NUCLEAR WASTE MANAGEMENT ORGANIZATION
SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Phase 1 Desktop Assessment Environment Report

TOWNSHIP OF SCHREIBER, ONTARIO

APM-REP-06144-0034

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PHASE 1 DESKTOP ASSESSMENT

Environment Report
Township of Schreiber, Ontario

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REPORT

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1.0 INTRODUCTION

The Township of Schreiber in northwestern Ontario is considering hosting 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 with 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 in the vicinity of Schreiber. To this end, this report provides a general description of the environment in the Township of Schreiber and surrounding area. It is complemented by reports prepared in parallel which characterize the geoscientific conditions and community well-being profile of the 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 will be sought at subsequent phases of the work.

The area considered in this report is similar to that used for the Phase I Geoscientific Assessment for Schreiber. This area is shown on Figure 1, and includes the Township of Schreiber, as well as areas to the north, east and west of the Township.

2.0 COMMUNITIES AND INFRASTRUCTURE

2.1 Communities

The Township of Schreiber (Figure 1) is located along the north shore of Lake Superior approximately 150 km east of Thunder Bay. The Township is approximately 40 km^2 in size[1] and is bordered by the Township of Terrace Bay to the east (LIO, 2012). Figure 2 presents satellite imagery for the area taken in 2006. Table 1 summarizes the total population and population density for the Township of Schreiber and District of Thunder Bay.

Table 1: Population Statistics for the Schreiber Area

Political Boundary	Population	Population Density per km²
Township of Schreiber	1,126	30.6
District of Thunder Bay	146,057	1.4

Source: 2011 Census of Population (Statistics Canada, 2012)

Figure 1 also shows the municipal boundaries for neighbouring townships within the Schreiber area. The Townships of Schreiber and Terrace Bay each maintain a municipal government (MMAH, 2009). Land ownership within the Schreiber area, including areas of Crown land[2], Crown Reserve[3] lands, parks and reserves, and private lands is shown on Figure 3.

There are a number of Aboriginal communities and organizations in the Schreiber area including Biinjitiwaabik Zaaging Anishinaabek (Rocky Bay First Nation), Fort William First Nation, Gull Bay First Nation, Ojibways of the Pic River First Nation, Pays Plat First Nation, Red Rock First Nation and Sand Point First Nation. Métis Councils in the area include Greenstone Métis Council, Superior North Shore Métis Council and Thunder Bay Métis Council as represented by Lakehead/Michipicoten/Nipigon Traditional Territory Consultation Committee and the Métis Nation of Ontario.

Further information on Schreiber and its surrounding communities, including First Nations and Métis communities, is provided in the Community Profile Report for Schreiber.

2.2 Infrastructure

Figure 1 shows the location of the primary infrastructure corridors in the Schreiber area. The main transportation routes include the Trans-Canada Highway (Highway 17) which passes through the southern end of the Schreiber area in an east-west orientation, and through the community of Schreiber (Figure 1). A Canadian Pacific (CP) rail corridor also runs approximately parallel to Highway 17 through the Schreiber area. There are two primary transmission corridors through the area. These include the East-West Tie 230 kV line north of the Township of Schreiber, as well as a 115 kV transmission line parallel to Highway 17. There is an airport in the

[1] Area estimated 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 Leased Land, Non-freehold Disposition Public and Unpatented Public Land. Crown Leased land is acquired by MNR for reasons based on ecological sustainability, including ecosystem health, the protection of natural and cultural assets, recreation, and / or the protection of people and property. 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.

Schreiber area at Terrace Bay, as shown on Figure 1. No pipelines such as natural gas were identified within the Schreiber area. There are four operating landfills and a wastewater treatment plant within the Schreiber area.

2.3 Protected Areas

2.3.1 Parks and Reserves

Protected areas in the Schreiber area are shown on Figure 4. These include parcels of land along the north shore of Lake Superior that have been designated under Ontario's Living Legacy Approved Land Use Strategy, collectively referred to as the Lake Superior North Shore Conservation Reserve, as well as the Rainbow Falls Provincial Park and Schreiber Channel Natural Reserve west of the community of Schreiber. Also, a portion of the Gravel River Conservation Reserve occurs in the northwest of the Schreiber area and the Lake Superior Archipelago Conservation Reserve (proposed) includes Copper Island and Cat Islands in Lake Superior. Conservation 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.

Rainbow Falls Provincial Park is a 575 ha recreation-class provincial park including trails and camping located between Whitesand Lake and the Lake Superior shore, approximately 8 km west of the community of Schreiber (Ontario Parks, 2008).

2.3.2 Heritage Sites

The cultural heritage screening examined known archaeological and historic sites for the Schreiber area, using the Ontario Archaeological Sites Database, the Ontario Heritage Trust Database and the National Historic Sites Database. There are 13 known archaeological sites in the Schreiber area: two sites are within the Township of Schreiber; nine sites are located on the Lake Superior shoreline; one site is located on Copper Island; and one site is located on the lakebed floor (von Bitter, 2010). There are no National or Provincial Historic Sites in the Schreiber area (Ontario Heritage Trust, 2011; Parks Canada, 2012).

Five of the identified sites are pre-contact Aboriginal sites, three located to the west of Schreiber Township and two to the east. Another four sites are stone structures on cobble beaches, one on Copper Island and the other three along the north Lake Superior shore. These are most likely Pukaskwa pits. A Pukaskwa pit is a pit, typically located on a cobble beach, measuring approximately 1 m in depth or more, surrounded by large boulders and believed to be a structure of indeterminate use which may date from 400 to 900 years ago, before European contact (Wright, 1963; Greenman, 1964; Betts and Latta, 2000). Two of the other known archaeological sites are located at Worthington Bay within Schreiber Township: the Worthington Bay Pictograph, a pre-contact Aboriginal rock art site of indeterminate date and a rare rock art site in the area (Rajnovich, 1994); and the Worthington Bay Red Ochre Mine where First Nations people may have excavated a red ochre source. One multi-component site, the Bend Site, has also been recorded along the north Lake Superior shore in the western portion of the Schreiber area, consisting of pre-contact Aboriginal material and a 19th century military button. The underwater site is the shipwreck of a late 19th to 20th century luxury steam yacht, the Gunilda.

Archaeological potential is established by determining the likelihood that archaeological resources may be present on a subject property. In archaeological potential modelling, a distance criterion of 300 m is generally employed for known archaeological resources; water sources; and early Euro-Canadian settlements (Government of Ontario, 2011). The potential for archaeological and historical sites within the Schreiber area is

considered to be high given the sites already documented, the proximity to the Lake Superior shoreline and the proximity to a known source of chert for lithic tool manufacture. The presence of local heritage sites would need to be further confirmed in discussion with the community and Aboriginal peoples 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 Schreiber area. Forest Management Units (FMU) in the vicinity of Schreiber are presented on Figure 5. The Schreiber area is fully within the Kenogami FMU (Nipigon District), which is managed by Terrace Bay Pulp Inc. (TBPI). East of the Schreiber area, the Pic River/Ojibway FMU is managed by Great West Timber Ltd.

Within heavily forested areas such as the Schreiber area there is a risk of forest fires. Locations where forest fires occurred in the vicinity of the Schreiber area between 1976 and 2010 affecting an area of greater than 200 ha are also shown on Figure 5.

There are currently no producing mines in the Schreiber area. Mining in the Schreiber area has historically focussed on metals (especially gold) within the Schreiber-Hemlo greenstone belt[4] and the contact halos with surrounding batholiths[5], where most of the occurrences have been found and where most of the current exploration activity is centered. The Schreiber area is linked to the historic Schreiber-Hemlo mining camp which produced a number of mines over the past century. Mineral exploration continues in some areas today with particular emphasis on gold and volcanogenic massive sulphide (VMS) deposits within the Schreiber-Hemlo greenstone belt, copper-nickel deposits within the gabbroic intrusive that border the Crossman Lake batholith, and copper-molybdenum deposits near the contact between the granitic batholiths and the surrounding metavolcanic country rock.

Metallic mineralization and occurrences in the Schreiber area include: iron formations, zinc-copper-lead-silver, cobalt-copper-nickel-platinum group metals and gold. Molybdenite occurs in quartz veins as well as disseminations in granitic rocks and gneisses in the Sox Lake area. Known non-metallic mineral resources within the Schreiber area include sand and gravel, stone, amethyst, and potentially industrial minerals such as garnet, fluorite and barite.

As noted in Section 3.3, other land uses include trapping, commercial fishing and commercial bait operations.

[4] A greenstone belt is a zone of volcanic and sedimentary rocks that have undergone metamorphic alteration. The name comes from the green hue imparted by the colour of the dominant minerals within the rocks.

[5] Batholiths are made of multiple masses, or plutons, of igneous rock that have melted and intruded surrounding strata at great depths.

3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 Physiography

The Canadian Shield region generally has a low-relief, gently undulating land surface with an elevation of about 150 masl (metres above sea level) in the north and about 450 masl in the south. The Township of Schreiber lies in the Abitibi Upland, a broadly rolling surface of Canadian Shield bedrock that occupies most of north-central Ontario (NRCan, 2011). Within this area, bedrock is typically either exposed at surface or shallowly covered with Quaternary[6] glacial deposits or post-glacial organic soils. Lands to the west of Schreiber are part of the Port Arthur Hills which consist of a characteristically rugged topography produced by the underlying Precambrian bedrock (Thurston, 1991). The land surface within the Schreiber area itself is rugged with the elevation ranging from around 585 masl in the north to 183 masl along the shore of the Schreiber Peninsula on Lake Superior. Near-vertical cliffs along the west side of the Schreiber Peninsula exceed 60 m (Gartner, 1979). The settlement area of Schreiber is located within a valley at approximately 300 masl elevation.

Topographic highs generally correspond to exposed bedrock while topographic lows are typically areas of thicker overburden. The areas of least relief are typically underlain by glaciofluvial and glaciolacustrine overburden deposits including the glacial lake terraces that are the origin of the name Terrace Bay. Figure 6 presents the topography of the Schreiber area as a digital elevation model (DEM).

3.2 Geology

3.2.1 Bedrock Geology

The bedrock geology of the Schreiber area is shown on Figure 7. Geologically, the municipal boundaries of the Township of Schreiber are situated in the east-central portion of the Wawa Subprovince, which is part of the western region of the Superior Province of the Canadian Shield – 3 to 2.6 billion year old rocks that form the core of the North American continent. The Wawa Subprovince is about 900 km long and 150 km wide, extending from central Minnesota in the United States to the Kapuskasing area in northeastern Ontario. It is composed primarily of Archean greenstone belts[7] and granitic intrusions, with smaller mafic intrusive rocks locally present. Diabase dikes, largely of Proterozoic age, occur in “swarms” in the entire Superior Province. Based on field mapping and interpretation from aeromagnetic data, in the Schreiber area, these dikes may be up to 15 km long.

The Schreiber area is located in the Schreiber assemblage (Williams et al., 1991) that constitutes the western part of the Schreiber-Hemlo greenstone belt within the Wawa Subprovince. Most of the Township of Schreiber (approximately 70%) is underlain by rocks of the greenstone belt, which extend well beyond the Township boundaries to the north and northeast. Most of the remainder of the Township is underlain by granitic intrusions. These include the Gwynne Mountain pluton and small portions of two large intrusions, the Whitesand Lake batholith[8] on the northwest of the township, and the Terrace Bay batholith on the southeast. The Crossman Lake batholith is a third large intrusion that lies approximately 10 km north of the Township of Schreiber.

[6] Quaternary refers to the last 2.6 million years of Earth’s history.

[7] A greenstone belt is a zone of volcanic and sedimentary rocks that have undergone metamorphic alteration. The name comes from the green hue imparted by the colour of the dominant minerals within the rocks.

[8] Batholiths are made of multiple masses, or plutons, of igneous rock that have melted and intruded surrounding strata at great depths.

3.2.2 Quaternary Geology

The Quaternary geology of the Schreiber area is shown on Figure 8. Bedrock in the Schreiber area is either exposed or covered by a thin discontinuous layer of ground moraine till that comprises a mixture of sand, gravel and boulders of granitic origin (Carter, 1988; Morris, 2000). The most prominent Quaternary feature in the Schreiber area is a belt of glaciofluvial and glaciolacustrine deposits running along the Trans-Canada Highway between the settlement areas of Schreiber and Terrace Bay, where overburden thicknesses of up to 30 m are encountered.

Several well-developed eskers occur within a broad valley extending southwest from Long Lac some 70 km to the north of the settlement area of Schreiber to Gurney on Lake Superior roughly 40 km west of the settlement area of Schreiber. Glaciofluvial channel deposits were also identified within several narrow bedrock controlled valleys, while coarse-grained glaciolacustrine materials have been associated with historic lake levels of the ancestral Lake Superior.

3.3 Natural Environment

3.3.1 Natural Environment Overview

There is an important interrelationship between the natural heritage features and the cultural heritage of the Township of Schreiber and the Schreiber area (Township of Schreiber, 2011). The forest resources of the Terrace Bay area east of Schreiber are the headquarters of several forestry companies. These conifer dominated expanses not only provide valuable timber, but habitat for a variety of animals harvested for their fur, hides and food. The underlying geology supports forest growth as well as inland lakes, rivers and wetlands which support several fish and wildlife species. The southern boundary of the Township of Schreiber and the Schreiber area consists of the Lake Superior shoreline and this large, linear land-water interface adds a unique character to the natural environment of these lands. Many of the natural areas are closely associated with the shoreline of Lake Superior. The natural environment of the Schreiber 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, the terrestrial ecology and aquatic ecology, and focus on rare species that may be most sensitive to impacts from alterations or changes to the landscape.

3.3.2 Natural Areas

The edges of two reserves are within the Township of Schreiber, as shown and numbered on Figure 9; these include the Schreiber Channel Provincial Nature Reserve (1) and the Lake Superior North Shore Conservation Reserve (2). The Township has a number of Environmental Constraint Areas[9] associated with small inland lakes and Lake Superior identified in the Official Plan Schedule ‘A’ (Quartek, 2012) and shown on Figure 9.

Within the Township boundary, the following Earth Science Areas of Natural and Scientific Interest (ANSI), are shown and numbered on Figure 9: Schreiber Archean Microfossils (3) and Schreiber Minong Shore Bluff (4) and the Life Science Site called Worthington Bay (5).

[9] Environmental Constraint Areas are classified in the Official Plan as: Natural Heritage Features and Areas (i.e., significant wetlands, wildlife habitat, fish habitat or habitat of endangered and threatened species), or Other Areas with Natural Constraints (i.e., lands susceptible to flooding or erosion or those determined to be unsuitable for development because of soil, topography or drainage) (Quartek, 2012).

In addition to these areas, the Schreiber area also includes Rainbow Falls Provincial Park (6) and the edge of the Gravel River Conservation Reserve (7) (LIO, 2012). Two additional Earth Science ANSIs, the Channel Island Rossport Formation (8) and Cobinosh Island (9), are located within the Schreiber area.

The Schreiber area includes the following Earth Science Sites: Terrace Bay (10); Terrace Bay Nippissing Shore 1 (11) and 2 (12); Terrace Bay Sub-Sault Shore (13); Terrace Bay Raised Shores (14); Terrace Bay Raised Beaches (15); Terrace Bay Tombolo (16); Terrace Bay Kettled Moraine (17); Schreiber Channel Fossils (18); Collingwood Bay Pillow Lava (19); and Wilson Island Shoreland Erosion Area (20). It also includes the following Life Science Sites: Rainbow Falls (21); Cobinosh Island Arctic Alpine Flora (22); and Copper Island Arctic Species (23).

Figure 9 also shows the 19,605 ha (hectares) Enhanced Management Area defined along the Lake Superior shoreline as part of the Ontario Ministry of Natural Resources (MNR) Great Lakes Heritage coastal area. Enhanced Management Areas are areas of Crown land with specific land use direction for areas containing special features or values. The land use intent defined for this area is to “provide long term tourism and recreational benefits to local communities through conservation of the coastline's significant scenic, recreational and tourism attributes” (MNR, 2007). The area was defined in recognition of its scenic cliffs and bays which also represent habitat for local wildlife and vegetation, including some species at risk.

There are no Provincially Significant Wetlands (PSW) identified within the Township of Schreiber, or in the Schreiber area. Wetlands identified in the natural resources data layers (LIO, 2012) have been depicted on Figure 10. The Schreiber area has 751 ha of wetland, comprising less than 1% of the area according to wetlands mapped through LIO. Ground investigations are likely to reveal additional wetland areas that have not been identified in the LIO data. If wetlands are to be impacted by a proposed activity, they may require evaluation of significance according to the Ontario Wetland Evaluation System (OWES).

3.3.3 Terrestrial Features and Wildlife

The Schreiber area lies in the southern portion of the Boreal Forest Region where it meets the Great Lakes-St. Lawrence Forest and within the Kenogami FMU 350 (Hoffman, 2011). The Kenogami Forest extends over the Township of Schreiber and the Schreiber area (Hoffman, 2011; LIO, 2012) (Figure 5). This FMU is reported to have more than 79% productive forest for the potential timber harvesting, although it is heavily impacted by the effects of spruce budworm. Within the Schreiber area, 81,130 ha are wooded, covering approximately 74% of the land area. The value of this forest cover varies annually due to timber harvest and replanting of forest, and it supports conifer and mixed forest types frequently of black spruce *(picea mariana)*, jack pine *(Pinus banksiana)*, balsam fir *(Aibes balsamea)*, balsam poplar *(Populus balsamifera)* and white birch *(Betula papyrifera)* (Hoffman, 2011).

The Schreiber area falls primarily within parts of Wildlife Management Units (WMU) 21A and 14. These areas are considered important for the trapping of furs and hunting of game. Emphasis on retaining old growth stands and maintaining natural disturbance patterns are main objectives in managing the overall ecology. No specific migration routes or animal movement corridors have been identified based on existing publicly available resources. Migration routes or animal movement corridors are typically described based on field investigations. Known areas may be requested from agencies, which would complement the results of field investigations. Management of woodland caribou (*Rangifer tarandus*), moose (*Alces alces)*, marten (*Martes americana)*, lynx (*Lynx canadensis*), black bear (*Ursus americanus),* pileated woodpecker (*Dryocopus pileatus*) and black-backed

woodpecker (*Picoides articus*) populations are a particular concern to MNR (TBPI, 2011). Known feeding and wintering sites are depicted on Figure 9. Concentration and nesting areas for raptors, herons and waterfowl are also an important management concern; known locations are shown on Figure 9.

3.3.4 Aquatic Features and Fish

The lands within the Schreiber area are located within the Lake Superior drainage basin and the Little Pic tertiary watershed and this terrain cradles wetlands, lakes and rivers that support a diversity of fish and wildlife. Wetlands, including swamps, marshes and peatlands, are often ecologically sensitive. Waterbodies are mainly cold and cool water classified (Figure 10). Approximately 7% of the Schreiber area (excluding Lake Superior) is mapped as waterbodies (LIO, 2012). The Township of Schreiber has several waterbodies around its periphery including Lake Superior, a major cold-water recreational and commercial fishery abutting the shores to the south of the Township (MNR, 2007). The Schreiber area lies within Fisheries Management Zone (FMZ) 7 on the mainland and abuts FMZ 9, which represents Lake Superior. Fisheries in and around the Township of Schreiber support recreational use and commercial tourism (Fish and Wildlife Service Branch, 2011). Major species include walleye (*Sander vitreus*), northern pike (*Esox lucius*), brook trout (*Salvelinus fontinalis*) and lake trout (*Salvelinus namaycush*) (Hoffman, 2011; Township of Schreiber, 2011). These fish populations are managed to maintain and maximize their size and availability to both locals and tourists. Additional income is provided by bait fish operations and commercial fishing, and the shallows of several lakes and large wetlands support natural northern wild-rice *(Zizania palustris)* crops (MNR, 2007). Fish and fish habitat are managed by the MNR and the Department of Fisheries and Oceans (DFO). At present there is only one active commercial fishing licence held within the Schreiber area (TBPI, 2011).

Some aquatic habitat features are identified and discussed in Forest Management Plans and reported by FMZs (i.e., spawning areas). 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, data deemed sensitive within the FMZ may not be reported or shown on mapping. Classification of data sensitivity may vary based on the FMZ. Therefore, features which appear to be disproportionately abundant across the landscape may reflect reporting constraints, rather than actual presence or absence of these features. 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 Natural Heritage Information Centre (NHIC, 2012) records show three occurrences of species that are listed as Endangered (END), Threatened (THR) or Special Concern (SC) either under the Ontario *Endangered Species Act* (ESA) (Government of Ontario, 2007), or the Federal *Species at Risk Act* (SARA) (Government of Canada, 2012) within the Schreiber area (Table 2). The Royal Ontario Museum range maps (ROM, 2012) were queried, which provide general areas where species at risk may occur, including that of listed species. The Ontario Herpetofaunal Summary Data (Oldham and Weller, 2000), Atlas of the Breeding Birds of Ontario (Cadman et. al., 2007), the Ontario Odonata Atlas (2005) and the Ontario Butterfly Atlas (Holmes et al., 1991) were also queried for listed species. END, THR or SC species identified from these sources to have a range that overlaps the Schreiber area are listed in Table 2.

Although there is a woodland caribou record identified by the NHIC, the wintering areas for caribou are north of the Schreiber area, to the east of Lake Nipigon. They may occur anywhere within the boreal forest which

extends into the Schreiber area, and there is a separate population known on Slate Island Provincial Park, which is southeast of the Schreiber area in Lake Superior (Figure 4). The range of eastern cougar (*Puma concolor*) extends to the Schreiber area, but this species is extremely secretive and can cover a very large home range for each individual. Seven END, THR or SC bird species are listed in Table 2 as documented by the OBBA as well as a peregrine falcon (*Falco peregrinus*) record from NHIC. An additional three species have ranges which overlap the Schreiber area according to the ROM. No END, THR or SC amphibian or reptile species are known to occur within the Schreiber area. Four aquatic species and one invertebrate's range was reported to overlap with the Schreiber area according to ROM.

The records identified here represent known occurrences that have been reported in the past. However, more recent occurrences of species at risk will be on record with the MNR, upon request. 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 would be obtained as part of the data requests to agencies which would complement the results of field investigations conducted at the site.

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

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

Common Name	Scientific Name	SARO Status[a]	SARA Status (Schedule)[b]	Source[c]
Mammals				
Eastern cougar	*Puma concolor*	END		ROM
Woodland caribou (Forest-dwelling boreal population)	*Rangifer tarandus caribou*	THR	THR (1)	NHIC, ROM
Birds				
Acadian flycatcher	*Empidonax virescens*	END	END (1)	OBBA
Bald eagle	*Haliaeetus leucocephalus*	SC		OBBA, ROM, NHIC
Barn swallow	*Hirundo rustica*	THR		OBBA
Black tern	*Chlidonias niger*	SC		ROM
Canada warbler	*Cardellina canadensis*	SC	THR (1)	OBBA
Common nighthawk	*Chordelies minor*	SC	THR (1)	ROM, OBBA
Golden eagle	*Aquila chrysaetos*	END		ROM
Olive-sided flycatcher	*Contopus cooperi*	SC	THR (1)	OBBA
Peregrine falcon	*Falco peregrinus*	THR		NHIC, ROM
Rusty blackbird	*Euphagus carolinus*	Not at risk	SC (1)	ROM, OBBA
Short-eared owl	*Asio flammeus*	SC	SC (3)	ROM

Common Name	Scientific Name	SARO Status[a]	SARA Status (Schedule)[b]	Source[c]
Fish and other aquatic species				
Kiyi (Upper Great Lakes population)[d]	*Coregonus kiyi*	SC	SC (3)	ROM
Lake sturgeon (Northwestern Ontario Population)	*Acipenser fulvescens*	THR		ROM
Northern brook lamprey	*Ichthyomyzon fossor*	SC	SC (3)	ROM
Shortjaw cisco	*Coregonus zenithicus*	THR	THR (2)	ROM
Invertebrates				
Monarch butterfly	*Danaus plexippus*	SC	SC (1)	ROM, 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

[a] Status on the Species at Risk of Ontario list of the *Endangered Species Act* (ESA), (Government of Ontario,2007)

[b] Status listed on the federal *Species at Risk Act* (SARA) (Government of Canada, 2012)

[c] Data obtained from the Natural Heritage Information Centre (NHIC) (NHIC, 2012), Royal Ontario Museum (ROM) range maps (ROM, 2012), Ontario Herpetofaunal Summary Database (Herp Atlas) (Oldham and Weller, 2000), Atlas of the Breeding Birds of Ontario (OBBA) (Cadman et. al., 2007) or the Ontario Butterfly Atlas (Holmes et al., 1991)

[d] Species records for Lake Superior are not necessarily known to occur within the Schreiber area

3.3.6 Aboriginal Interests and Traditional Knowledge

Traditional lifestyles, culturally significant wildlife and the extent of sacred and ceremonial locations important to Aboriginal communities 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, which cover much of the Schreiber area, are shown on Figure 3. Figure 9 presents terrestrial ecology mapping for the area and Figure 10 presents aquatic resource mapping.

It is recognized that this does not fully represent the environmental issues and concerns of Aboriginal communities in the area and that further information and discussion is required before a more complete picture can be developed. Discussions with Aboriginal groups, community members and field investigations 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 north central Ontario indicate that ground-level ozone and particulate matter fall within normal values compared to the national average (EC, 2011a). Table 3 provides a list of industrial facilities that reported air and water emissions through Environment Canada's National Pollutant Release Inventory (NPRI) database (EC, 2012). The list includes sites in Atikokan, Dryden, Thunder Bay, Marathon and Terrace Bay, Ontario which have local air emissions. Additional sources that may affect background air quality include rail operations and the Trans-Canada Highway, both of which traverse the Schreiber area, as well as use of diesel generators in the remote First Nations communities in northern Ontario.

Table 3: NPRI Regional Sources of Air Emissions

NPRI ID	Facility Name	City
10374	Hydro One Remote Communities Inc. - Armstrong Diesel Generating Station	Armstrong
3238	Ontario Power Generation Inc. - Atikokan Generating Station	Atikokan
10376	Hydro One Remote Communities Inc. - Bearskin Diesel Generating Station	Bearskin Lake
928	Domtar Inc. - Dryden Mill	Dryden
10381	Hydro One Remote Communities Inc. - Gull Bay Diesel Generating Station	Gull Bay
917	Resolute FP Canada Inc. - Fort Frances Division	Fort Frances
3197	Williams Operating Corporation - Williams Mine	Hemlo
10382	Hydro One Remote Communities Inc. - Hillsport Diesel Generating Station	Hillsport
10385	Hydro One Remote Communities Inc. - Lansdowne Diesel Generating Station	Lansdowne House
1400	Newmont Canada Corporation - Golden Giant Mine	Marathon
3197	Williams Operating Corporation - Williams Mine	Marathon
10405	Atlantic Power LP - Nipigon Power Plant	Nipigon
11906	Hydro One Remote Communities Inc. - Marten Falls Diesel Generating Station	Ogoki Post
2607	AV Terrace Bay Inc. - AV Terrace Bay	Terrace Bay
6771	TransCanada PipeLines Ltd. - Station 62 - Upsala	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 Schreiber area is attributed to naturally occurring radioactive materials (NORM), specifically potassium, uranium and thorium-bearing minerals. The background radiation levels for the Schreiber area are presented on Figure 11. The dose rate in the Schreiber area ranges from approximately 5 to 50 nGy/h, with an average of approximately 20 nGy/h. This range of dose rates and average are consistent with regional dose rates for northwestern Ontario. NORM minerals are typically elevated in granitic geology and local dose rate highs are attributed to granitic batholiths, notably the White Otter Lake batholith. These highs are consistent with dose rate highs in other areas of northwestern Ontario.

A recent review of background concentrations of radionuclides in surface waters and soils across Canada has been supplemented by measurements of surface waters sampled at various Canadian sites (NWMO, 2011). There were several sites in northern Ontario and one located within the Schreiber area, west of Schreiber at the crossing at Highway 17 and McLean's Creek. Results included measured concentrations of cosmogenic

radionuclides such as Iodine-129, primordial radionuclides such as uranium and man-made radionuclides. Additional detailed information is available in the geophysical interpretation report (Mira, 2013).

3.4.3 Soil Quality

There is no specific available information on background soil quality in the Schreiber area, although it would be expected that the soil would have concentrations of parameters consistent with Ontario Typical Background ranges, as noted in Table 1 of Ontario MOE Regulation 153/04 (Government of Ontario, 2004).

3.4.4 Water Quality

A high density water survey in the Schreiber-Terrace Bay area was carried out by Dyer (1997). Water samples were obtained at a depth of 0.5 m in shallow lakes (<3 m deep) and 2 m in deep lakes. These samples were tested for pH and conductivity. The average pH and conductivity were found to be 6.7 and 31.6 mS/m, respectively.

The Township of Schreiber draws its potable water supply from Cook Lake. The lake is located 2 km north of the settlement area of Schreiber at an approximate elevation of 18.5 m above the settlement area of Schreiber (OCWA, 2012), enabling water to flow by gravity to the municipality's water treatment plant for filtration and chlorination. The 2011 annual report on water quality from the Schreiber Water Treatment Plant operated by the Ontario Clean Water Agency compared monitored water quality to the requirements of the Ontario *Safe Drinking Water Act* (O. Reg. 170/03) (Government of Ontario, 2002) and regulations therein (i.e., Ontario Drinking Water Standards, Objectives and Guidelines [ODWS] (Government of Ontario, 2006)). The report indicated that "a review of the treated water samples shows the plan met or exceeded the requirements of the ODWS" (OCWA, 2012). Notification of, and corrective actions for, adverse water quality incidents (e.g., exceedance of a Maximum Acceptable Concentration or where observations indicate safety of water cannot be guaranteed) are required under O. Reg. 170/03. No such incidents were recorded in 2011.

As noted, a recent review of background concentrations of radionuclides in surface waters and soils across Canada has been supplemented by measurements of surface waters sampled at various Canadian sites (NWMO, 2011), including one west of Schreiber at the crossing of Highway 17 and McLean's Creek. Results included elemental composition.

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

3.4.5 Lake Sediment Chemistry

Lake sediments in the Schreiber area have been studied fairly extensively by Dyer (1997) as part of lake sediment and water survey. Lake sediment samples were collected at 1,222 sites in the Schreiber-Terrace Bay area. Interpretation of the geochemical patterns showed the concentrations of some elements elevated above the typical crustal abundance. These elements include: Al, As, Ba, Br, Ca, Cd, Co, Cu, Fe, Hf, K, Mg, Mn, Mo, Na, Ni, Pb, Rb, Re, Sb, Si, Sr, Ti, Tl ,V, Zn and rare earth elements (REEs). Digital geochemical data for this survey is available as Miscellaneous Release Data (MRD) 033 (Dyer, 1997). The anomalous geochemical patterns observed in the lake sediment chemistry, relative to typical abundances, are a result of natural mineralization.

3.4.6 Potential Sources of Pollutants

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

There are four operating landfill sites within the region. Table 4 presents small open and closed landfills by Certificate of Approval (C of A) number for the wider region near Schreiber provided on the Ministry of Environment landfill list (MOE, 2010).

Table 4: Registered Landfills in the Schreiber Area and Surrounding Region

Certificate of Approval (C of A) Number	Site Name	Location	Status
A591201	Client: The Township of Schreiber	Mining Claim TB 3833 Twp of Schreiber	Closed
A591401	Client: The Township of Terrace Bay	Part of Location J.K. 306 Twp of Terrace Bay	Closed
A591403	Client: Terrace Bay Pulp Inc.	2500 Ft. N.E. of Pulp Mill Main Entrance Twp of Terrace Bay	Closed
A591404	Neenah Paper Company of Canada Waste Disposal Site Client: Kimberly-Clark Inc.	Mill Rd; W 1/2 of N. 1/2 of Location J.K. 306 Twp of Terrace Bay	Open
A591405	Client: Kimberly-Clark Of Canada Limited Pulp & Forest Products Division	Approximately 200 Yds. W. of Kimberly-Clark Mill Buildings Terrace Bay Twp of Terrace Bay	Closed
A591406	Terrace Bay Client: The Corporation of the Township of Terrace Bay	Terrace Bay Twp of Terrace Bay	Open
A591408	Client: Ministry of Natural Resources	Hwy 17 Twp of Schreiber	Closed
A7001601	Aldina Lake Client: Ministry of Natural Resources	Zone 16, Grid 804636 Unorganized	Closed
A7006501	Client: Ministry of Natural Resources	Lot E Of Hwy17, 1/4 Mi S. of Rain Bay, Conc Twp of Terrace Bay	Closed
A7182201	Inmet Mine Client: Inmet Mining Corporation	20 km NW of Schreiber Unorganized	Closed
A7182901	Portage Lake Client: Ministry of Natural Resources	Twp of Terrace Bay	Open
A7312501	Client: Ministry of Natural Resources	0.8 Km E of Hamlet of Coldwell Twp of Terrace Bay	Open

Source: Ontario Landfill List (MOE, 2010)

Transportation corridors, such as the Trans-Canada Highway, secondary roads, logging roads and rail lines, traverse the Schreiber 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. Additionally, the Schreiber area contains a local airport which is also a potential source of pollution, due to air emissions and fuel handling. Local septic systems are a potential source 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 Schreiber area is located within the Little Pic tertiary watershed of the Lake Superior drainage basin. Surface water drainage for the Schreiber area is shown on Figure 12. Drainage is southerly into Lake Superior from the height of land between the Lake Superior drainage and that of the Hudson Bay system further to the north. The main drainage is carried by the Aguasabon River, Big Duck Creek and the Hewitson River. The Aguasabon River rises in the headwaters of the Kenogami River portions of which have been artificially diverted south to Long Lac and then to Lake Superior via the Aguasabon River which outlets to Lake Superior at Terrace Bay. The Hewitson River rises from a number of small lakes and wetlands located above 500 masl in the area to the northeast of Winston Lake. From this area it follows a southwesterly course as the Whitesand River to Whitesand Lake. The outlet from Whitesand Lake flows over a series of falls as the Hewitson River to Lake Superior approximately 10 km west of Schreiber. Big Duck Creek rises from a number of small lakes and wetlands to the north of Big Duck Lake (approximately 25 km north of Schreiber) and flows in a southerly direction to Hays Lake where it is joined by Ansell Creek. Hays Lake outlets to Lake Superior via the Aguasabon River.

In addition to these larger drainage systems, much of the land bordering Lake Superior drains directly to the lake via a number of small creeks, including Cook Creek, which flows through the settlement area of Schreiber, Worthington Creek, Blind Creek and a number of short unnamed streams. Given the rugged terrain, modest precipitation and moderate size of catchment areas, there is a possibility of flooding in the area.

3.6 Groundwater and Wells

The Township of Schreiber obtains its municipal water supply from Cook Lake located 2 km north of the township boundary. The Township of Terrace Bay's main source of water is Lake Superior. However, the system is designed to draw from Hays Lake if required.

There is limited information on groundwater resources in the Schreiber area. Information concerning groundwater in the Schreiber area was obtained from the Ontario Ministry of the Environment (MOE) Water Well Record (WWR) database (MOE, 2012). The locations of known water wells are shown on Figure 12. Water wells in the Schreiber area obtain water from the overburden or the shallow bedrock. The MOE water well database contains 30 water well records in the Schreiber area, 15 of which provided useful information regarding well yield and other parameters noted in Table 5 (AECOM, 2013).

Table 5: Water Well Record Summary for the Schreiber Area

Water Well Type	Number of Wells	Total Well Depth (m)	Median Well Depth (m)	Static Water Level (m below surface)	Tested Well Yield (L/min)	Depth to Top of Bedrock (m)
Overburden[a]	7	4.3 to 47.2	25.8	2.1 to 3.0	0 to 23	N/A
Bedrock	8	31.1 to 94.5	62.8	0 to 22.5	9 to 455	0 to 38.7

Notes:
[a] Inferred for some records which were lacking stratigraphic descriptions.

3.6.1 Overburden Aquifers

There are seven water well records in the Schreiber area that can be confidently assigned to the overburden aquifer. Wells confirmed to be in overburden are generally restricted to glaciolacustrine/glaciofluvial deposits in the southern part of the area. Wells are located in the town sites of Terrace Bay and Schreiber (one each), at the south end of Whitesand Lake (one well) and at the south end of Walker Lake (three wells). The remaining water well was drilled at the site of the Winston Lake Mine. The overburden wells have depths of between 4.3 and 47.2 metres below ground surface (mbgs), and generally have low pumping rates although little data on yields are contained in the water well database. Yields, however, are likely not reflective of aquifer capacity, as the wells supply residences with limited demand (AECOM, 2013).

3.6.2 Bedrock Aquifers

No information was found on deep bedrock groundwater conditions in the Schreiber area at a typical repository depth of approximately 500 m. Within the Schreiber area, there are eight water wells which can confidently be assigned to being developed in bedrock (MOE, 2012). These wells, encountered bedrock at depths ranging from 0 to 38.7 mbgs, have maximum depths between 31.1 and 94.5 mbgs. Reported yields range from 9 to 455 L/min with static water levels ranging from 0.9 to 9.1 mbgs. Two additional wells located south of Terrace Bay, in close proximity to the Lake Superior shoreline, have recorded pumping rates of approximately 716 and 719 L/min from depths of 20.7 and 22.9 m, respectively. The depth of the wells suggests that they may be completed in bedrock; however, this is not confirmed. The high pumping rates may indicate that recharge to the wells is, at least in part, from Lake Superior either through one or both of the bedrock fractures or coarse-grained glacial sediments (AECOM, 2013).

No potable water supply wells are known to exploit aquifers at typical repository depths in the Schreiber area or anywhere else in northern Ontario. 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 (Singer and Cheng, 2002). 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 Schreiber area has a continental climate, typified by large seasonal temperature differences, with warm to hot (and often humid) summers and cold (sometimes severely cold) winters. Lake Superior has a strong moderating influence on the local climate. Lake Superior moderating effects results in cooler summer temperatures and warmer winter temperatures. The summer months are normally characterized by cool

evenings and relatively high incidence of mean monthly days with fog as compared to other areas in Canada. The Schreiber area receives most of its yearly precipitation during the late spring and summer months.

Climatological information presented in this section is based on meteorological data from Environment Canada's meteorological station located in Terrace Bay approximately 13 km to the west of the Township of Schreiber; it has more than 30 years of continuous data and is at a similar elevation. Parameters that are measured at the Terrace Bay station include temperature and precipitation. Since winds are not measured at the Terrace Bay climate station, the last ten years (2002 - 2011) of wind records from the Pukaskwa meteorological station have been used to assess the local winds condition. Pukaskwa meteorological station is located approximately 75 km to the west of the Township of Schreiber and it is also located on the north shore of Lake Superior, thus it is expected to have a very similar climate.

3.7.1 Temperature

Temperature data was obtained from Environment Canada's 1971-2000 climate normals for the Terrace Bay meteorological station (EC, 2011b). Figure 13 presents monthly temperatures for Terrace Bay, displaying daily average, maximum and minimum and extreme values over the calendar year.

3.7.2 Precipitation

Figure 14 presents monthly precipitation data obtained from Environment Canada's 1971-2000 climate normals for the Terrace Bay meteorological station, including total rainfall, rainfall, snowfall and all-time extreme values over the calendar year (EC, 2011b).

3.7.3 Wind

Figure 15 presents annual and seasonal wind rose diagrams of the wind data from 2002 to 2011 at the Pukaskwa meteorological station (EC, 2011b). It should be noted that the southerly winds, or "on-shore" winds from Lake Superior, are more frequent in the late spring through to early fall. In the winter season the opposite is true, the southerly winds are the least frequent, due to the winds being driven by the general atmospheric flow rather than Lake Superior influences. Monthly climate normals for wind data (e.g., based on a 30-year or greater record of climate data) were not available for the Schreiber area.

3.8 Natural Hazards

3.8.1 Earthquakes and Seismicity

The Schreiber 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 Schreiber area has a low seismic hazard rating (NRCan, 2010). Since 1627, no earthquakes exceeding a magnitude m_N 6 have been known to occur within 1,000 km of the Schreiber area. According to the National Earthquake Database (NEDB) for the period between 1985 and 2011 (NRCan, 2012) all recorded seismic events in the Schreiber area had magnitudes m_N ranging from less than 1 to 3.

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

3.8.2 Tornadoes and Hurricanes

The Schreiber area experiences thunderstorms in the summer months and is located in an area with a low tornado frequency (<0.1 tornadoes per year / 10,000 km^2), but where there is a potential for F0-F1 tornadoes

(Sills et al., 2012). The Schreiber 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 maximum hourly wind pressure for the Schreiber 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 Schreiber area experiences on average between 35 and 100 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 Terrace Bay station (Figure 14) are 102 mm of rain and 48 cm of snow, respectively. In years where there is a high snowpack accumulation, the spring freshet can result in an increase in water levels in local streams and rivers. As noted on Figure 12, the Schreiber area contains several separate catchment areas that drain to Lake Superior, including the Aguasabon River catchment, which is moderate in size. This, in combination with the rugged terrain, makes for a possible risk of flash flooding in the Schreiber area. The potential risk of drought or flooding affecting the facility will also depend to some degree on the specific location selected.

3.8.4 Snow and Ice

As noted on Figure 14, the Schreiber area receives on average about 210 cm of snowfall per year, primarily between the months of November and March. No single month receives an average snowfall greater than 55 cm. The highest single day snowfall accumulation on record is 48 cm, recorded on January 6, 1980. The National Building Code of Canada recommends a design 1/50 snow load (S_s + S_r) for the Schreiber area of 3.7 kPa, which is a typical value for northern Ontario (NRC, 2010). Local lakes and waterbodies freeze over in the winter months in the Schreiber area, as average daily temperatures from November to March typically range from -15 to -3^{0}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 Schreiber area there is a risk of forest fires. Locations where forest fires have occurred in the vicinity of the Schreiber area between 1976 and 2010 affecting an area of greater than 200 ha are shown on Figure 8. These forest fires combine to comprise approximately 2% of the total Schreiber 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 do occur in the Schreiber area and lightning strikes are not uncommon in the summer months.

3.8.6 Landslides and Tsunamis

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

4.0 SUMMARY

This report provides a general description of the environment in the Township of Schreiber and surrounding area.

Situated in the District of Thunder Bay along the north shore of Lake Superior, the Township of Schreiber is approximately 40 km^2 in size, with a population of 1,126 (Statistics Canada, 2012). The Township of Schreiber is bordered to the east by the Township of Terrace Bay and is located approximately 150 km east of Thunder Bay. The climate in Schreiber is typical of a mid-latitude, humid continental region typified by large seasonal temperature differences, with warm to hot (and often humid) summers and cold (sometimes severely cold) winters. Schreiber receives most of its yearly precipitation during the late spring and summer months.

There are a number of Aboriginal communities and organizations in the Schreiber area including Biinjitiwaabik Zaaging Anishinaabek (Rocky Bay First Nation), Fort William First Nation, Gull Bay First Nation, Ojibways of the Pic River First Nation, Pays Plat First Nation, Red Rock First Nation and Sand Point First Nation. Métis Councils in the area include Greenstone Métis Council, Superior North Shore Métis Council and Thunder Bay Métis Council as represented by Lakehead/Michipicoten/Nipigon Traditional Territory Consultation Committee and the Métis Nation of Ontario.

The Township of Schreiber lies in the Abitibi Upland, featuring the broadly rolling surface of Canadian Shield bedrock that occupies most of north-central Ontario; either exposed at surface or shallowly covered with Quaternary glacial deposits. Lands to the west of Schreiber are part of the Port Arthur Hills which consist of a characteristically rugged topography. Topographic highs generally correspond to exposed bedrock while topographic lows are typically areas of thicker overburden. Most of the Township of Schreiber is underlain by rocks of the Schreiber-Hemlo greenstone belt, extending beyond the Township boundaries to the north and northeast. Most of the remainder of the Township is underlain by granitic intrusions, including the Gwynne Mountain pluton and small portions of two large intrusions, the Whitesand Lake batholith and the Terrace Bay batholith. The Crossman Lake batholith is a third large intrusion in the Schreiber area.

There are currently no producing mines in the Schreiber area. Mining in the Schreiber area has historically focussed on metals (especially gold) within the Schreiber-Hemlo greenstone belt and the contact aureolas with surrounding batholiths, where most of the occurrences have been found and where most of the current exploration activity is centered. Metallic mineralization and occurrences in the Schreiber area include iron formations, zinc-copper-lead-silver, cobalt-copper-nickel-platinum group metals and gold. Molybdenite occurs in quartz veins as well as disseminations in granitic rocks and gneisses in the Sox Lake area. Known non-metallic mineral resources within the Schreiber area include sand and gravel, stone, amethyst, and potentially industrial minerals such as garnet, fluorite and barite.

Infrastructure within the Schreiber area includes the Trans-Canada Highway (Highway 17) which passes through the southern end of the Schreiber area in an east-west orientation, and through the community of Schreiber. As well, a rail corridor runs approximately parallel to Highway 17 through the Schreiber area, as does a 115 kV transmission line corridor. The East-West Tie 230 kV transmission corridor runs north of Schreiber. There are no utility pipelines, such as natural gas, located in the Schreiber area. The Rainbow Falls Provincial Park and areas of three conservation reserves are located within the Schreiber area.

The Schreiber area lies in the southern portion of the Boreal Forest Region where it meets the Great Lakes-St. Lawrence Forest (Hoffman, 2011). The Kenogami Forest Management Unit (FMU) 350 managed by Terrace

Bay Pulp Inc. (TBPI) extends over the Township of Schreiber and the Schreiber area (Hoffman, 2011; LIO, 2012). This FMU is reported to have more than 79% productive forest for the potential timber harvesting, although it is heavily impacted by the effects of spruce budworm. The forest supports conifer and mixed forest types frequently comprised of black spruce, jack pine, balsam fir, poplar and white birch (Hoffman, 2011).

The region's forests provide habitat for wildlife including game, furbearing mammals and fish. The Natural Heritage Information Centre (NHIC, 2012) identified three species observed within the Schreiber area that are listed as endangered, threatened or of special concern either under the Ontario *Endangered Species Act*, (Government of Ontario, 2007) or the Federal *Species at Risk Act* (Government of Canada, 2012): woodland caribou, bald eagle and peregrine falcon. Using habitat range mapping, an additional 15 endangered, threatened or special concern species were identified to have a range that overlaps the Schreiber area (ROM, 2012; Oldham and Weller, 2000; Cadman et al., 2007; Holmes, 1991). Regarding habitat use by these species, wintering areas for caribou are north of the Schreiber area, to the east of Lake Nipigon; however, individuals may use habitat anywhere within the boreal forest which extends into the Schreiber area. The range of eastern cougar extends to the Schreiber area, but this species is extremely secretive and can cover a very large home range for each individual. Provincially threatened lake sturgeon (northwestern Ontario population) and shortjaw cisco are two of the fish species identified as using habitat within the Schreiber area.

The lands within the Schreiber area are located within the Lake Superior drainage basin and the Little Pic tertiary watershed and this terrain cradles wetlands, lakes and rivers that support a diversity of fish and wildlife. Waterbodies are mainly cold and cool water classified. The Township of Schreiber is close to several waterbodies including Lake Superior, a major cold-water recreational and commercial fishery, abutting the shores of the Township to the south (MNR, 2007). The Schreiber area supports recreational and commercial tourism use, with species including walleye, northern pike, brook trout and lake trout (Hoffman, 2011; Township of Schreiber, 2011).

Water wells in the Schreiber area obtain water from the overburden or the shallow bedrock. The MOE water well database contains 30 discrete water well records in the Schreiber area. There are no records of water wells sourcing potable water aquifers at repository depths in the Schreiber area or elsewhere in northern Ontario. The Township of Schreiber obtains its municipal water supply from Cook Lake.

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

The Ontario Archaeological Sites Database identified 13 known archaeological sites in the Schreiber area, with two of these found within the Township of Schreiber. Sites identified include pre-contact Aboriginal sites, stone structures, the Worthington Bay Pictograph site, the Worthington Bay Red Ochre Mine site and Euro-Canadian sites including the shipwreck of the Gunilda. The presence of local heritage sites would need to be confirmed in discussion with the community and Aboriginal peoples in the area.

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Report Signature Page

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Geoscientist

George Schneider, M.Sc., P.Geo.
Principal, Senior Geoscientist

BT/DM/GWS/JLH/wlm

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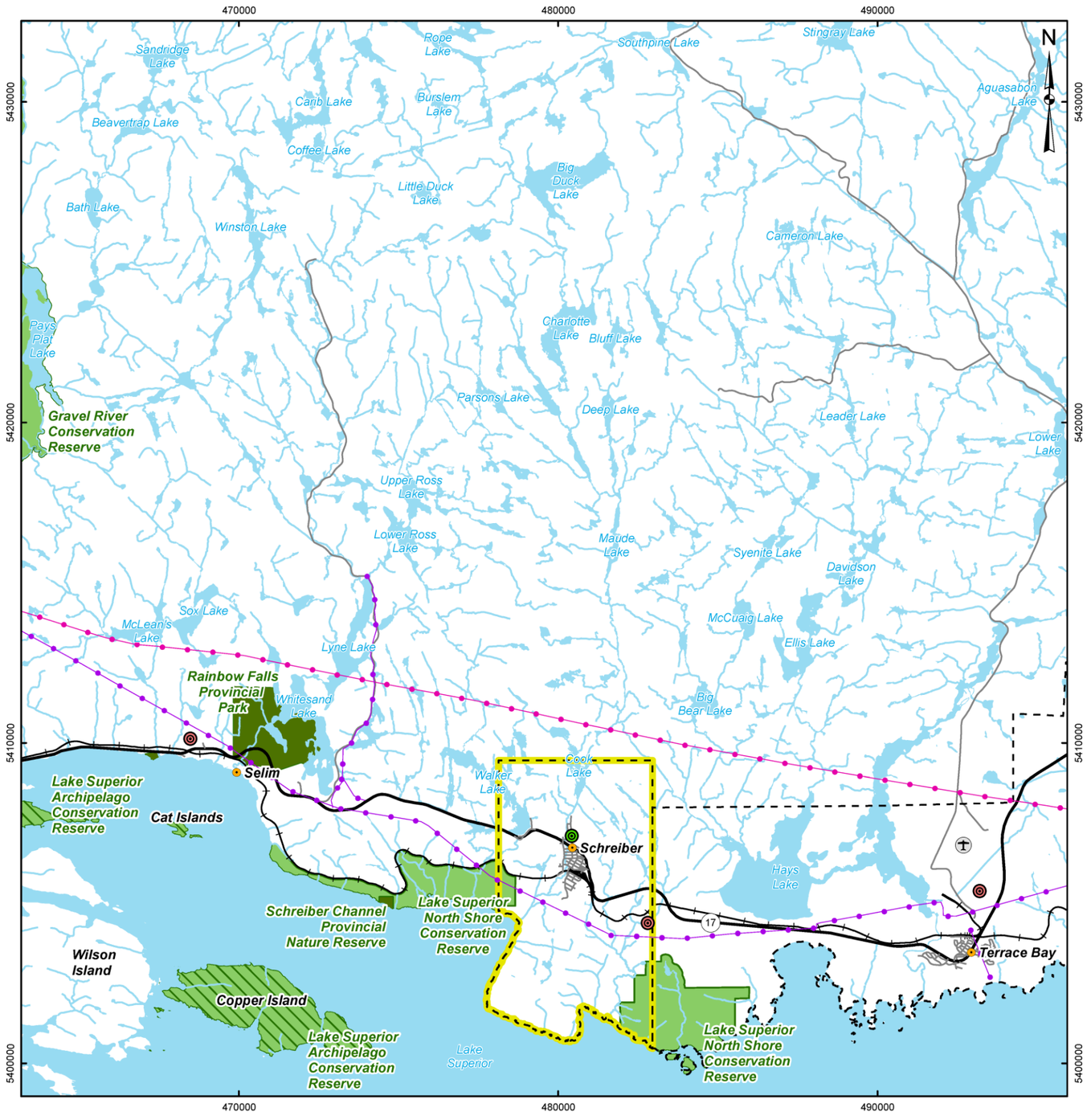
FIGURES



LEGEND

- Community
- Airport
- Domestic Waste Site
- Waste Water Treatment Plant
- Main Road
- Local Road
- Railway
- 230 kV Transmission Line
- 115 kV Transmission Line
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Conservation Reserve (Recommended)
- Conservation Reserve
- Provincial Park
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber and Surrounding Lands

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	2 Apr. 2012		
GIS	PRM	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 1

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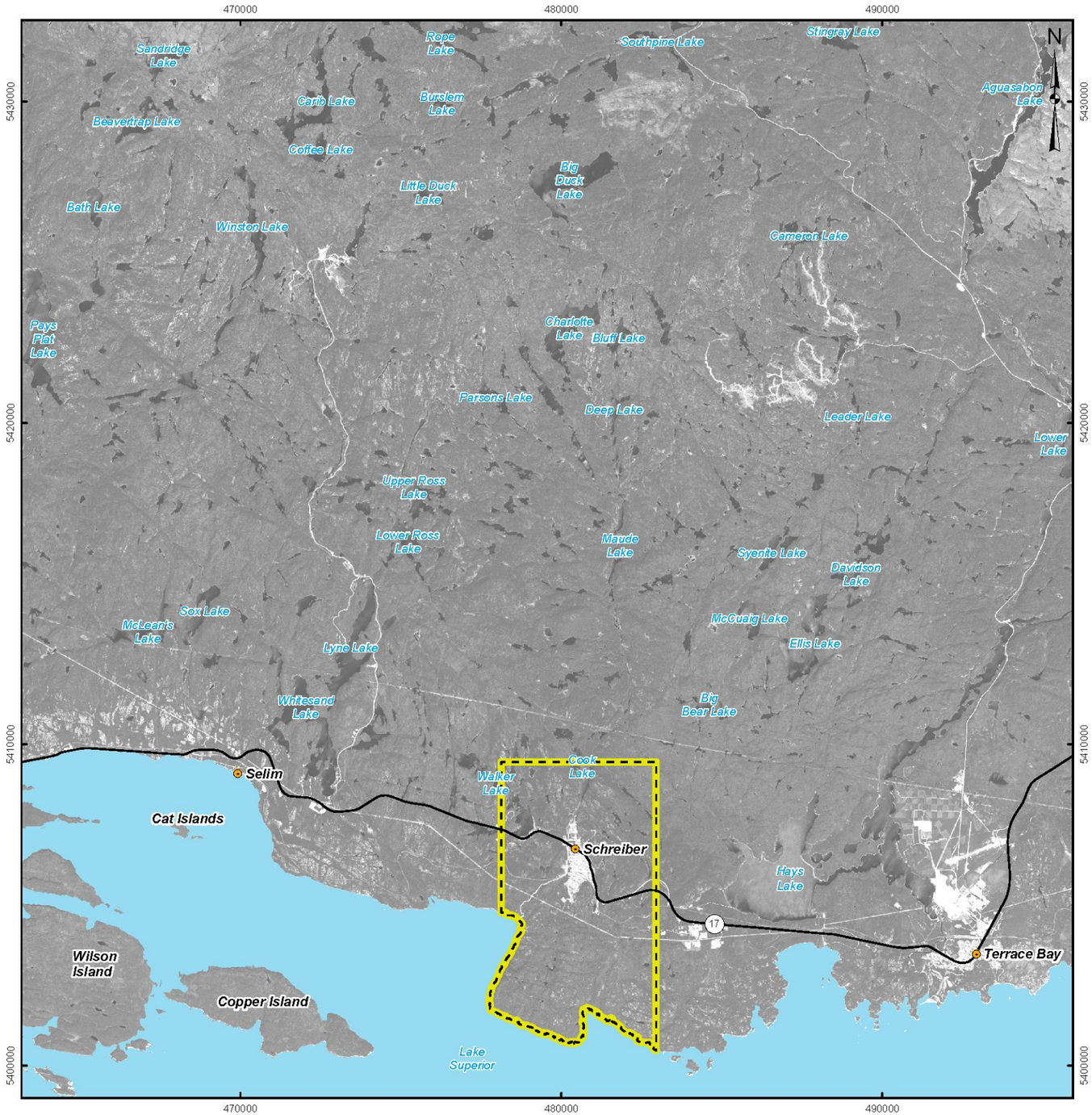

LEGEND

- Community
- Main Road
- Water Area, Permanent
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Imagery - Spot 5 , Obtained from Geobase (2005 and 2008 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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Satellite Imagery of the Schreiber Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 1.0
DESIGN	PRM	2 Apr. 2012		
GIS	PRM	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 2

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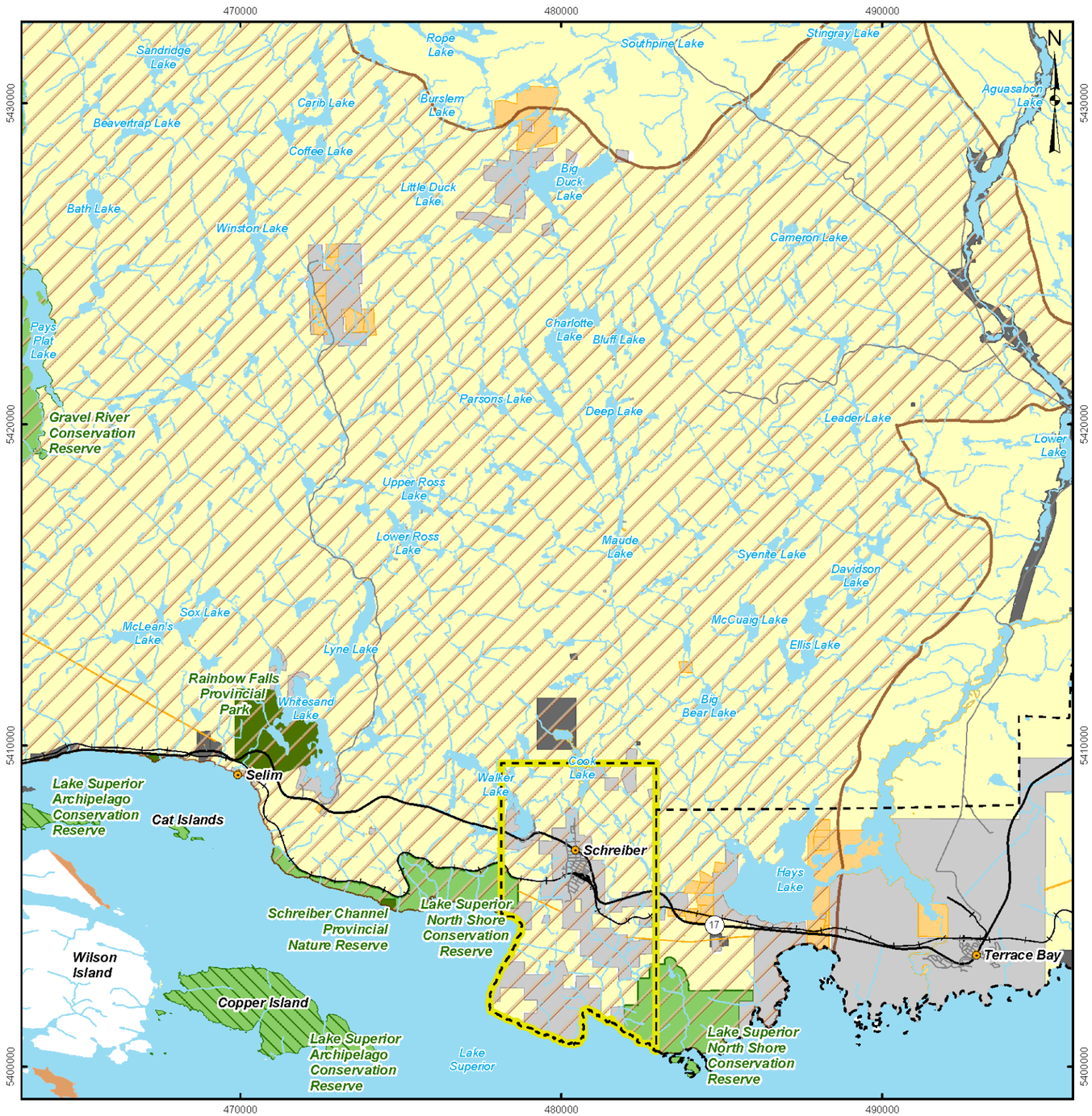

LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Conservation Reserve (Recommended)
- Conservation Reserve
- Provincial Park
- ANSI, Earth Science
- Private Land
- Crown Leased Land
- Crown Land - Non-Freehold Dispositions Public
- Crown Land - Unpatented Public Land
- Crown Reserves
- Regular Registered Trapper Area License
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber Area Land Ownership

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	2 Apr. 2012		
GIS	PRM	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 3

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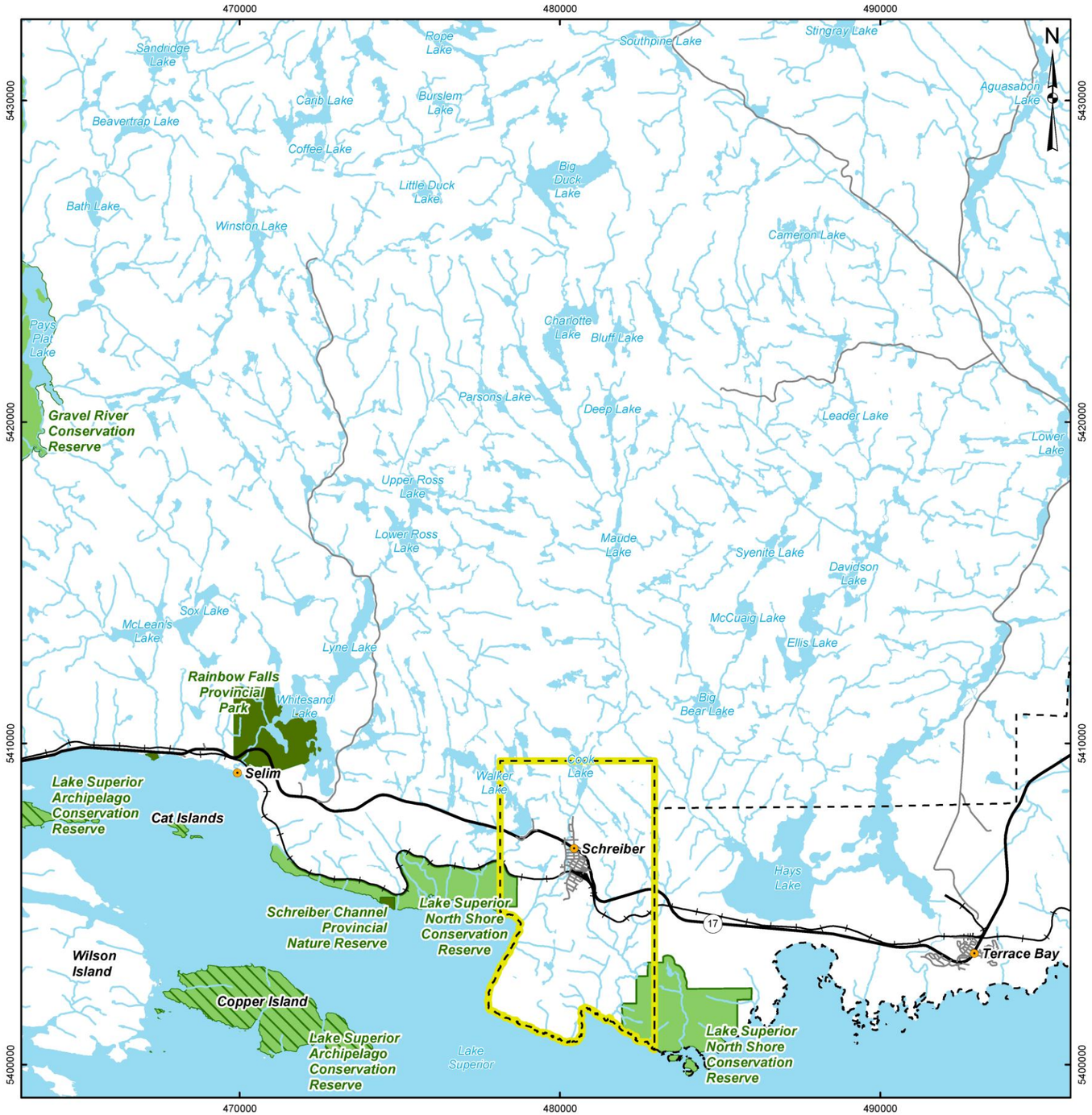

LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Conservation Reserve (Recommended)
- Conservation Reserve
- Provincial Park
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber - Parks and Protected Lands

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	28 Mar. 2012	FIGURE: 4	
GIS	PM/JB	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

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LEGEND

- Community
- Main Road
- Local Road
- Railway
- Water Area, Permanent
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

Forest Fire Areas (greater than 200 hectares)

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

Forest Plan Renewal Year

- 2013
- 2014
- 2015
- 2016
- 2017

FOREST MANAGEMENT UNITS

350 - Kenogami Forest

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Forest Management Units & Forest Fire Areas - Canadian Forest Service. 2010.
Canadian National Fire Database - Agency Fire Data. Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre, Edmonton, Alberta.
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Forest Management Units of the Schreiber Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	2 Apr. 2012	FIGURE: 5	
GIS	PM/JB	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

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LEGEND

- Community
- Main Road
- Local Road
- Railway
- Water Area, Permanent
- Wetland, Permanent
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

Elevation (masl)

540
480
420
360
300
240
180

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Digital Elevation Model (DEM) of the Schreiber Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	2 Apr. 2012		
GIS	PM/JB	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 6

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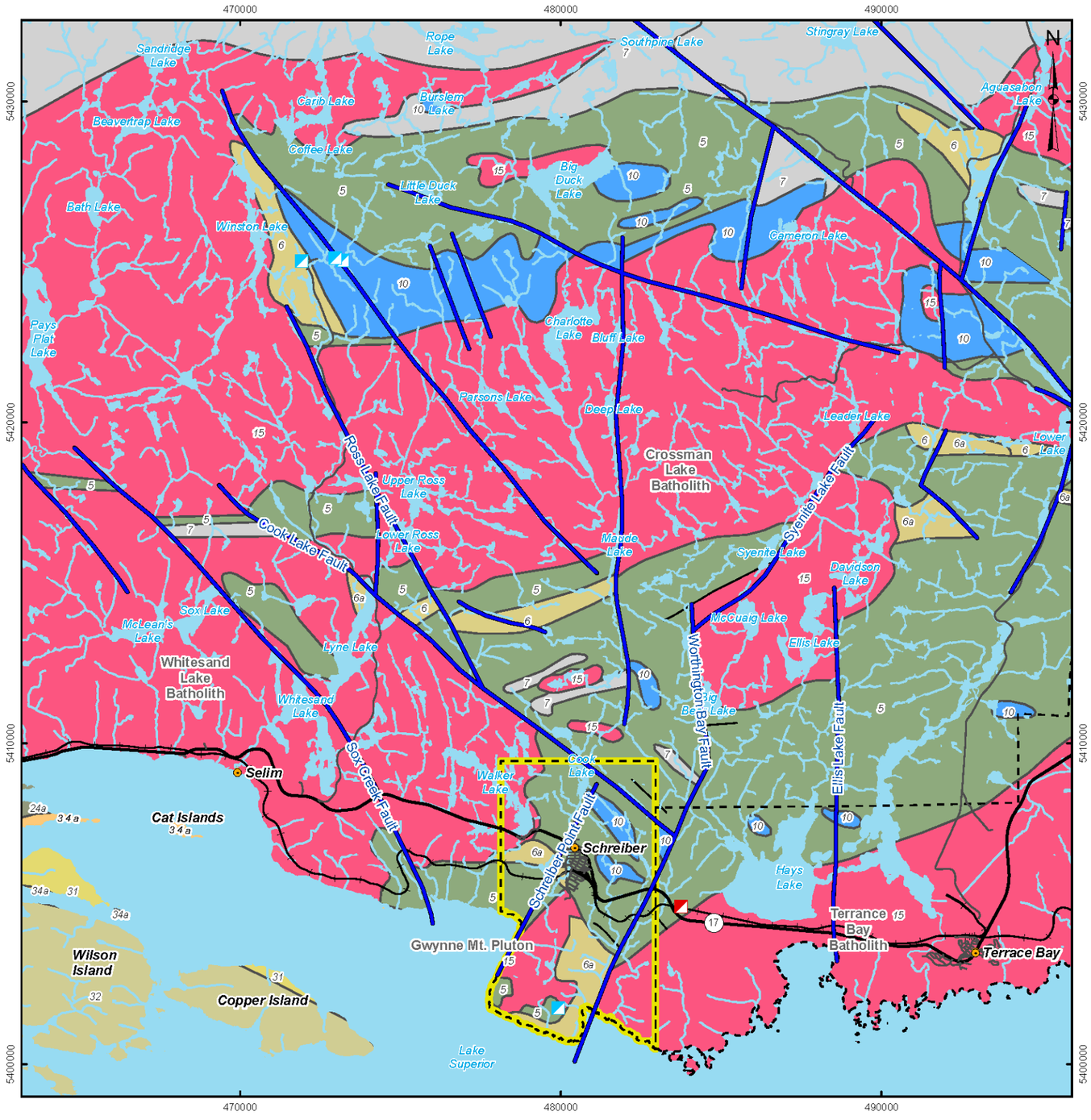

LEGEND

- Community
- Past Producing Mine with Reserves
- Past Producing Mine without Reserves
- Main Road
- Local Road
- Railway
- Watercourse, Permanent
- Water Area, Permanent
- Geological Fault
- Geological Contact
- Iron Formation
- 34 Mafic and related intrusive rocks (Keweenawan age)
  - 34a Logan and Nipigon sills (1109 Ma): diabase sills
- 32 Osler Gp., Maminse Point Fm., Michipicoten Island Fm.
- 31 Sibley Gp.
- 24 Sedimentary Rocks (Animikie Group): wacke, shale, iron formation, limestone, minor volcanic rocks, conglomerate, taconite, aldal chert, carbonate rocks, argillite-tuff
  - 24a Rove Formation: argillite, shale, wacke, minor volcanic rocks
- 15 Massive granodiorite to granite
- 10 Mafic and ultramafic rocks
- 7 Metasedimentary rocks
- 6 Felsic to intermediate metavolcanic rocks
  - 6a Dacitic and Andesitic flows, tuffs and breccias
- 5 Mafic to intermediate metavolcanic rocks
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Geology: MRD126-Bedrock Geology of Ontario, 2011
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Bedrock Geology of the Schreiber Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN / REV. 1.0
DESIGN	PRM	2 Apr. 2012	
GIS	PRM	2 Aug. 2013	**FIGURE: 7**
CHECK	JH	2 Aug. 2013	
REVIEW	GWS	2 Aug. 2013	

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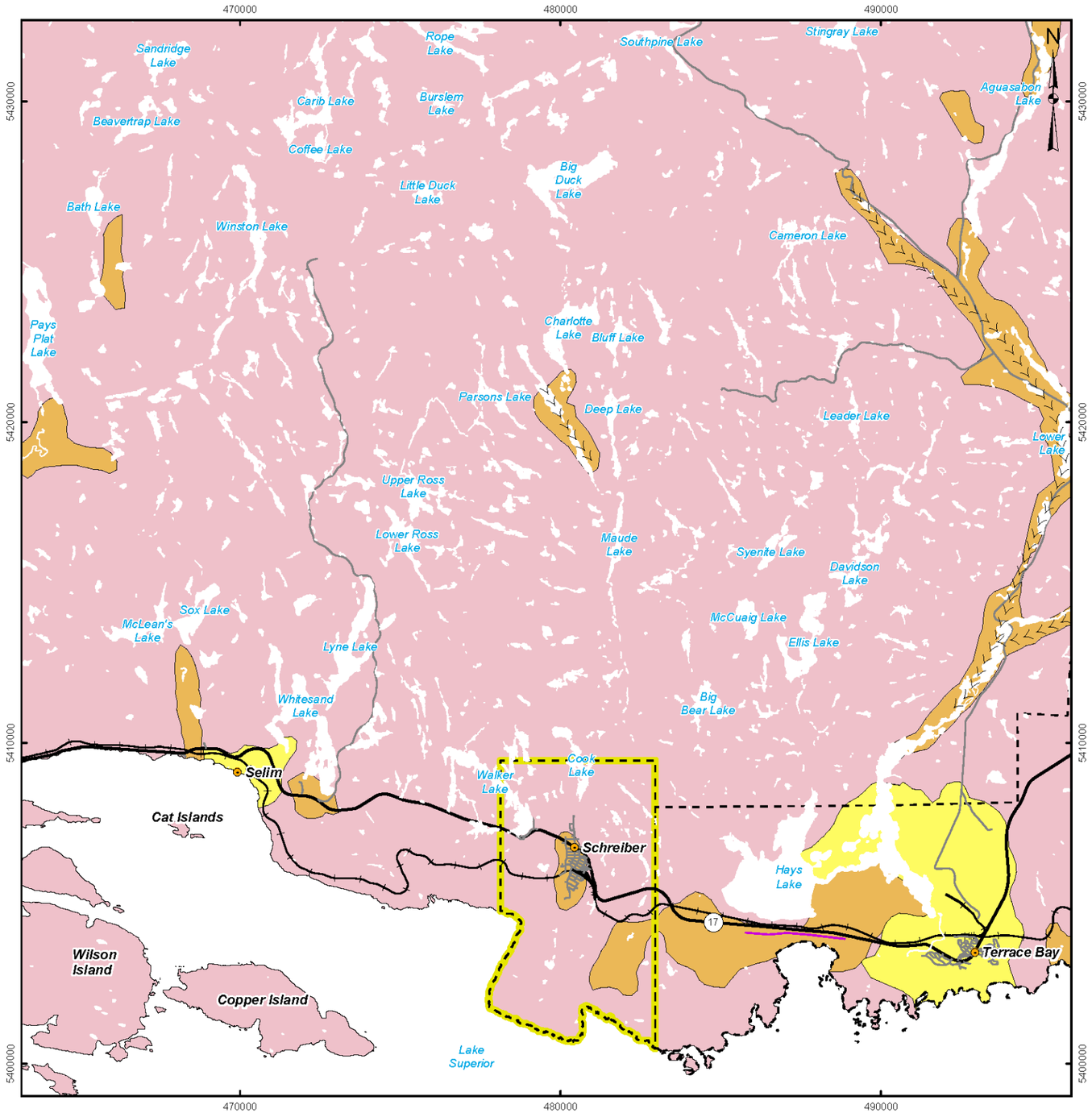

LEGEND

- Community
- Main Road
- Local Road
- Railway
- Esker or Area of Eskers; Direction of Flow known or Assumed
- Terrace Escarpment (Abandoned Shore Bluff)
- 1: Bedrock
- 23: Glaciofluvial Outwash deposit
- 25: Glaciolacustrine Deposits – Coarse Grained
- 33: Water Area
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Geology - Modified EDS014-Surficial Geology of Ontario 1:1,000,000, 2000
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Quarternary Geology of the Schreiber Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 1.0
DESIGN	PRM	4 Apr. 2012		
GIS	PRM	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 8

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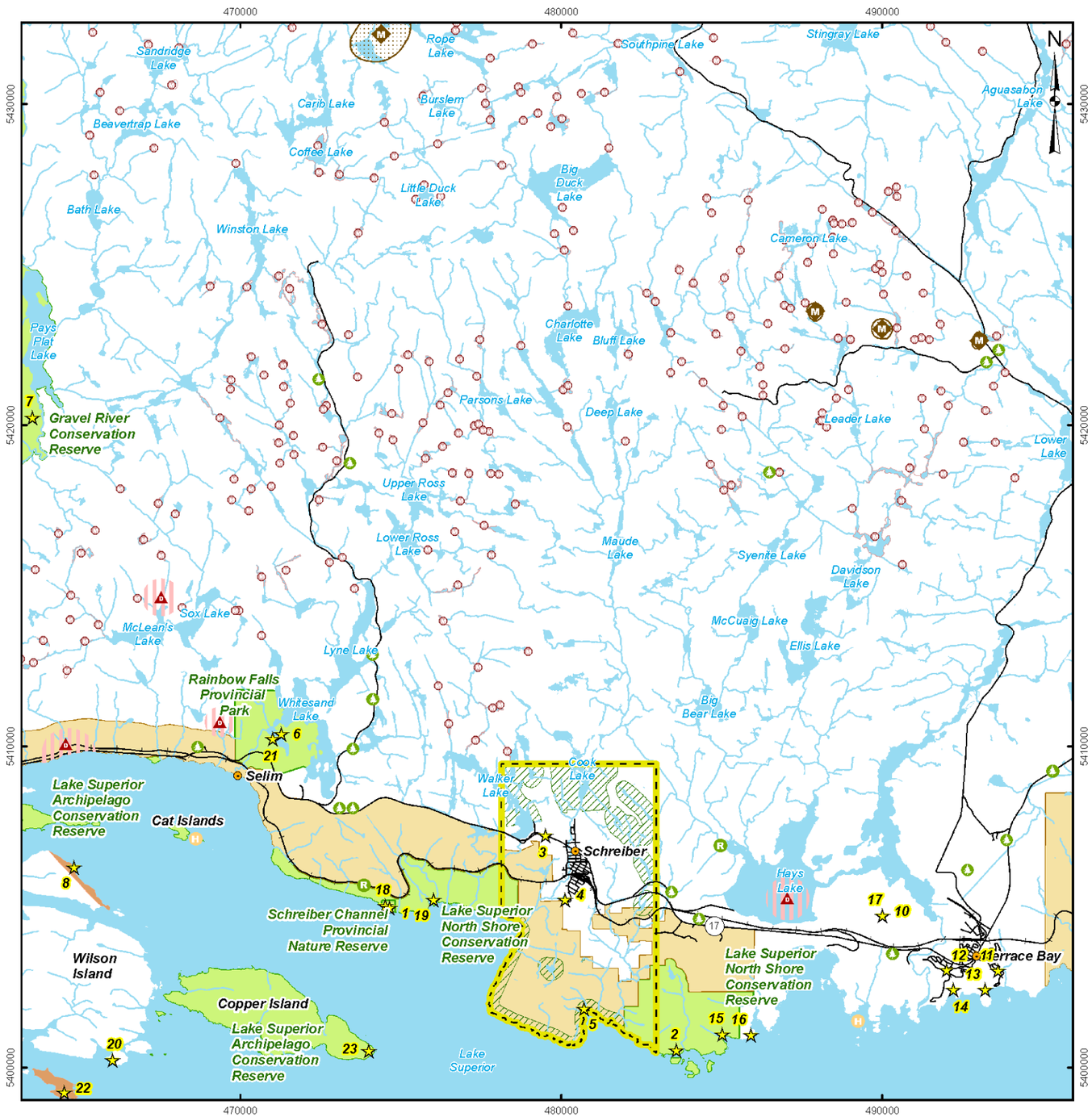

LEGEND

- Community
- Road
- Railway
- Watercourse
- Water Area, Permanent
- Provincial Park / Reserve
- Enhanced Management Area
- ANSI, Earth Science
- Environmental Constraint Area
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)
- Earth or Life Science Site

Wildlife and Forestry

- Forest Research Area
- Moose Aquatic Feeding Area

Nesting

- Heron
- Raptor

Staging Area

- Deer
- Deer

Wintering Area

- Moose
- Moose

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Environmental Constraint Area - Township of Schreiber Official Plan, Schedule 'A' Land Use Plan, June 2011
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber - Terrestrial Ecology

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	29 Sep. 2010	**FIGURE: 9**	
GIS	PMJB	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

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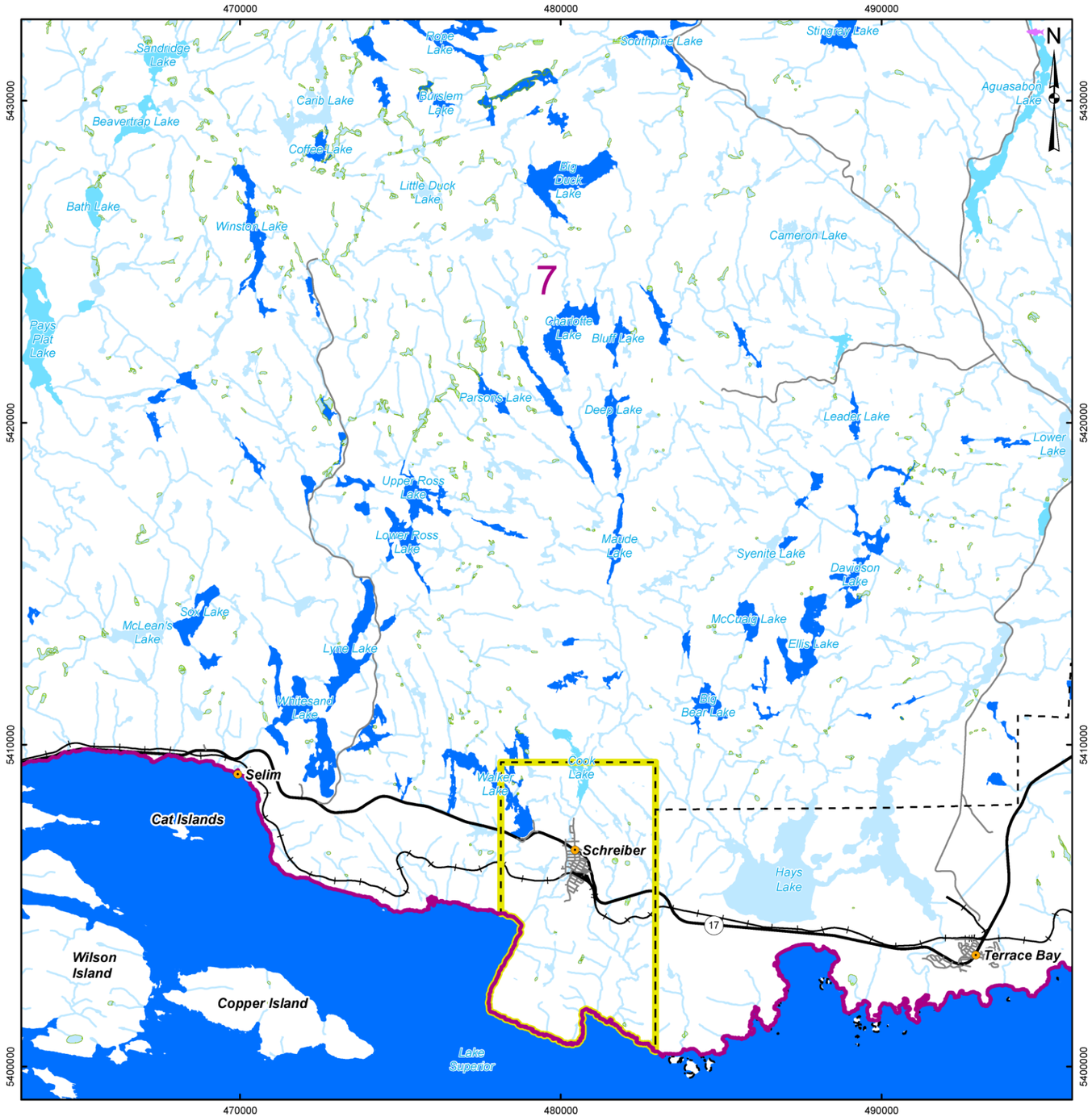

LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse
- Fisheries Management Zone (7)
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

Fisheries and Wetlands

- Spawning Area
- Waterbody (unspecified)
- Cold Water Lake
- Cool Water Lake

Natural Heritage

- Wetland

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Lake Nipigon Forest - Natural Resource Feature Values Fisheries and Wetland
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber - Aquatic Ecology

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	28 Mar. 2012	FIGURE: 10	
GIS	PM/JB	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

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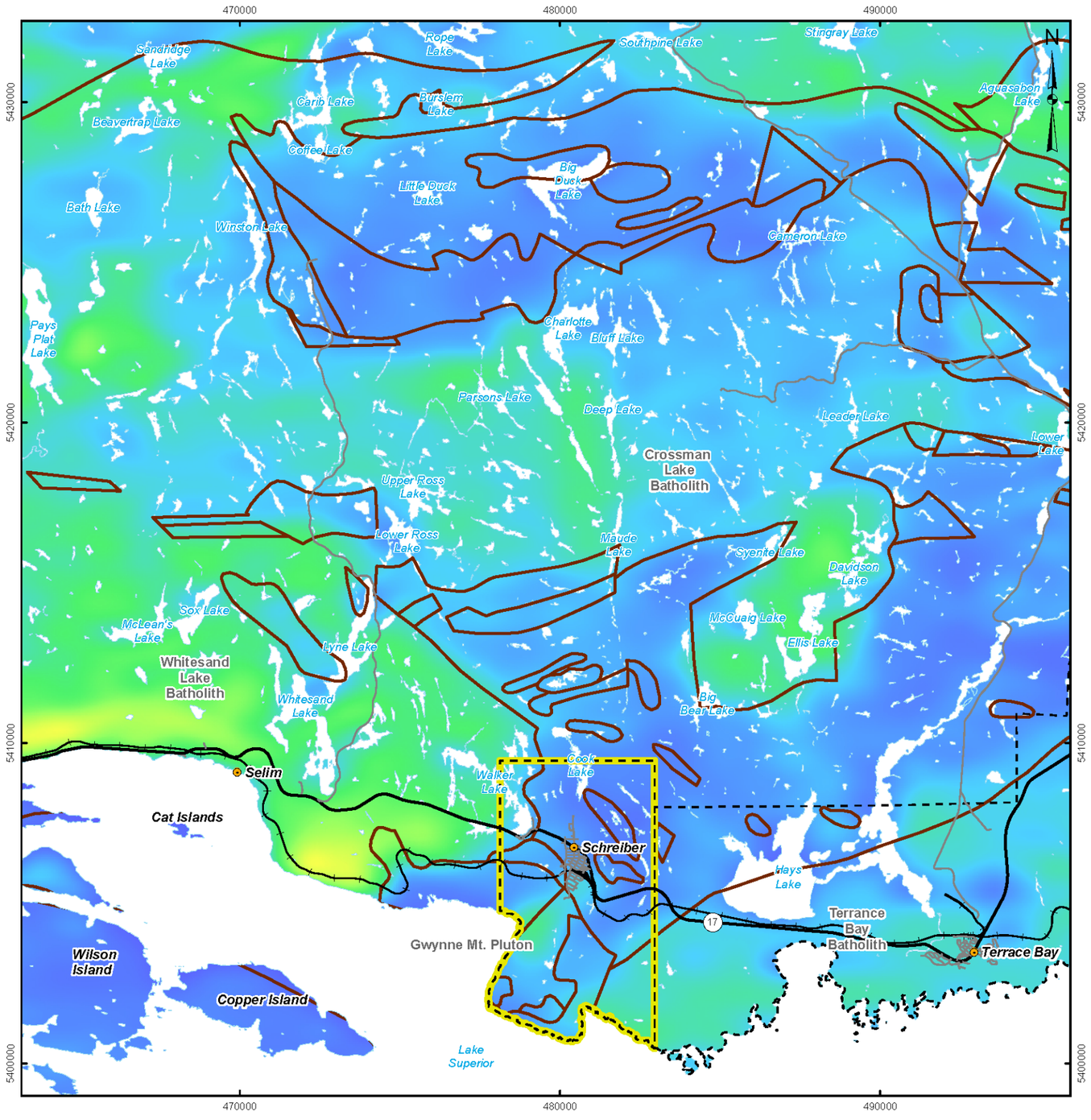

LEGEND

- Community
- Main Road
- Local Road
- Railway
- Water Area, Permanent
- Geological Contact
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

Air Absorbed Radiation Levels (nGy/h)

110
100
90
80
70
60
50
40
30
20
10
0

REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Geology - MRD126-Bedrock Geology of Ontario, 2011
Radiometrics - GSC Canada - 250m -Natural Air Absorbed Dose Rate, 2012; National Gamma-Ray Spectrometry Program Data Base, Airborne Geophysics Section, GSC - Central Canada Division, Geological Survey of Canada, Earth Sciences Sector, Natural Resources Canada
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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 16N

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber - Background Radiation Levels

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 1.0
DESIGN	PRM	4 Apr. 2012		
GIS	PRM	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 11

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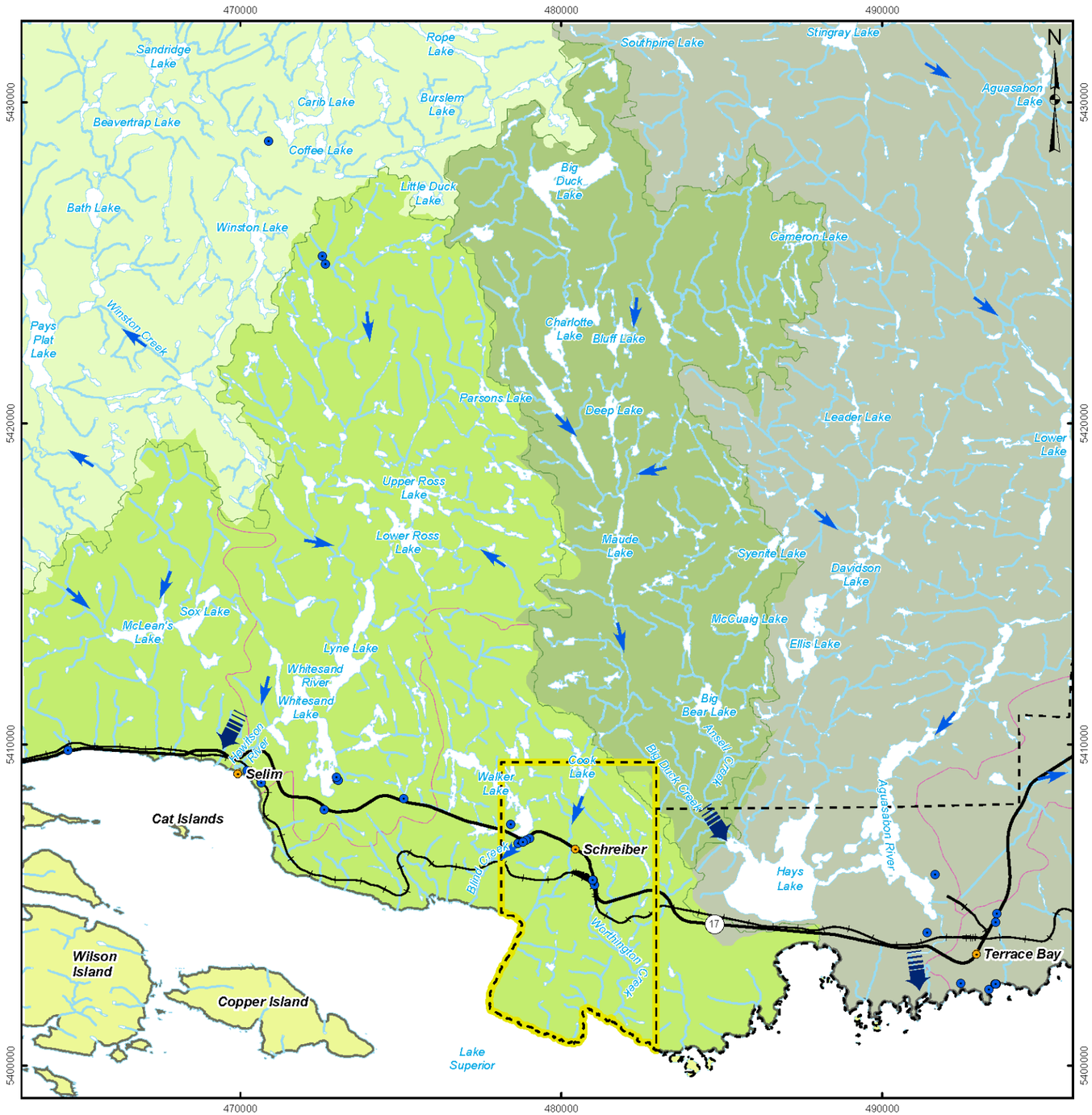


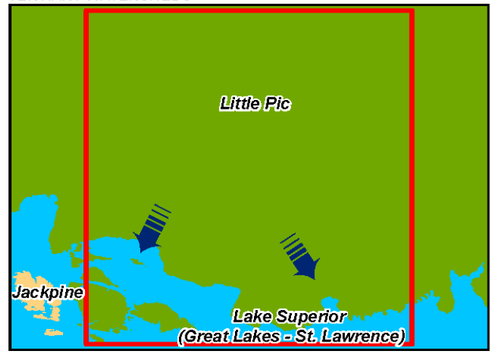
LEGEND

- Community
- MOE Well Location
- Main Road
- Railway
- Watercourse, Permanent
- Watercourse, Intermittent
- Water Area, Permanent
- Surface Water Flow Direction
- Watershed Outflow Point

Drainage Divide

- Delineated by JDMA
- Delineated by MNR
- Municipal Boundary, Lower Tier
- Municipal Boundary (Township of Schreiber)

TERTIARY WATERSHEDS



REFERENCE

Base Data - MNR LIO, obtained 2009-2012, CANMAP v2006.4
Wells - Ministry of the the Environment , 2010
Watershed - LIO quaternary watershed (updated by JDMA)
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

2.5 1.25 0 2.5 5 7.5
SCALE 1:150,000 KILOMETRES

PROJECT
Environment Report
Township of Schreiber, Ontario

TITLE
Schreiber Surface Water Drainage and Water Wells

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 1.0
DESIGN	PM	2 Apr. 2012		
GIS	PMJB	2 Aug. 2013		
CHECK	JH	2 Aug. 2013		
REVIEW	GWS	2 Aug. 2013		

FIGURE: 12

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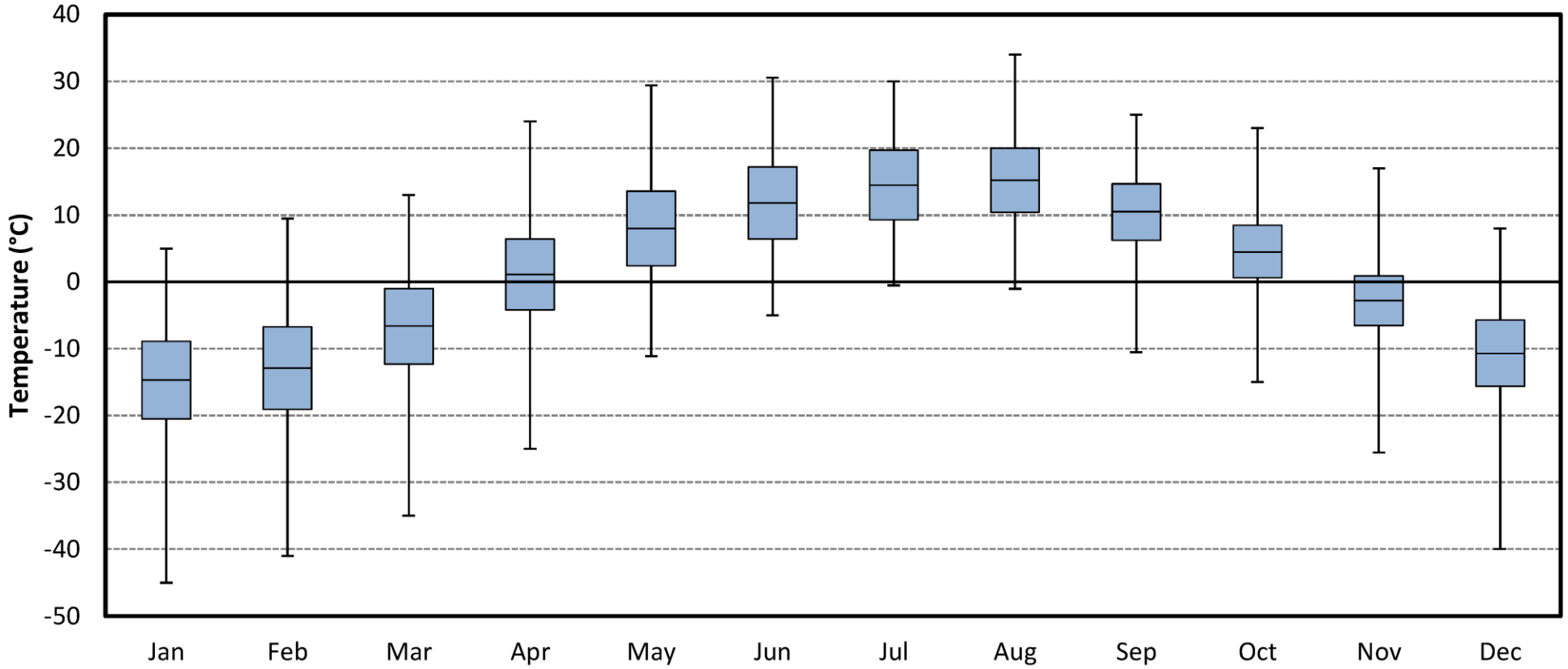


LEGEND

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

DATA SOURCE

Environment Canada

PROJECT

Environment Report
Township of Schreiber, Ontario

TITLE

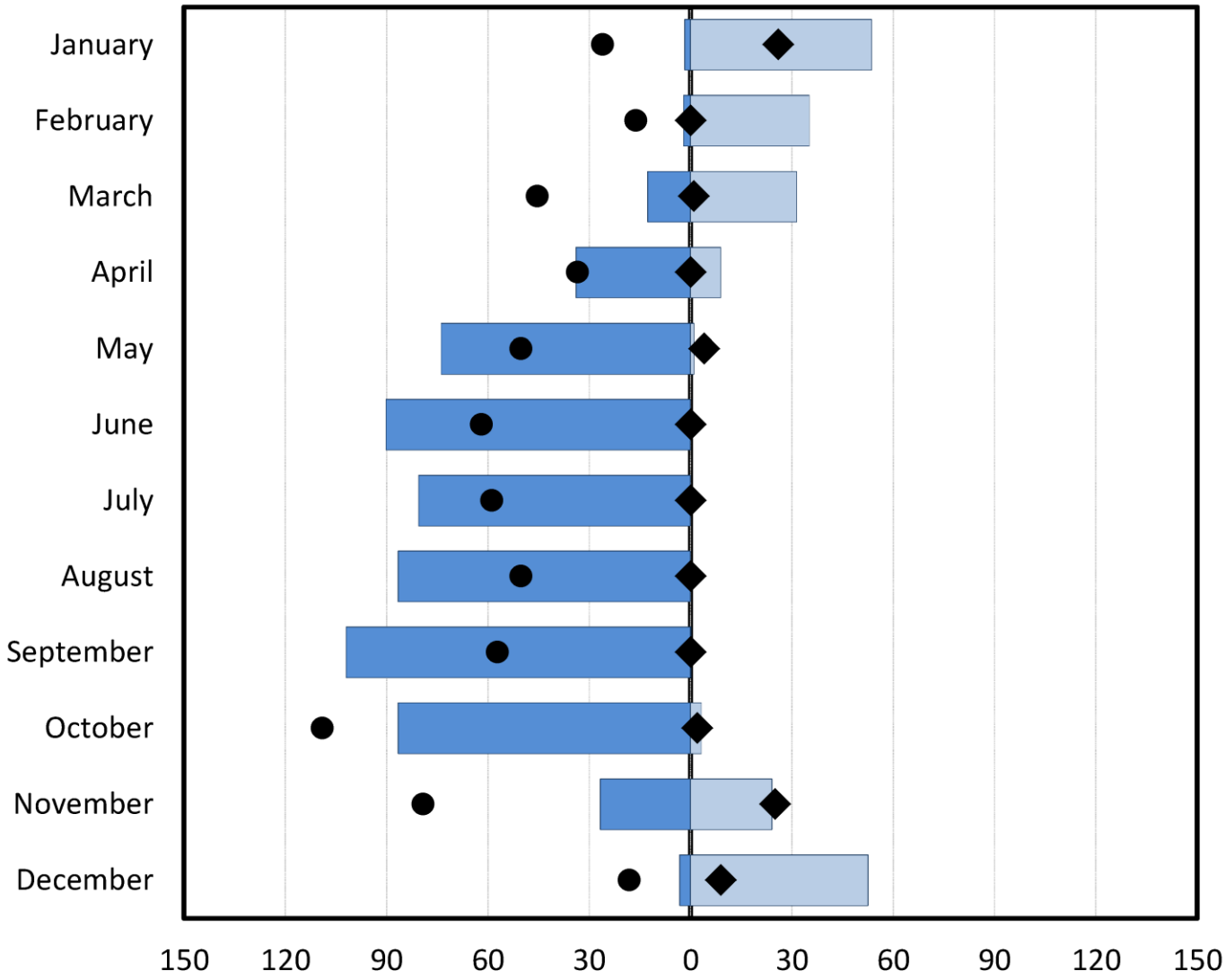
Terrace Bay 1971-2000 Temperature Data Summary

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	5 Apr. 2012		
GIS	PRM	27 Jun. 2013		
CHECK	JH	27 Jun. 2013		
REVIEW	GWS	27 Jun. 2013		

FIGURE: 13

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Schreiber\SchreiberTerraceBayTemperatureDataSumary.mxd



LEGEND

- Monthly Rainfall (mm eq.)
- Monthly Snowfall (mm eq.)
- Extreme Daily Rainfall (mm eq.)
- Extreme Daily Snowfall (mm eq.)

DATA SOURCE

Environment Canada

PROJECT

Environment Report
Township of Schreiber, Ontario

TITLE

Terrace Bay 1971-2000 Precipitation Data Sumary

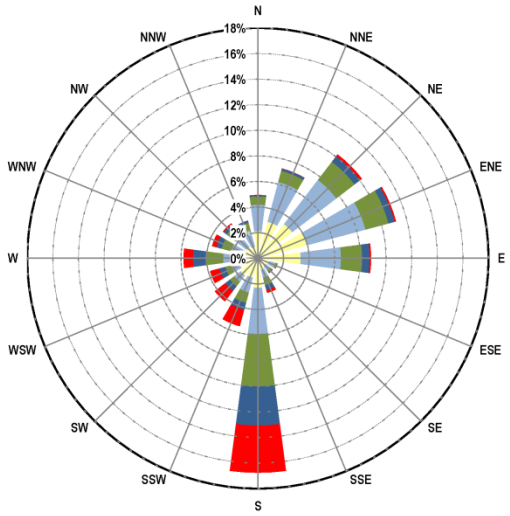
Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	5 Apr. 2012		
GIS	PRM	27 Jun. 2013		
CHECK	JH	27 Jun. 2013		
REVIEW	GWS	27 Jun. 2013		

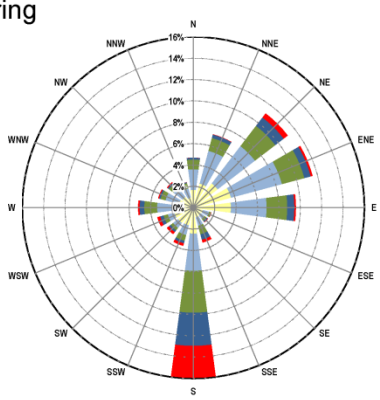
FIGURE: 14

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Schreiber\SchreiberTerraceBayPrecipitationDataSumary.mxd

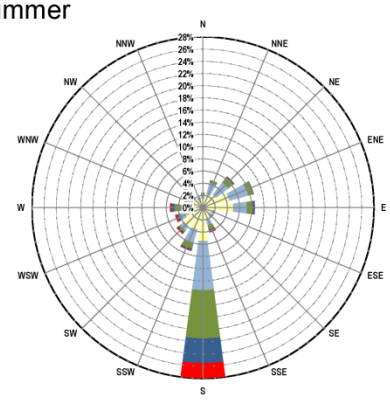
Annual



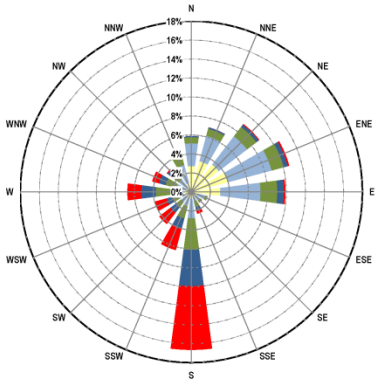
Spring



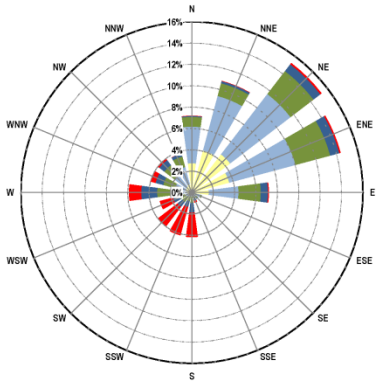
Summer



Fall



Winter



LEGEND

Wind Speed (m/s)

- >9 m/s
- 7 to 9 m/s
- 5 to 7 m/s
- 3 to 5 m/s
- 0.01 to 3 m/s

DATA SOURCE

Environment Canada

PROJECT

Environment Report
Township of Schreiber, Ontario

TITLE

Pukaskwa Annual and Seasonal Wind Rose
January 1, 2002 – December 31, 2011

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PRM	5 Apr. 2012		
GIS	PRM	27 Jun. 2013		
CHECK	JH	27 Jun. 2013		
REVIEW	GWS	27 Jun. 2013		

FIGURE: 15

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXDs\Reporting\Env_Safety_Report\Schreiber\SchreiberAnnualSeasonalWindRose.mxd

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