nipigon Area		
	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN PM 19 Aug. 2013		
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	REVIEW GWS 21 May. 2014		

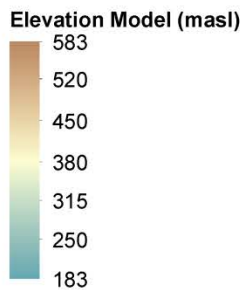
FIGURE: 7

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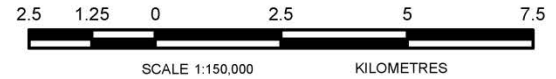
LEGEND

- Community
- Main Road
- Railway
- Watercourse
- Waterbody
- Wetland
- Municipal Boundary (Township of Nipigon)



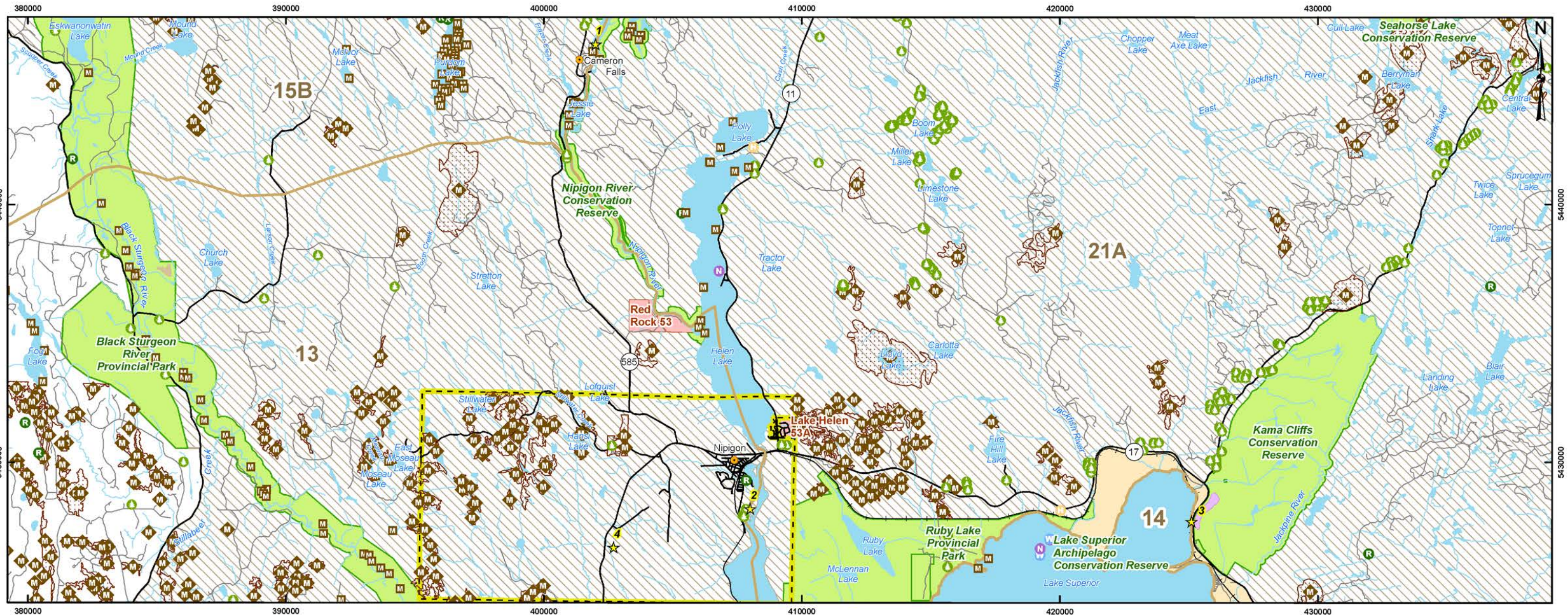
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 Digital Elevation Model - CDED slope raster: Geobase.ca (1:50,000)
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Digital Elevation Model (DEM) of the Nipigon Area		
 Golder Associates <small>Mississauga, Ontario</small>	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN PM 19 Aug. 2013	FIGURE: 8	
	GIS PM/JB 21 May. 2014		
	CHECK JH 21 May. 2014		
REVIEW GWS 21 May. 2014			

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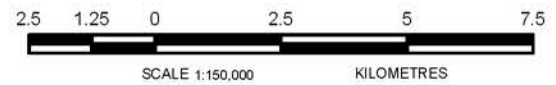


LEGEND

- | | | | |
|--|--|--|---|
| <ul style="list-style-type: none"> ● Community — Main Road — Local Road — Railway — Watercourse — Waterbody — Provincial Park / Reserve — Enhanced Management Area | <ul style="list-style-type: none"> ■ Federal Land - Indian Reserve ■ ANSI, Earth Science ■ Municipal Boundary (Township of Nipigon) ★ Earth or Life Science Site Wildlife and Forestry ● Forest Research Area ■ Discontinuous Caribou Habitat ■ (Wildlife Management Unit (13, 14, 15B, 21A)) | <ul style="list-style-type: none"> Nesting ● Heron ● Other ● Raptor ● Waterfowl Significant Ecological Area ■ Significant Old Growth Forest | <ul style="list-style-type: none"> Wintering Area ■ Moose ■ Moose Calving/Fawning Sites ■ Moose Calving Site |
|--|--|--|---|

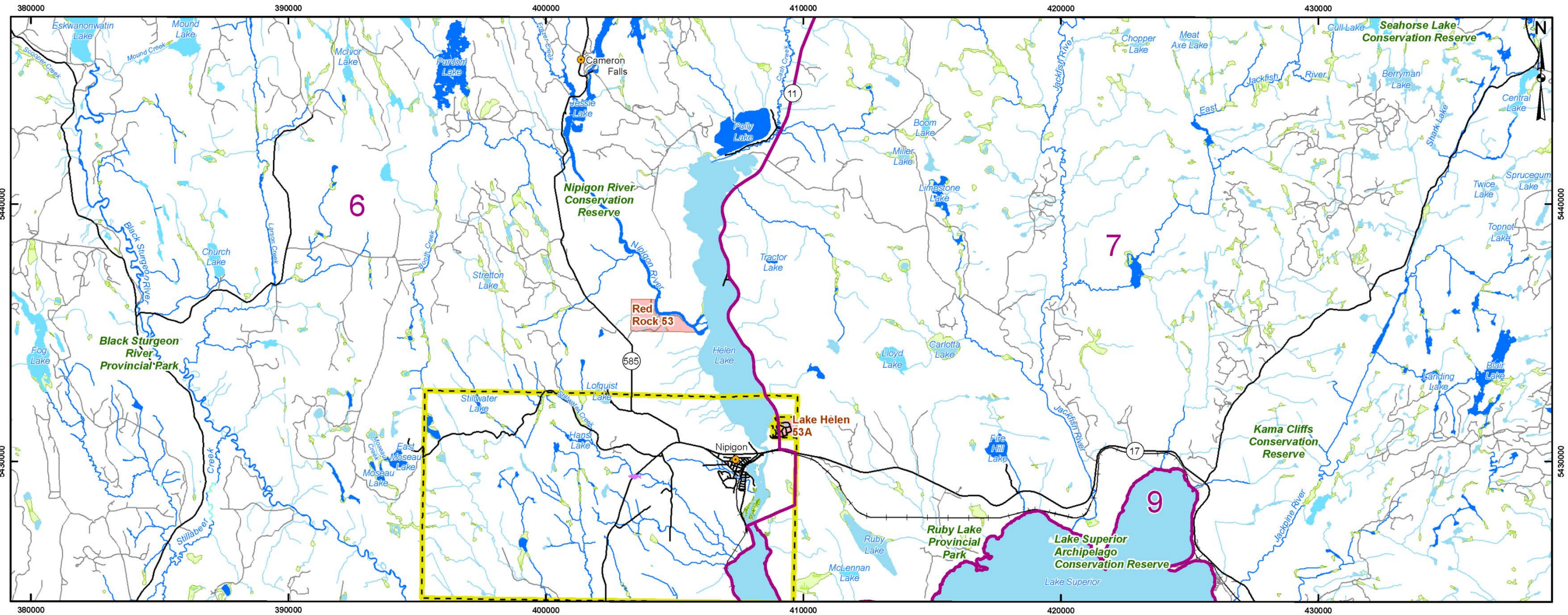
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 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Nipigon - Terrestrial Ecology		
PROJECT NO.	12-1152-0026	SCALE AS SHOWN	REV. 0.0
DESIGN	PM 19 Aug. 2013	FIGURE: 9	
GIS	PM/JB 20 Nov. 2014		
CHECK	JH 20 Nov. 2014		
REVIEW	GWS 20 Nov. 2014		

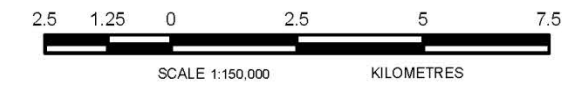
G:\Projects\2011\12-1152-0026_NWMO_Phase1_Report\Nipigon\Nipigon_TerrestrialEcology.mxd



- LEGEND**
- Community
 - Main Road
 - Local Road
 - Railway
 - Federal Land - Indian Reserve
 - Fisheries Management Zone (6, 7, 9)
 - Municipal Boundary (Township of Nipigon)
 - Fisheries and Wetlands**
 - ◆ Spawning Area
 - Cold Watercourse
 - Cool Watercourse
 - Warm Watercourse
 - Cold Waterbody
 - Cool Waterbody
 - Warm Waterbody
 - Natural Heritage**
 - Wetland

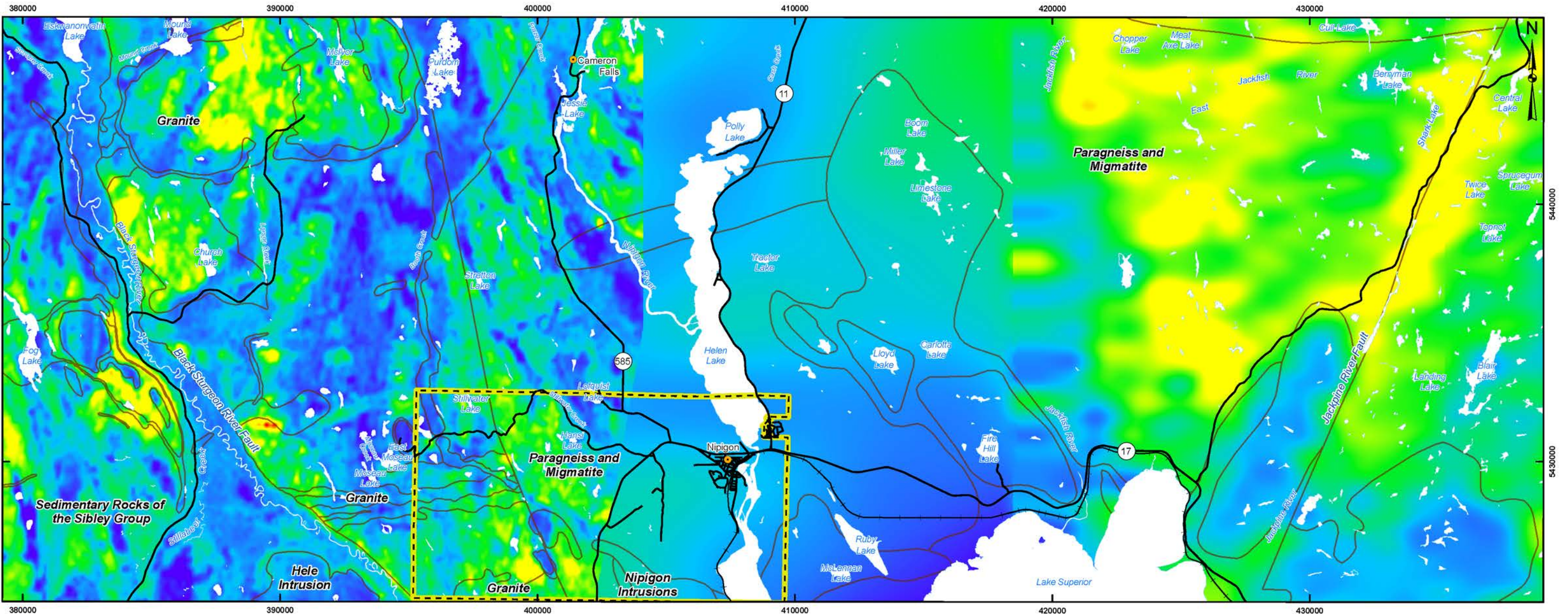
REFERENCE

Base Data - MNR LIO, obtained 2009-2013
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N



PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Nipigon - Aquatic Ecology		
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 19 Aug. 2013	REV. 0.0
	GIS	PWJB 21 May. 2014	FIGURE: 10
	CHECK	JH 21 May. 2014	
REVIEW	GWS 21 May. 2014		

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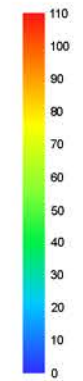
LEGEND

- Community
- Main Road
- Railway
- Waterbody
- ▭ Geologic Contact
- ▭ Municipal Boundary (Township of Nipigon)

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
 Geology: Modified 1:250 000 Scale MRD126-Bedrock Geology of Ontario, 2011 - incorporating detailed mapping published by Hart (2005)
 Radiometrics - National Gamma-Ray Spectrometry Program Data Base, Airborne Geophysics Section, GSC - Central Canada Division, Geological Survey of Canada, Earth Sciences Sector, Natural Resources Canada; Ontario Geological Survey 2004. Ontario airborne geophysical surveys, magnetic and gamma-ray spectrometer data, Lake Nipigon Embayment Area; Geophysical Data Set 1047
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

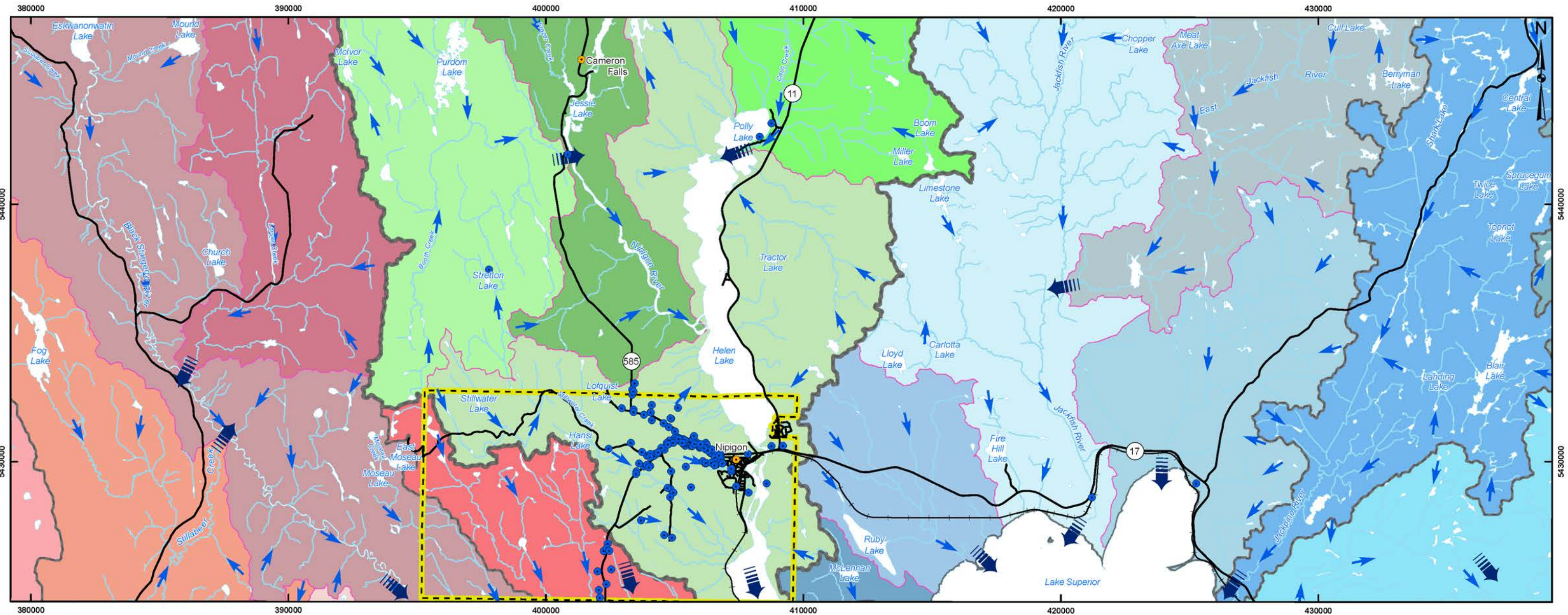
Air Absorbed Radiation Levels (nGy/h)



PROJECT		Environment Report Township of Nipigon, Ontario	
TITLE		Nipigon - Background Radiation Levels	
PROJECT NO. 12-1152-0026		SCALE AS SHOWN	REV. 0.0
DESIGN	PM 19 Aug. 2013	FIGURE: 11	
GIS	PM/JB 29 May, 2014		
CHECK	JH 29 May, 2014		
REVIEW	GWS 29 May, 2014		



G:\Projects\2012\1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Nipigon\NipigonBackgroundRadiationLevels.mxd



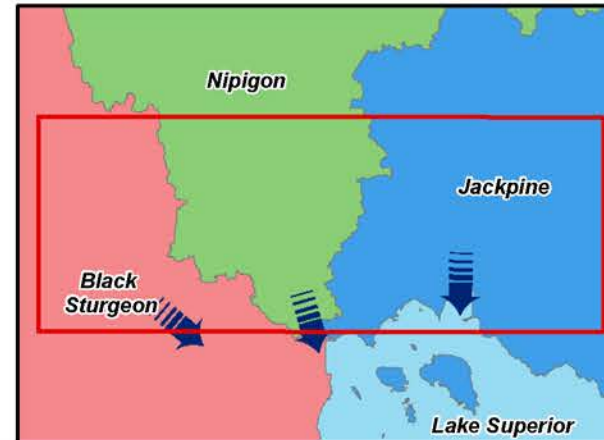
LEGEND

- Community
- MOE Water Well
- Main Road
- Railway
- Watercourse
- Waterbody
- ➔ Surface Water Flow Direction
- Watershed Outflow Point
- Drainage Divide**
- Delineated by MNR/JDMA
- Delineated by JDMA
- Tertiary Watershed
- Municipal Boundary (Township of Nipigon)

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
 Watershed - LIO quaternary watershed
 Wells - Ministry of the Environment, 2013
 Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2009
 Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

TERTIARY WATERSHEDS

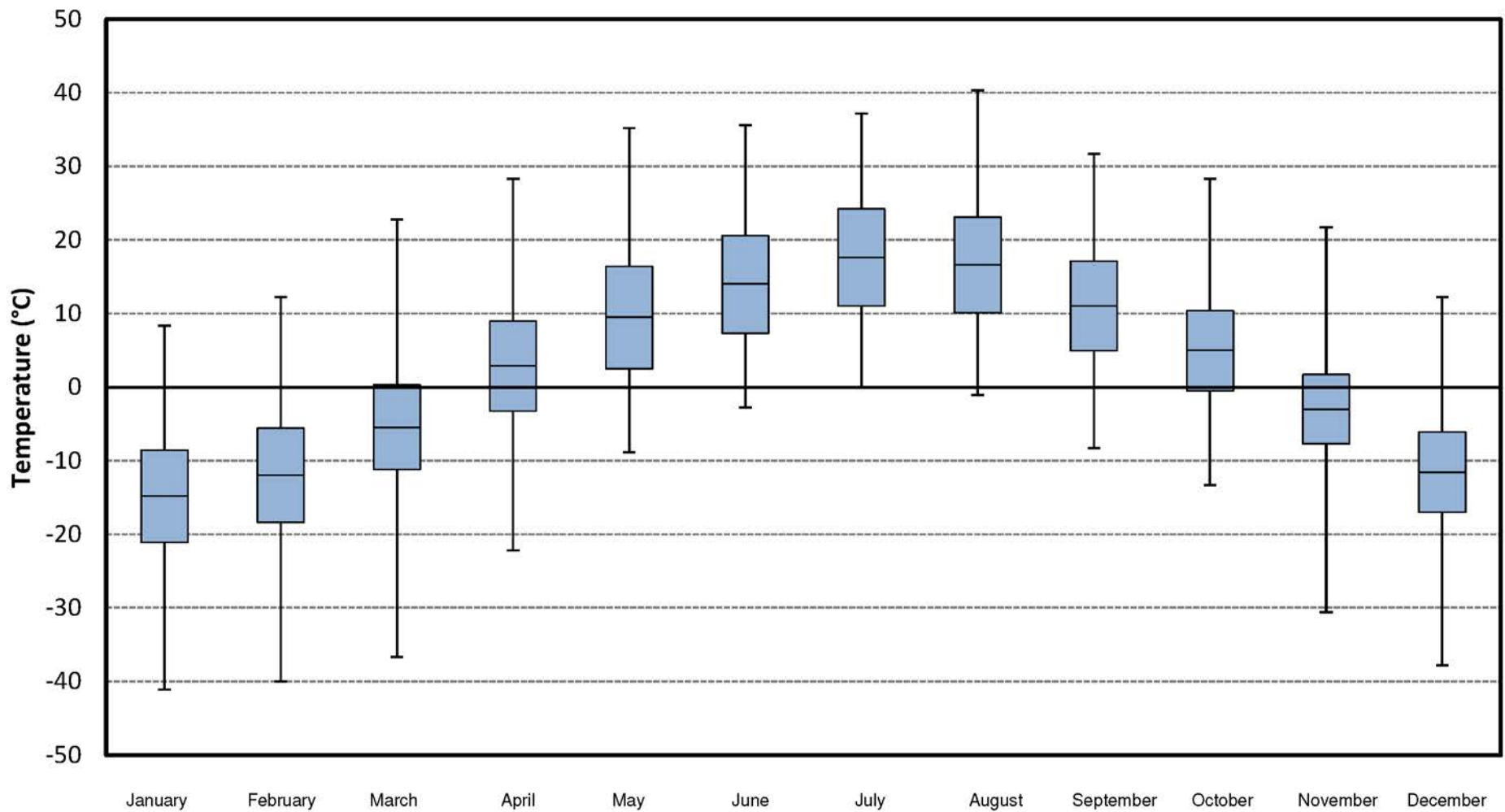


PROJECT	Environment Report Township of Nipigon, Ontario		
TITLE	Nipigon Surface Water Drainage and Water Wells		
	PROJECT NO. 12-1152-0026	SCALE AS SHOWN	REV. 0.0
	DESIGN PM 19 Aug. 2013		
	GIS PM/JB 20 Nov. 2014		
	CHECK JH 20 Nov. 2014		
	REVIEW GWS 20 Nov. 2014		



FIGURE: 12

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LEGEND

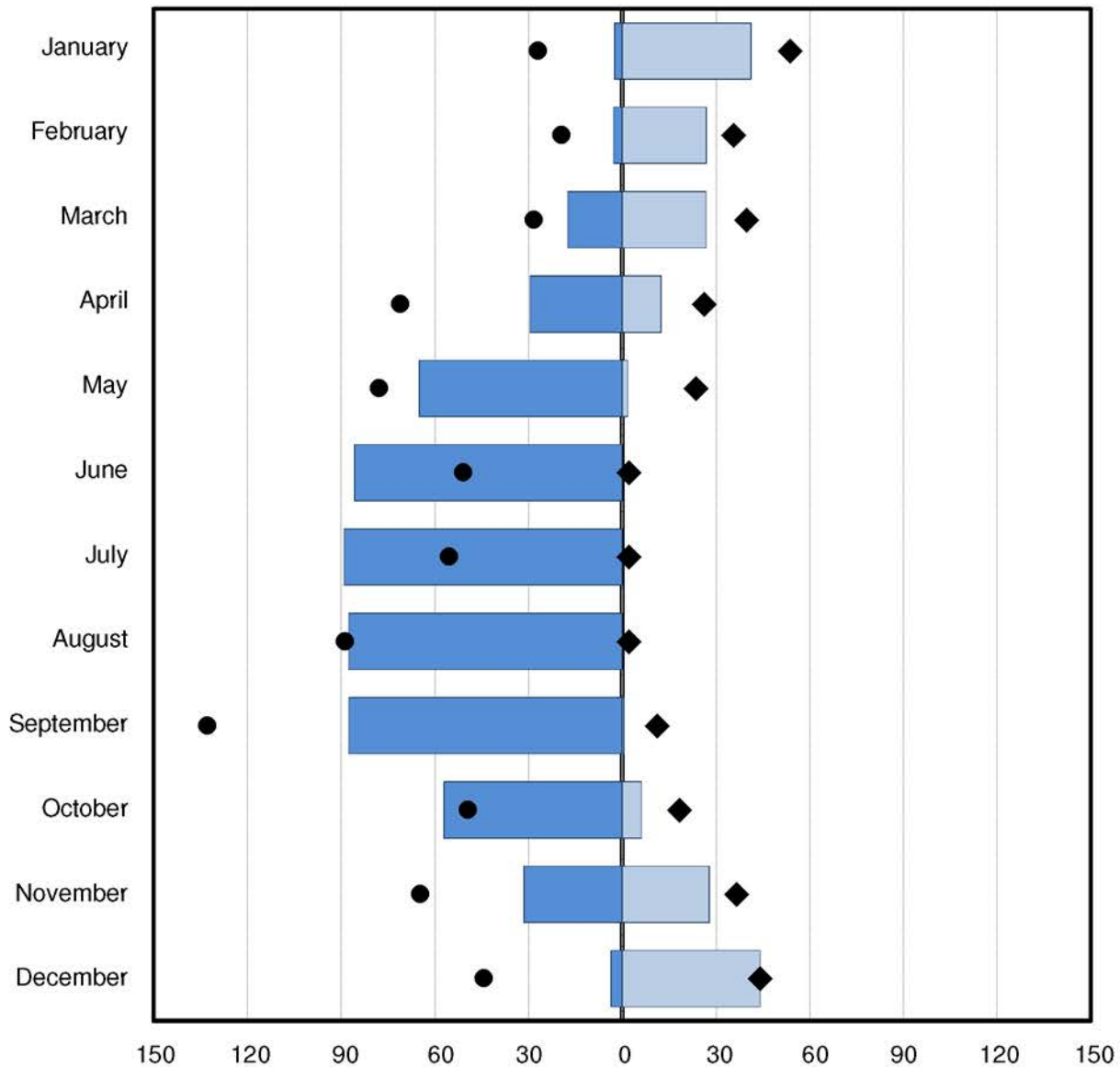
- Extreme Maximum (°C)
- ▣ Daily Maximum (°C)
- ▬ Daily Average (°C)
- ▣ Daily Minimum (°C)
- Extreme Minimum (°C)

DATA SOURCE

Environment Canada

PROJECT		Environment Report Township of Nipigon, Ontario	
TITLE		Thunder Bay 1971-2000 Temperature Data Summary	
PROJECT NO. 12-1152-0026		SCALE AS SHOWN	REV. 0.0
DESIGN	PM	7 Jun 2012	FIGURE: 13
GIS	PM/AB	21 May 2014	
CHECK	JH	21 May 2014	
REVIEW	GWS	21 May 2014	





LEGEND

- Monthly Rainfall (mm eq.)
- Monthly Snowfall (cm or mm eq.)
- Extreme Daily Rainfall (mm eq.)
- Extreme Daily snowfall (cm or mm eq.)

DATA SOURCE
Environment Canada

PROJECT		Environment Report Township of Nipigon, Ontario	
TITLE		Thunder Bay 1971-2000 Precipitation Data Summary	
 Golder Associates Mississauga, Ontario	PROJECT NO.	12-1152-0026	SCALE AS SHOWN
	DESIGN	PM 7 Jun 2012	REV 0.0
	GIS	PM/JB 21 May 2014	
	CHECK	JH 21 May 2014	
	REVIEW	GWS 21 May 2014	

FIGURE: 14

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