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SOCIÉTÉ DE GESTION DES DÉCHETS NUCLÉAIRES

Phase 1 Desktop Assessment, Environment Report

MUNICIPALITY OF CENTRAL HURON, ONTARIO

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REPORT

PHASE 1 DESKTOP ASSESSMENT

Environment Report - Municipality of Central Huron, Ontario

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1.0 INTRODUCTION

The Municipality of Central Huron in southern 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 with an informed and willing host community. The process is presently at an early stage.

Part of the process is focused on determining if there are environmental features that would preclude the potential for a facility to be constructed and operated in Central Huron. To this end, this report provides a general description of the environment in the Municipality of Central Huron. It is complemented by reports prepared in parallel that 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 geographic area used here is the same as that used for the Phase 1 Geoscientific Desktop Assessment for the Municipality of Central Huron, and is shown on Figure 1.

2.0 COMMUNITIES AND INFRASTRUCTURE

2.1 Communities

The Municipality of Central Huron is 456 km^2 in size[1] and is situated in Huron County in southwestern Ontario (LIO, 2013). The Municipality of Central Huron was formed by the amalgamation of the Town of Clinton, the Township of Hullett and the Township of Goderich on January 1, 2001 (Municipality of Central Huron, 2013). The largest settlement areas in Central Huron are Clinton and the area to the south and east of Goderich, shown on Figure 1. Other settlement areas in the Municipality include Holmesville, Kinburn and Londesborough (Municipality of Central Huron, 2010). Central Huron is located along the eastern shores of Lake Huron between the communities of Goderich and Bayfield. Figure 2 presents satellite imagery for the area taken in 2006. Table 1 summarizes the total population and population density for the Town of Clinton and the Municipality of Central Huron.

Table 1: Population Statistics for the Municipality of Central Huron

Political Boundary	Population	Population Density per km^2
Clinton	3,114	739
Central Huron	7,591	16

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

Central Huron is located in the centre of Huron County. Land ownership within the Municipality of Central Huron, including areas of privately owned land, Crown land[2], parks, wildlife management areas and conservation areas, is shown on Figure 3.

There are a number of First Nation and Métis communities in the vicinity of Central Huron including the Chippewas of Kettle and Stony Point, Aamjiwnaang, Walpole Island, Six Nations and the Saugeen Ojibway Nations. The Georgian Bay Council of the Métis Nation of Ontario are in the vicinity. The Historic Saugeen Métis are also located in the vicinity.

2.2 Infrastructure

Figure 1 shows the location of the primary infrastructure corridors in the Municipality of Central Huron. The main transportation routes through Central Huron include Highway 8, which passes through the Municipality on a northwest-southeast orientation, through the community of Clinton and to Goderich. As well, Highway 21 runs from north to south along the western boundary of the Municipality, following the Lake Huron shoreline. Highway 4 runs northward up to the community of Clinton. A railway runs through Central Huron from Goderich to Clinton en route to Georgetown via Stratford. A railway line also branches from Clinton south to Exeter, parallel to Highway 4.

A number of transmission lines cross through the Municipality of Central Huron. These include: a 500 kV transmission line running from north to south, approximately 5 km east of the Lake Huron shoreline; a 115 kV

[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 Non-freehold Disposition Public and Unpatented Public Land. Crown Leased land is acquired by OMNR 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 OMNR (OMNR, 2013a).

transmission line running southeast from Goderich to north of Seaforth; and a 230 kV transmission line running parallel to the easternmost boundary of the Municipality. A natural gas pipeline crosses Central Huron in a south easterly direction from Goderich through Clinton and along the southern boundary of the Municipality. As shown on Figure 1, the closest airport to the Municipality of Central Huron is located in Goderich. There is one active landfill in the Municipality of Central Huron; the Mid-Huron Landfill located near Holmesville (MOECC, 2013a). The Blyth-Hullet Landfill located near Blythe is currently inactive but could be reopened for use in the future. Within the Municipality of Central Huron, there is a Waste Water Treatment Plant (WWTP) located in Clinton.

2.3 Protected Areas

2.3.1 Parks and Reserves

There is one provincial wildlife management area, two conservation areas and one nature reserve in the Municipality of Central Huron. Figure 4 shows the location of these protected areas. The Hullet Wildlife Management Area, located northeast of the Town of Clinton, was acquired by the Ontario Ministry of Natural Resources (OMNR) in the 1970s for the purposes of conserving and expanding wetlands in southwestern Ontario. It also provides day use for recreation such as hiking and bird watching (OMNR, 2014). The two conservation areas within the Municipality of Central Huron are the Naftels Creek and Black's Point conservation areas. Both of these are located in the northwestern portion of the Municipality. They have a combined area of about 0.5 km^2. The George G. Newton Nature Reserve is a 0.4 km^2 property, formerly a farm, currently owned by the Federation of Ontario Naturalists.

There is a provincial park and a nature reserve located beyond the geographic boundaries of the Municipality of Central Huron. The Point Farms Provincial Park is 3 km^2 in size; it is classed as a recreation park and is located 6 km north of the Municipality of Central Huron along the shore of Lake Huron. The park offers day use and overnight camping (Ontario Parks, 2009). The Morris Tract Provincial Nature Reserve, located east of Goderich is 0.6 km^2 in size and has trails for hiking (Ontario Parks, 2002). There are an additional 13 conservation areas located in the area immediately surrounding Central Huron.

2.3.2 Heritage Sites

The cultural heritage screening examined known archaeological and historic sites in the Municipality of Central Huron, using the Ontario Archaeological Sites Database through Past Portal, the Ontario Heritage Trust Database, Huron Counties Online Interactive Mapping, the Parks Canada Database and the National Historic Sites Database. There are 20 registered archaeological sites in the Municipality of Central Huron (OMTCS, 2015). There are 17 properties designated as municipal or provincial heritage sites (Huron County, 2015; OHT, 2015) and no federally designated historic sites (Parks Canada, 2015). Additionally, there are no conservation easements or heritage districts currently administered by the Ontario Heritage Trust in the Municipality of Central Huron.

Of the 20 archaeological sites, ten are recorded as early (Pre-Contact) campsites or findspots, but no cultural affiliation or time period can be established. Four archaeological sites have been identified as Middle or Late Woodland sites; three are campsites and one is a Late Woodland village. Two archaeological sites have more than one occupational time period (historic Euro-Canadian and Pre-Contact) and one site is identified as a historic Euro-Canadian homestead. No information is given for the three remaining sites.

Of the 17 designated municipal or provincial heritage properties within the Municipality of Central Huron, 14 are located within the Town of Clinton. The remaining properties include the Ball Chapel and private cemetery, located on Balls Line, and Ball's Bridge, located off County Road 8.

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 presence of local heritage sites would need to be further confirmed in discussion with the community and First Nation and Métis communities in the vicinity.

2.4 Land Use

Land use described in this section refers to commercial land use such as forestry, mining, trapping and agriculture, but not recreational or Aboriginal spiritual use. The Municipality of Central Huron contains residential development largely within or near town centres, whereas the rural landscape is dominated by agriculture with some areas of aggregate extraction (Municipality of Central Huron, 2010). Central Huron is also a popular tourist destination.

Agriculture is the largest single land use in the Municipality of Central Huron. More than 85% of the land in the Municipality of Central Huron is classified as Class One, Two or Three in the Canada Land Inventory of agricultural capability (Municipality of Central Huron, 2010). The use of agricultural lands includes farming of all types and industrial and commercial activities related to agriculture (Municipality of Central Huron, 2010).

Urban and settlement areas cover 6.4 km^2 or 1.4% of land area in the Municipality of Central Huron (LIO, 2013). Recreational and rural residential areas in Central Huron are near the Lake Huron shoreline and in limited parts of river valleys and north of Bayfield. These include permanent and seasonal residential developments, including campgrounds, trailer parks, golf courses, parks and open space and other recreational commercial uses. The lakeshore is important because of recreational, residential and tourist uses that it offers (Municipality of Central Huron, 2010).

There are no Forest Management Units[3] (FMUs) assigned by the Ontario government for this part of the province. Forests are managed jointly by the OMNR, municipalities and Conservation Authorities. As shown on Figure 5, the portion of the Municipality of Central Huron occupied by forest cover is approximately 47 km^2 of woodlands or 10% of the land coverage (LIO, 2013).

As shown on Figure 6, there are 35 sand and gravel pits in the Municipality of Central Huron, covering a total area of approximately 8.5 km^2 or 2% of the land area (Municipality of Central Huron, 2010). These sand and gravel pits are located along a north-south oriented band through the center of the Municipality, and correspond to the outwash channel deposits located between the Wyoming and Wawanosh moraines. Other pits are located on the southeastern and northern boundary of the Municipality. There are no bedrock quarries within the Municipality of Central Huron.

There is no record of current or past metallic mineral production and no identified exploration potential for metallic minerals within the Municipality of Central Huron. There are two known historic hydrocarbon pools in

[3] 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 (OMNR) regulations and approvals. Activities include forest management planning, harvest, forest renewal, access road construction, monitoring and reporting.

the Silurian Guelph Formation in the southwestern part of the Municipality of Central Huron. The reservoirs from these depleted pools are currently being used for gas storage (Figure 7). Locations of historic oil and gas exploration wells are also shown on Figure 7. No further economical oil or gas volumes have been reported within the Municipality of Central Huron; however, further studies would be needed to assess the potential for hydrocarbon generation. Salt beds are present in the Salina Formation beneath Central Huron and salt is currently being extracted in Goderich, immediately north of the Municipality, through underground mines and in brine wells. The Goderich mine is the largest salt mine in the world, with an annual production capacity of 9 million tonnes. It is found at a depth of approximately 550 m below ground surface (mbgs) and extends approximately 5 km from the shore beneath Lake Huron (Sifto, 2013; Compass, 2013).

As noted in Section 3.3, other land uses include hunting and trapping on private land (Ontario Fur Managers Federation, 2014).

3.0 DESCRIPTION OF THE ENVIRONMENT

3.1 Physiography

The Municipality of Central Huron is located in the Western St. Lawrence Lowlands, a low relief, gently undulating land surface that occupies much of southwestern Ontario and is covered with Quaternary[4] glacial sediments. The Municipality of Central Huron lies within five physiographic regions, the boundaries of which are oriented in a general north-south direction, parallel to the Lake Huron shoreline. The Huron Fringe physiographic region makes up the narrow westernmost strip of the Municipality, along the shoreline of Lake Huron. East of the Huron Fringe, covering a slightly wider belt is the Huron Slope which is characterized by a sand plain and bevelled till plain. The central portion of the Municipality lies within the Horseshoe Moraines, an array of moraines and spillways, which cover the majority of the Municipality. The Stratford Till Plain covers the easternmost part of the Municipality. The Teeswater Drumlin Field is located to the northeast and occupies a very small part of the Municipality (Chapman and Putnam, 2007). The land surface within Central Huron ranges from a maximum of about 366 metres above sea level (masl) to a minimum of about 176 masl along the shores of Lake Huron. The land surface shows a general downward slope from east to west towards Lake Huron.

Relief within the Municipality is undulating to hummocky in areas, characterized by the deposits of the Wyoming and Wawanosh moraines, while low relief areas are present along the Lake Huron shoreline. A narrow band of locally higher elevation runs parallel to the shoreline and represents the north-south trending crest of the Wyoming moraine and shoreline scarps to the west. Narrow gullies up to 20 m deep are encountered along the small streams flowing from the west side of the Wyoming moraine, through the Huron Slope physiographic region, and into Lake Huron on the western edge of the Municipality (ABMVSPR, 2014a,b). The Maitland River has also cut a well-defined valley along the northern boundary of the Municipality.

Figure 8 presents the topography of Central Huron as a digital elevation model (DEM).

3.2 Geology

3.2.1 Bedrock Geology

The bedrock geology of southern Ontario consists of a thick Paleozoic sedimentary sequence from Cambrian to Mississippian in age, deposited approximately 540 to 329 million years ago (Johnson et al., 1992). As shown on Figure 7, the uppermost Paleozoic sedimentary stratigraphy within the Central Huron area includes the Dundee and Lucas Formations of Middle Devonian age. This sedimentary sequence lies unconformably over the Precambrian crystalline basement of the Grenville Province. The Grenville Province, comprises 2,690 million to 990 million year old metamorphic rocks deformed during orogenic events 1,210 million to 970 million years ago (Percival and Easton, 2007; White et al., 2000).

The Paleozoic succession underlying the Central Huron area was deposited in the Michigan Basin, a broadly circular intracratonic basin centred in Michigan. The Paleozoic succession has a maximum thickness of approximately 4.8 km at the centre of the Michigan Basin, and is approximately 900 m thick east of the Municipality of Central Huron. The Paleozoic strata dip gently (3.5 to 12 m/km) to the west or southwest throughout the Ontario portion of the Michigan Basin (Armstrong and Carter, 2006). The Paleozoic sedimentary stratigraphy in Central Huron includes mostly layers of shale, carbonate and evaporate units (Johnson et al.,

[4] Quaternary refers to the last 2.6 million years of Earth's history.

1992; Armstrong and Carter, 2006). Within the Salina Formation of this sedimentary stratigraphy, salt beds are present beneath Central Huron. Note both the Paleozoic sedimentary rocks and the underlying Precambrian crystalline rock basement extend beneath Lake Huron.

3.2.2 Quaternary Geology

The Quaternary geology of the Municipality of Central Huron is shown on Figure 6. The Municipality of Central Huron is almost entirely covered by overburden, which includes glacial till, glaciofluvial outwash and ice-contact deposits, forming hummocky topography. Exposed bedrock is only found within the channel of the Maitland River along the northwestern boundary of the Municipality. The eastern part of the Municipality includes a portion of the low relief Stratford Till Plain and adjacent fine-grained glaciolacustrine deposits. The central part of the Municipality of Central Huron is dominated by the Wawanosh moraine, characterized by an area of interbedded till and glaciofluvial ice-contact deposits. Two east-west trending eskers are present in this area. In the western part of the Municipality of Central Huron, the Wyoming moraine forms well-defined north-south ridge crests parallel to the Lake Huron shoreline. A broad, low area of glaciofluvial outwash sediments borders its eastern flank, separating it from the Wawanosh moraine to the east. Outwash is also found locally within the Bayfield River valley, and more extensively within the Maitland River valley. On the western flank of the Wyoming moraine, gravelly-sandy glaciolacustrine beach deposits are present in the area that slopes down towards the lake. The narrow strip of land running along the Lake Huron shoreline is characterized by a bevelled till plain (Cooper and Fitzgerald, 1977).

3.3 Natural Environment

3.3.1 Natural Environment Overview

Within the Municipality of Central Huron there is a diversity of undeveloped natural areas. While some of these areas are generic in nature, there are several protected natural areas associated with the Maitland River, the Bayfield River and the shore of Lake Huron. Natural areas support an abundance of plants and animals, some of which have special status or designations. The following sections describe the protected natural areas, the terrestrial ecology and aquatic ecology, with a focus on rare and endangered species that may be most sensitive to impacts from alterations or changes to the landscape.

3.3.2 Natural Areas

As noted in Section 2.3.1, there is one Provincial Wildlife Management Area, two conservation areas and no Provincial Parks within the Municipality of Central Huron. As shown by the star symbols on Figure 9, the Municipality of Central Huron also contains five Areas of Natural and Scientific Interest (ANSI) (two Earth Science sites and three Life Science sites), three International Biological Program sites, and 25 wetlands (three of which are Provincially Significant Wetlands (PSWs)). All significant natural areas are listed in Table 2 and shown on Figure 9.

Many of the natural areas contain features or boundaries that form part of larger wetland complexes including the Goderich Wetland Complex and the Hullet Wetland Complex. In addition to provincially and federally designated areas, the Municipality of Central Huron has also designated ecologically important areas. Schedule B of the Municipality of Central Huron Official Plan (Municipality of Central Huron, 2010) includes several areas of "*Natural Environment Full Protection*" and "*Natural Environment Limited Protection*", the largest of which is associated with the Hullet Wildlife Management Area, east of the Town of Clinton. Although Central Huron falls under the jurisdiction of the Ausable Bayfield Conservation Authority (ABCA) and the Maitland Valley

Conservation Authority (MVCA), both Conservation Areas found within Central Huron are owned by the MVCA. These Conservation Authorities are shown on Figure 9.

Wetlands identified in the Land Information Ontario (LIO) data are shown on Figure 10 (LIO, 2013). The Municipality of Central Huron contains approximately 4,000 ha of wetlands, representing 8.8% of the land coverage. Future studies may also identify additional wetland areas. 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).

Table 2: ANSIs, Earth and Life Science Sites, Wetlands and International Biological Program Sites within the Municipality of Central Huron

Number (Figure 9)	Area Name	Area Type	Source
1	Seaforth-Wawanosh Moraines	Earth Science ANSI	NHIC
2	Holmesville Area Moraines	Earth Science ANSI	NHIC
3	Bayfield North	Life Science ANSI	NHIC
4	Bayfield River	Life Science ANSI	NHIC
5	Maitland River Valley	Life Science ANSI	NHIC
6	Hullet Wildlife Management Area	Provincial Wildlife Area	NHIC, Central Huron Official Plan
7	Bayfield River Valley - Western Section	International Biological Program site	NHIC
8	Bayfield River Valley - Eastern Section	International Biological Program site	NHIC
9	Varna Deciduous Forest	International Biological Program site	NHIC
10	Tricks Creek Swamp	Provincially Significant Wetland	NHIC
11	Hullet Marsh Complex	Provincially Significant Wetland	NHIC
12	Holmesville Creek Complex	Provincially Significant Wetland	NHIC
13	Goderich 51A- Wetland	Wetland	NHIC
14	Goderich 51D- Wetland	Wetland	NHIC
15	Hullet 23AB - Wetland	Wetland	NHIC
16	Hullet 21B2 - Wetland	Wetland	NHIC
17	Hullet 21B1- Wetland	Wetland	NHIC
18	Goderich 51H - Wetland	Wetland	NHIC
19	Goderich 51F - Wetland	Wetland	NHIC
20	Goderich 51C - Wetland	Wetland	NHIC
21	Goderich 51B - Wetland	Wetland	NHIC
22	Goderich 24F - Wetland	Wetland	NHIC
23	Goderich 24E - Wetland	Wetland	NHIC
24	Goderich 24B - Wetland	Wetland	NHIC
25	Hullet 28A - Wetland	Wetland	NHIC
26	Hullet 24J - Wetland	Wetland	NHIC

Number (Figure 9)	Area Name	Area Type	Source
27	Hullet 24H - Wetland	Wetland	NHIC
28	Hullet 24F - Wetland	Wetland	NHIC
29	Hullet 24E - Wetland	Wetland	NHIC
30	Hullet 24D - Wetland	Wetland	NHIC
31	Hullet 24C - Wetland	Wetland	NHIC
32	Hullet 24B - Wetland	Wetland	NHIC
33	Hullet 24A - Wetland	Wetland	NHIC

3.3.3 Terrestrial Features and Wildlife

The Municipality of Central Huron lies within the Deciduous Forest Region where woodlands consist primarily of American beech (*Fagus grandifolia*) and sugar maple (*Acer saccharum*), together with basswood (*Tilia americana*), red maple (*Acer rubrum*) and oak (*Quercus spp.*) on the northern limit of the Carolinian Forest (CCC, 2013). In areas where agriculture dominates, terrestrial features and areas are generally associated with valley lands along water courses and within wetlands. As noted in Section 2.4, forests are managed jointly by the OMNR, municipalities and Conservation Authorities. The portion of Central Huron occupied by forest cover is approximately 4,711 ha of woodlands or 10% of the land coverage (LIO, 2013), as depicted on Figure 9. The MVCA overall natural area cover is 19% with forests comprising 17% according to the forest cover assessment conducted in 1999 (MVCA, 2013a). The species of trees most common in these forests are maples (*Acer spp.*), ash (*Fraxinus spp.*) and hemlock (*Tsuga canadensis*). Timber harvest was estimated at 4% of the private forest land base, which is considered to be sustainable (Bowles et al., 2009). Within the jurisdiction of the ABCA, forests cover 13% of the watershed where many scattered woodlots run in a pattern perpendicular to the streams, in small areas of flood plain or wetlands and the backs of farms in broken mid-concession corridors (ABCA, 2013). The forests associated with the Bayfield River are extensive relative to other watersheds in southern Ontario, but still lower than the percentage cover suggested by Environment Canada for healthy watersheds (Schnaithmann et al., 2012).

The Municipality of Central Huron falls primarily within Wildlife Management Units[5] (WMU) 85a, 85b and 85c (OMNR, 2013a). WMUs are assigned based on the presence of important sustaining areas for wildlife such as feeding, wintering and calving sites for deer, and concentration and nesting areas for raptors, herons and waterfowl. There is a lower diversity of furbearers than is typically encountered in northern Ontario but beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*) are harvested by trappers – predominantly on privately owned lands. Hunting of white-tailed deer (*Odocoileus virginianus*), waterfowl and wild turkey (*Meleagris gallopava*) is common in permitted areas.

3.3.4 Aquatic Features and Fish

Central Huron is located within the Maitland and Ausable watersheds. The Municipality of Central Huron is adjacent to the shores of Lake Huron, but it does not include Lake Huron itself. The inland waters of the Municipality of Central Huron fall within Fisheries Management Zone[6] (FMZ) 16 (OMNR, 2013b). In the Bayfield River at least 45 species of fish and 14 species of mussels have been confirmed (Schnaithmann et al., 2012).

[5] Geographic units of land on which the Ontario Ministry of Natural Resources (OMNR) bases the sustainable management of species, hunting seasons and harvest limits.

[6] 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.

Fish that are commonly found in the Maitland River include rainbow trout (*Oncorhynchus mykiss*) chinook salmon (*Oncorhynchus tshawytscha*) and smallmouth bass (*Micropterus dolomieu*) (MVCA, 2013b). Water bodies occurring within the Municipality of Central Huron are mostly streams and rivers that are warm water tolerant, with some cool and cold water aquatic habitat in the tributaries.

Aquatic habitats (not including wetlands) depicted on Figure 10 represent approximately 615 ha or 1% of the Municipality of Central Huron according to LIO data (LIO, 2013). The water bodies noted are actively managed and support provincial and federal biodiversity initiatives as well as supporting local sport fishing and tourism. Fish and fish habitat are managed by the OMNR 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 OMNR for each area, 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

Although Central Huron is primarily an agricultural landscape, it is located at the transition of Ontario forest zones and in line with known bird migration routes along the eastern shore of Lake Huron. Therefore, the area has been subject to a large number of studies designed to understand and describe the ecology and habitats of this area. This research, based on a combination of range mapping and verified records, has resulted in the identification and recording of a number of Species at Risk (SAR) within this area. Habitats within Central Huron have the potential to directly or indirectly support the needs of 57 designated SAR listed under the provincial *Endangered Species Act* (ESA) (Government of Ontario, 2007), or the federal *Species at Risk Act* (SARA) (Government of Canada, 2002). All SAR potentially occurring within Central Huron are included in Table 3.

Species listed as provincially or federally endangered (END) are significant because these species and their habitats receive the highest level of protection afforded under applicable legislation. END species potentially occurring within the Municipality of Central Huron include provincially END American badger, eastern cougar, eastern small-footed myotis (bat), little brown myotis (bat), northern myotis (bat), barn owl, Henslow's sparrow, loggerhead shrike, yellow-breasted chat, queensnake, wood turtle, American eel, redside dace, shortnose cisco, gypsy cuckoo bumble bee, American ginseng and butternut, and the federally END tricolored bat, lake chubsucker pugnose shiner and wavy-rayed lampmussel. An additional 14 species are classified as provincially THR (and THR, SC or not classified federally), and 20 species are classified as provincially SC (and THR, SC or not classified federally) within the Municipality of Central Huron.

The ranges of SAR are generally identified through a reference grid and require detailed field study to precisely determine if a listed species or its habitat occurs in a specific location. Fragmentation of the landscape for agriculture has resulted in potential range shifts of many species, and made them concentrated within the remaining natural areas such as those listed in Table 2. Of the SAR mammals, the four bat species or their habitat are likely to be encountered while the other mammals are considered less common and are often secretive. There are 22 bird species listed in Table 3, of which some of the grassland birds such as bobolink and eastern meadowlark are most likely to be encountered in the habitats of Central Huron. Other birds in Table 3 may be associated with water, wetlands or forests, which are less abundant in the landscape of Central Huron. Many of the turtles and snakes listed are associated with wet habitats, except for the milksnake. Milksnake will

use a variety of natural or disturbed upland habitats. Fish and other aquatic species associated with Lake Huron are included in Table 3 because they may occasionally venture into connecting rivers. Inland aquatic species are mapped for each conservation authority by Conservation Ontario (CO, 2012). Two butterflies are listed in Table 3, of which the monarch is common and likely to be found in many field habitats of Central Huron. Except for tuberous Indian-plantain, which prefers wet meadows and shoreline fens, the plants listed in Table 3 are mostly associated with woodlands.

More recent occurrences of species at risk may be on record with the OMNR and available 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 could be developed in future through specific data requests to agencies and field investigations.

With reference to Table 3, there were no species of mosses or lichens identified as END, THR or SC within the Municipality of Central Huron.

Table 3: Potential Endangered, Threatened and Special Concern Species in the Municipality of Central Huron

Common Name	Scientific Name	ESA Status[1]	SARA (Schedule)[2]	Source[3]
Mammals				
American badger *jacksoni* subspecies	*Taxidea taxus jacksoni*	END	END	NHIC, OMNR
Eastern cougar	*Puma concolor*	END		OMNR
Eastern small-footed bat	*Myotis leibii*	END		BCI
Grey fox	*Urocyon cinereoargenteus*	THR	THR	ROM
Little brown myotis	*Myotis lucifugus*	END	END	BCI
Northern myotis	*Myotis septentrionalis*	END	END	BCI
Tri-colored bat	*Perimyotis subflavus*		END	BCI
Birds				
Bald eagle	*Haliaeetus leucocephalus*	SC		NHIC, OBBA
Bank swallow	*Riparia riparia*	THR		OMNR
Barn owl	*Tyto alba*	END	END	OMNR
Barn swallow	*Hirundo rustica*	THR		OBBA
Black tern	*Chlidonias niger*	SC		NHIC, OBBA, OMNR
Bobolink	*Dolichonyx orizivorus*	THR		NHIC, OBBA
Canada warbler	*Wilsonia canadensis*	SC	THR	OBBA
Cerulean warbler	*Setophaga cerulean*	THR	SC	NHIC, OBBA, OMNR
Chimney swift	*Chaetura pelagica*	THR	THR	OBBA, OMNR
Common nighthawk	*Chordelies minor*	SC	THR	OBBA, OMNR

Common Name	Scientific Name	ESA Status[1]	SARA (Schedule)[2]	Source[3]
Eastern meadowlark	*Sturnella magna*	THR		OBBA
Eastern wood-pewee	*Contopus virens*	SC		OBBA
Grasshopper sparrow *pratensis* subspecies	*Ammodramus savannarum* (*pratensis* subsp)	SC		OBBA
Henslow's sparrow	*Ammodramus henslowii*	END	END	NHIC
Hooded warbler	*Setophaga citrina*		THR	ROM
Least bittern	*Ixobrychus exilis*	THR	THR	NHIC, OBBA, OMNR
Loggerhead shrike	*Lanius ludovicianus (migrans subsp)*	END	END	NHIC, OBBA
Louisiana waterthrush	*Parkesia motacilla* (formerly *Seiurus motacilla*)	SC	SC	NHIC, OMNR
Red-headed woodpecker	*Melanerpes erythrocephalus*	SC	THR	OBBA, OMNR
Short-eared owl	*Asio flammeus*	SC	SC	NHIC, OBBA, OMNR
Wood thrush	*Hylocichla mustelina*	SC		OBBA
Yellow-breasted chat	*Icteria virens virens*	END	SC	OBBA, OMNR
Herpetofauna				
Blanding's turtle - Great Lakes/St. Lawrence population	*Emydoidea blandingii*	THR	THR	OMNRF
Eastern ribbonsnake - Great Lakes Population	*Thamnophis sauritius*	SC	SC	NHIC, OMNR
Milksnake	*Lampropeltis triangulum*	SC	SC	NHIC, Herp Atlas, OMNR
Northern map turtle	*Graptemys geographica*	SC	SC	NHIC, Herp Atlas
Queensnake	*Regina septemvittata*	END	END	NHIC, Herp Atlas, OMNR
Snapping turtle	*Chelydra serpentina*	SC	SC	NHIC, Herp Atlas
Western chorus frog - Great Lakes / St. Lawrence / Canadian Shield Population	*Pseudacris triseriata*		THR	Herp Atlas
Wood turtle	*Glyptemys insculpta*	END	THR	Herp Atlas, OMNR
Fish and other Aquatic Species				
American eel	*Anguilla rostrata*	END		CO
Black redhorse	*Moxostoma duquesnei*	THR		NHIC, OMNR
Lake chubsucker	*Erimyzon sucetta*	THR	END	OMNR
Lake sturgeon - Great Lakes / Upper St. Lawrence	*Acipenser fulvescens*	THR		NHIC, OMNR, CO

Common Name	Scientific Name	ESA Status[1]	SARA (Schedule)[2]	Source[3]
Population				
Mapleleaf mussel	*Quadrula quadrula*	THR		CO
Northern brook lamprey - Great Lakes / Upper St. Lawrence Population	*Ichthyomyzon fossor*	SC	SC	NHIC, OMNR, CO
Pugnose shiner	*Notropis anogenus*	THR	END	OMNR, CO
Redside dace	*Clinostomus elongatus*	END		NHIC, OMNR, CO
Shortnose cisco	*Coregonus reighardi*	END	END	NHIC, OMNR
Rainbow mussel	*Villosa iris*	THR		OMNR, CO
River redhorse	*Moxostoma carinatum*	SC	SC	OMNR
Wavy-rayed lampmussel	*Lampsilis fasciola*	THR	END	NHIC, CO
Invertebrates				
Gypsy cuckoo bumble bee	*Bombus bohemicus*	END		OMNR
Monarch butterfly	*Danaus plexippus*	SC	SC	Butterfly Atlas, OMNR
West Virginia White	*Pieris virginiensis*	SC		OMNRF
Plants				
American ginseng	*Panax quinquefolius*	END	END	OMNR
Butternut	*Juglans cinerea*	END	END	NHIC, OMNR
Goldenseal	*Hydrastis canadensis*	THR	THR	OMNR
Green dragon	*Arisaema dracontium*	SC		NHIC, OMNR
Tuberous Indian-plantain	*Arnoglossum plantagineum*	SC	SC	NHIC, OMNR

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* (SARA) (Government of Canada, 2002)

[3] - Data obtained from the Natural Heritage Information Centre (NHIC, 2013); Ontario Ministry of Natural Resources (OMNR, 2015); Reptile and Amphibian Atlas Program (Herp Atlas) (Ontario Nature 2015); Atlas of the Breeding Birds of Ontario (OBBA) (BSC, 2006); Bat Conservation International Species Profiles (BCI, 2013a,b, 2014, 2015); Ontario Butterfly Atlas (Butterfly Atlas) (Jones et al., 2013); Mammal Atlas of Ontario (Mammal Atlas) (Dobbyn, 1994); Aquatic Species at Risk (CO, 2012)

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 are noted in Section 2.3.2. 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 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 southwestern Ontario indicate ground-level ozone and particulate matter fall within normal values compared to the national average (EC, 2013a). Table 4 provides a list of industrial facilities that reported air and water emissions through Environment Canada's National Pollutant Release Inventory (NPRI) database (EC, 2013b). The list includes sites in the areas around Walkerton, Mitchell, Goderich and Wingham that have local air emissions. Additional sources that may affect background air quality include emissions from vehicles along highways and local roads, rail operations and application of fertilizers, pesticides and/or agricultural source material (ASM) on agricultural land.

Table 4: NPRI Regional Sources of Air Emissions

NPRI ID	Facility Name	City
11440	Musashi Auto Parts Canada Inc.	Arthur
10428	Howson & Howson - Flour Mill	Blyth
7603	The Murray Group Limited - Bowman Pit Complex	Centre Wellington Township
7659	Parrish & Heimbrecker Ltd. - Centralia Facility	Centralia
10449	Fleming Feed Mill Ltd.	Clinton
10917	New-Life Mills, a division of Parrish & Heimbecker Limited - Denfield Feed	Denfield
7637	Thompsons Ltd. - Port Albert Facility	Dungannon
5897	Durham Furniture Inc. - Durham Plant	Durham
7375	Interforest Ltd. - Durham	Durham
7686	Sifto Canada - Sifto Canada-Goderich Mine	Goderich
10287	Sifto Canada Corp. - Goderich Plant	Goderich
5842	American Water Canada Corp. - Lake Huron Water Primary Supply System	Grand Bend
10935	Thompsons Ltd. - Granton Facility	Granton
11818	Cargill Limited - Cargill AgHorizons, Harriston, ON	Harriston

NPRI ID	Facility Name	City
10469	General Coach	Hensall
7634	Thompsons Ltd. - Hensall Facility	Hensall
11417	Gnutti Ltd.	Huron Park
10143	Union Gas Limited - Lobo Compressor Station	Ilderton
7098	Ontario Power Generation Inc. - Western Waste Management Facility	Kincardine
7604	The Murray Group Limited - Murphy Pit	Minto
11437	Bio Agri Mix LP - Wellington & Herbert Street	Mitchell
4411	Cooper Standard Automotive Canada Ltd. - Mitchell NVH	Mitchell
11757	FS Partners, a division of Growmark - Mitchell	Mitchell
5616	Parmalat Canada Inc. - Mitchell	Mitchell
7633	Thompsons Ltd. - Mitchell Facility	Mitchell
11904	Wallenstein Feed & Supply Ltd. - Monkton	Monkton
2068	Rothsay - Moorefield Site	Moorefield
5727	Dana Canada Corp. - Dana Mount Forest	Mount Forest
2355	Vintex Incorporated - Vintex	Mount Forest
10093	Langs Dehy Ltd.	Palmerston
10148	TG Group - TG Minto Corporation	Palmerston
5883	American Water Canada Corp. - Elgin Area Primary Water Supply System	Port Stanley
11817	Bluewater Agromart Ltd	Ripley
7329	Maple Leaf Consumer Foods Inc. - Cold Springs Farm	Thamesford
11521	Nutreco Canada Inc. - Shur-Gain Thamesford	Thamesford
7041	Bruce Power LP - Bruce Power	Tiverton
209	Greenfield Ethanol Inc. - Tiverton	Tiverton
2009	Energizer Canada Inc. - Production Facility	Walkerton
10751	Larsen & Shaw Ltd.	Walkerton
11797	Dufferin Construction Company A division of Holcim (Canada) - CMI Portable Asphalt Plant	Waterford
11879	Waste Management of Canada Corporation - Twin Creeks Landfill (formerly Warwick Landfill)	Watford
11673	Masterfeeds Inc. - Wingham	Wingham
2380	Wescast Industries Inc. - WCW - Wescast Casting Wingham	Wingham
7040	Wescast Industries Inc. - WCN - Wescast Casting North Huron	Wingham

3.4.2 Background Radiation

The source of background radiation in the Municipality of Central Huron is attributed to naturally occurring radioactive materials (NORM), specifically potassium, uranium and thorium-bearing minerals. The background radiation levels for the Municipality of Central Huron are presented on Figure 11. The dose rate in the Municipality of Central Huron is less than 60 nGy/h, with an average of approximately 40 nGy/h. This range of dose rates and average are consistent with regional dose rates for southwestern Ontario.

A recent survey by Health Canada of radon gas concentrations in Canadian homes shows the percentage of residences in the Huron County Health Unit testing below the national guideline of 200 Bq/m^3 to be 89%, while those testing between 200 and 600 Bq/m^3 were 10% and the remaining 1% testing above 600 Bq/m^3 (Health Canada, 2013). Additional detailed information on background radiation is available in the geophysical interpretation report (PGW, 2015).

3.4.3 Soil Quality

As noted in Section 2.4, much of the land within the Municipality of Central Huron is prime agricultural land, ranked as Class One, Two or Three in the Canada Land Inventory (CLI) (Municipality of Central Huron, 2010). Class One soils have no limitations for crops, Class Two soils have moderate limitations that restrict the range of crops or require moderate conservation practices, and Class Three have more limitations or require special conservation practices (Agri Canada, 2013). Soil concentrations for metals and other parameters are in general expected to be consistent with Ontario Typical Background ranges, as noted in Table 1 of Ontario Ministry of the Environment and Climate Change (MOECC) Regulation 153/04 (Government of Ontario, 2004).

Within developed areas where residential, commercial, industrial or agricultural activities have taken or are taking place, there is a potential for elevated soil parameters or contaminants to be present in the soils. This potential for soil contaminants to be present on particular lands would need to be assessed in future through specific agency requests and field investigations.

3.4.4 Water Quality

The Municipality of Central Huron draws its potable water from the overburden and shallow bedrock aquifers. In addition to municipal water supply, shallow groundwater also supports private domestic, agricultural and industrial use. There are six active municipal water supply well fields within the Municipality of Central Huron. These are as follows: Clinton Drinking Water System, Kelly Drinking Water System, McClinchey Drinking Water System, Auburn Drinking Water System, SAM Drinking Water System and VanderWetering Drinking Water System. The largest of these well fields is in Clinton with three shallow bedrock wells at depths of 99 m, 108 m and 110 m. For each of these water supply well fields, the monitored water quality was compared to the requirements of the Ontario *Safe Drinking Water Act* (O. Reg. 170/03) (Government of Ontario, 2003) and regulations therein (i.e., Ontario Drinking Water Standards, Objectives and Guidelines (ODWS) (Government of Ontario, 2006a)). These reports indicated that in 2012 there were no exceedances for any measured organic parameter (e.g., pesticides, herbicides, PCBs, volatile organics) or inorganic parameter (i.e., antimony, arsenic, cadmium, mercury, uranium, nitrate or nitrites) (MOECC, 2013b). In 2009, an exceedance of sodium was observed in the Kelly, McClinchey and VanderWetering Drinking Water Systems. In June and October 2012, total coliforms were detected in the Auburn Drinking Water System. In the Clinton Drinking Water system, concentrations of lead exceeded the ODWS from a sample taken within the distribution system; however, this represented less than 10% of the total samples taken from within the system, and subsequent monitoring has met the Standard (MOE, 2013b).

A groundwater study in Huron County was conducted in 2000 and 2001. Results from this study showed that a high percentage of shallow wells completed in the overburden contained *E. coli* and total coliforms in concentrations that exceeded the ODWS. Nitrates were also present in a high percentage of shallow overburden and bedrock wells. Most wells in the overburden and bedrock also contained concentrations of total dissolved iron that exceeded the aesthetic ODWS concentration of 0.3 mg/L (Huron County Planning and Development Department, 2001).

Surface water quality in Central Huron reflects traditional rural non-point source issues of nitrogen, phosphorus and bacteria (ABMVSPR, 2014a,b). Large hydrogologic events flush high concentrations of accumulated sediments, nutrients and bacteria through the hydrologic system to Lake Huron (ABMVSPR, 2014a,b).

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

3.4.5 Lake Sediment Chemistry

The desktop review did not identify any information related to sediment chemistry for inland lakes within the Municipality of Central Huron and did not consider lake sediment chemistry for Lake Huron in this report.

3.4.6 Potential Sources of Pollutants

There are a number of potential sources of pollutants in the Municipality of Central Huron including landfills, waste water treatment plants, domestic septic systems, agricultural activities, transportation corridors and local industries.

As listed in Table 5 below, there is one operating landfill site within the Municipality of Central Huron (Figure 1), the Mid-Huron Landfill (MOECC, 2013a). The Blythe-Hullet Landfill, while listed as active by the MOECC, is currently not used, but could be reopened in the future. There are also three closed landfills within Central Huron (Municipality of Central Huron, 2010). All sites are classified as small landfills.

Table 5: Registered Landfills in the Municipality of Central Huron

Certificate of Approval (C of A) Number	Site Name	Location	Status
A160701	Blyth-Hullet Landfill	Part of Lot 21, Concession 8	Open
	Client: The Corporation of the Township of North Huron	Township of Central Huron	
A161302	Mid-Huron Landfill	North 1/2 of Lot 39, Highway 4 and Highway 86, Concession 12	Open
	Client: The Corporation of the Town of Goderich	Township of Central Huron	

Source: Ontario Landfills List (MOE, 2013a)

3.5 Surface Water Hydrology

The Municipality of Central Huron is located within the St. Lawrence Drainage Area, which drains into the Atlantic Ocean through the St. Lawrence River. Surface water drainage for the Municipality of Central Huron is shown on Figure 12. Most of the northern part of Central Huron is within the Maitland tertiary watershed while the southern part is within the Ausable tertiary watershed. Drainage is generally from east to west into Lake Huron.

The most prominent drainage features in the Municipality of Central Huron are the Maitland and Bayfield rivers. The Maitland River discharges to Lake Huron at the Town of Goderich and the Bayfield River discharges to Lake Huron at the Village of Bayfield. Several tributaries in the Maitland watershed flow in a northwesterly direction as they approach the Maitland River, whereas some tributaries in the Ausable watershed flow southward towards the Bayfield River. Many smaller rivers, creeks and agricultural drains along the Lake Huron shoreline flow east

to west directly into Lake Huron. Extensive channel modification has occurred in the southern portion of the Maitland tertiary watershed and the area is characterized by flash flows following storm events (ABMVSPR, 2014b).

3.6 Groundwater and Wells

Information concerning groundwater in the Municipality of Central Huron was obtained from the MOECC Water Well Information System (WWIS) database (MOECC, 2014a). The locations of known water wells are shown on Figure 13. In addition to municipal water supply, overburden and shallow bedrock aquifers are used for rural domestic, industrial and agricultural purposes. The WWIS database contains 1,117 well records for the Municipality of Central Huron. Table 6 summarizes the number and type of wells within the Municipality.

Table 6: Water Well Record Summary for the Municipality of Central Huron

Water Well Type	Number of Wells	Total Well Depth (m)	Static Water Level (m below surface)	Tested Well Yield (L/min)
Overburden	90	1.2 to 134.1	0.3 to 33.5	7.6 to 75.7
Bedrock	1,027	7.0 to 275.0	0.3 to 96.0	3.8 to 700

3.6.1 Overburden Aquifers

There are 90 water well records in the Municipality of Central Huron that can be confidently assigned to overburden aquifers. The well yields for these wells range from 7.6 L/min to 75.7 L/min. These well yields reflect the purpose of the wells (private residential supply) and do not necessarily reflect the maximum sustained yield that might be available from overburden aquifers. The static water levels in the overburden wells ranged from 0.3 m to 33.5 m, with the largest depth-to-water being associated with thick deposits of coarse grained materials at higher elevations.

3.6.2 Bedrock Aquifers

In the Municipality of Central Huron, there are 1,027 well records that can be confidently assigned to the shallow bedrock aquifer. These wells range from 7.0 to 135.0 m in depth, with two deeper wells at 235 m and 275 m. Measured pumping rates range from 3.8 L/min to 700 L/min. Long-term groundwater yield in fractured bedrock will depend on the number and size of fractures, their connectivity, transmissivity, storage and on the recharge properties of the fracture network in the wider aquifer.

Shallow bedrock is the most important source of drinking water in the Municipality of Central Huron, and is the primary source of all the public and municipal water supplies located inland from Lake Huron. Shallow bedrock aquifers within the Municipality are composed of an aggregate of the upper few metres to over 100 m of the different shallow bedrock formations present, which typically include Middle Devonian Dundee Formation limestone and Lucas Formation dolostone and limestone. Water quantity and quality within the shallow bedrock aquifer can vary dramatically across the Municipality of Central Huron as a consequence of the different chemical and physical characteristics of the individual bedrock formations. No potable water supply wells are

known to exploit aquifers at typical repository depths in the Municipality of Central Huron or anywhere else in southern Ontario.

3.6.3 Source Water Protection

As part of the *Clean Water Act* (Government of Ontario, 2006b), source water protection areas are defined for all public drinking water supplies, both groundwater and surface water. Source water protection areas are defined for each municipal water supply and identify areas where land use constraints may apply to ensure the safety and protection of Ontario's drinking water.

For Municipal groundwater supplies, the source water protection areas are defined as Well Head Protection Areas (WHPAs). WHPAs are determined by geometrical factors and hydrogeological modelling, which considers the travel time of groundwater to a drinking water supply well. Up to five WHPAs (A to E) are defined for each well. Use restrictions for WHPAs are dependent on the WHPA zone designation and intrinsic characteristics of the aquifer.

For surface water supplies, the source water protection areas are defined as Intake Protection Zones (IPZ) based on simple geometrical factors and hydrological modelling considering surface water flow and overland flow to surface water. Two IPZs are potentially defined for each surface water source.

Figure 13 shows the extents of the WHPAs for drinking water supplies in the Municipality of Central Huron and surrounding area, based on the Source Protection Plans completed by the Ausable Bayfield Maitland Valley Source Protection Region (ABMVSPR 2015a,b). There are nine WHPAs and one IPZ located within or extending into the Municipality of Central Huron.

3.7 Climate and Meteorology

The climate assessment for the Municipality of Central Huron is based on Environment Canada's Blythe climate station 1971-2000 normals, as this is the closest station to the Municipality of Central Huron (EC, 2013c). The Blythe station has more than 30 years of continuous data required for establishing climate normals. Parameters measured at the Blythe station include temperature and precipitation. To determine local wind conditions, ten years of hourly wind records were used from Environment Canada's Goderich station, located approximately 20 km west of Blyth, just to the north of the Municipality of Central Huron.

The Municipality of Central Huron is within a temperate and humid continental climate zone, with relatively hot, humid summers and cold winters. In summer, the warmth and humidity originates from air masses that often come out of the southern United States, transporting warm, humid air northward from the Gulf of Mexico. In the fall and winter, temperatures are moderated by Lake Huron making it considerably milder than other locations in Ontario that are further inland. Spring and fall are generally mild with cool nights.

In winter, the proximity of Lake Huron results in lake effect snow squalls from east of Sarnia northward to the Bruce Peninsula. Local snow squalls or lake effect snow can affect areas much further inland, as far as 100 km or greater from the shore, but the heaviest snows usually occur within 20 to 40 km from the shoreline. In summer, active weather such as showers and thunderstorms occur in June, July and August due to weather systems moving from western Canada and from the American upper Midwest, dragging cold fronts across the region generating the active weather. Central Huron is also prone to severe thunderstorms and even occasional tornadoes during the summer.

3.7.1 Temperature

Temperature data were obtained from Environment Canada's 1971-2000 climate normals for the Blyth meteorological station (EC, 2013c). Temperature in the Municipality of Central Huron can reach highs of 37°C in summer months and lows of -36°C in winter months. Annual average temperature is 7°C, where the average summer temperature is approximately 19°C and the average temperature in winter is -6°C. Figure 14 shows monthly temperatures for Blyth, displaying the daily average, maximum and minimum and extreme values over the calendar year.

3.7.2 Precipitation

As shown on Figure 15, the annual average precipitation in the Municipality of Central Huron is 1,184 mm, where one cm of snow is considered to be equal to one mm of equivalent rainfall. The region receives an average 70 to 90 mm of precipitation each month from February to July. Higher amounts are seen from late summer through the winter months, with average monthly precipitation greater than 90 mm. The increase in precipitation is due to snow squall activity developing over the winter period, as a result of proximity to Lake Huron. Figure 15 presents monthly precipitation data obtained from Environment Canada's 1971-2000 climate normals for the Blyth meteorological station, including total rainfall, rainfall, snowfall and all-time extreme values over the calendar year (EC, 2013c).

3.7.3 Wind

Wind data has been collected from January 1, 2003 to December 31, 2012 at Environment Canada's Goderich meteorological station (EC, 2013c). South and southwest winds prevail in the Municipality of Central Huron, changing to a northwest to west direction at times. Wind flow is strongly influenced by nearby Lake Huron. There are occasional occurrences of calm wind conditions with an annual wind speed average of approximately 17 km/hr.

3.8 Natural Hazards

3.8.1 Earthquakes and Seismicity

The Municipality of Central Huron lies within the Western St. Lawrence Lowland, where Paleozoic sedimentary rock overlies Precambrian crystalline rock of the Grenville Province (Percival and Easton, 2007). The Municipality of Central Huron has a low seismic hazard rating (NRCan, 2015a). Since 1627, no earthquakes exceeding a magnitude m_N 6 have been known to occur within 300 km of the Municipality of Central Huron. According to the National Earthquake Database (NEDB), no earthquakes were recorded for the period between 1985 and 2015 within the Municipality of Central Huron (NRCan, 2015b). In summary, available literature and recorded seismic events indicate that the Municipality of Central Huron is located within an area of low seismicity.

3.8.2 Tornadoes and Hurricanes

As noted in Section 3.7.3, average annual wind speeds in the Municipality of Central Huron are approximately 17 km/hr. The Municipality of Central Huron experiences thunderstorms in the summer and is located in an area with a low to moderate tornado frequency (<2.7 tornadoes per year / 10,000 km^2), but where there is a potential for F2-F5 tornadoes (Sills et al., 2012). It is noted that an F3 tornado struck the Town of Goderich and Central Huron on August 21, 2011 (The Weather Network, 2013). The Municipality of Central Huron is located outside of the geographic area where hurricanes typically occur. The National Building Code of Canada recommends a

design 1/50 maximum[7] hourly wind pressure for the Goderich area of 0.55 kPa, which is an elevated value for southern Ontario (NRC, 2010).

3.8.3 Drought and Flooding

According to precipitation climate normals for the region (Figure 14), the Municipality of Central Huron experiences on average between 70 and 140 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 Blythe station (Figure 14) are 137 mm of rain and 51 cm of snow. 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 Municipality of Central Huron lies at the outflow of moderately sized catchment areas. This makes flooding a potential risk along some rivers and creeks in the Municipality of Central Huron. 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 15, the Municipality of Central Huron receives on average about 350 cm of snowfall per year, primarily between the months of November and March. No single month receives an average snowfall greater than 103 cm. The highest single day snowfall accumulation on record is 51 cm, recorded on December 11, 2000. The National Building Code of Canada recommends a design 1/50 snow load (S_s + S_r)[8] for the Goderich area of 2.7 kPa, which are typical values for southern Ontario (NRC, 2010). Local lakes and water bodies freeze over in the winter months in the Municipality of Central Huron, as average daily temperatures from December to March typically range from -8 to -2^{o}C. The central part of Lake Huron normally does not freeze over in winter, but drifting patches of thin ice may be present from early February until mid-March.

3.8.5 Forest Fires and Lightning

As land use in the Municipality of Central Huron is largely agricultural, with only 10% of land coverage being wooded, there is a small risk of forest fires. Information on the location of past forest fires in the Municipality of Central Huron was not available. In wooded areas, fires can be initiated by lightning strikes or human activity, particularly if dry conditions are present. As previously noted, thunderstorms do occur in the Municipality of Central Huron and lightning strikes are not uncommon in the summer months.

3.8.6 Landslides and Tsunamis

Generally low topographic relief and low seismicity result in a low landslide risk in the Municipality of Central Huron. There is a low risk of tsunamis in the Municipality of Central Huron along the immediate Lake Huron shoreline, owing to low seismicity and the geology of the lake basin and near shore areas.

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

[8] 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 Municipality of Central Huron.

Situated in Huron County along the eastern shore of Lake Huron, the Municipality of Central Huron is 456 km^2 in size, with a population of 7,951 (Statistics Canada, 2013). The climate in Central Huron is a temperate and humid continental climate that is characterized by hot, humid summers and cold winters. Central Huron receives most of its yearly precipitation between August and January.

There are a number of First Nation and Métis communities in the vicinity of Central Huron including the Chippewas of Kettle and Stony Point, Aamjiwnaang, Walpole Island, Six Nations and the Saugeen Ojibway Nations. The Georgian Bay Council of the Métis Nation of Ontario are in the vicinity. The Historic Saugeen Métis are also located in the vicinity.

Geologically, the Municipality of Central Huron is entirely covered by overburden, which includes glacial till, glaciofluvial outwash and ice-contact deposits, forming hummocky topography. The eastern half of the Municipality of Central Huron is dominated by the Wawanosh moraine, characterized by an area of interbedded till and glaciofluvial ice-contact deposits. The Wyoming moraine forms well-defined north-south ridge crests parallel to the Lake Huron shoreline (Cooper and Fitzgerald, 1977). The bedrock geology in Central Huron consists of a thick Paleozoic sedimentary sequence, deposited approximately 540 to 329 million years ago. The sedimentary stratigraphy includes layers of mostly shale, carbonate and evaporate units (Johnson et al., 1992). This sedimentary sequence lies unconformably over the Precambrian crystalline basement, characterized by gneisses and metamorphic rocks of the Grenville Province (Percival and Easton, 2007; White et al., 2000).

There is no record of current or past metallic mineral production and no identified exploration potential for metallic minerals within the Municipality of Central Huron; however there are two known historic hydrocarbon pools in the Silurian Guelph Formation in the southwestern part of the Municipality. No further economical oil or gas volumes have been reported. Salt beds are present beneath the Municipality of Central Huron and salt is currently being extracted in Goderich, immediately north of the Municipality, through underground mines and in brine wells. There are 35 sand and gravel pits in the Municipality of Central Huron, covering an area of approximately 8.5 km^2, approximately 2% of the land area (Municipality of Central Huron, 2010).

Infrastructure within the Municipality of Central Huron includes numerous roads, including Highway 8, which passes through the centre of the area in a northwest-southeast orientation through the community of Clinton, as well as Highway 21 along the Lake Huron shoreline. A railway runs through Central Huron from Goderich to Clinton and south towards Stratford. Several electrical transmission lines run through the Municipality. The closest airport to the Municipality of Central Huron is located in Goderich. A natural gas pipeline passes through the Municipality, roughly alongside the Goderich to Clinton railway.

There are no provincial parks, two conservation areas and one provincial wildlife area in the Municipality of Central Huron. The Point Farms Provincial Park, approximately 3 km^2 in size is located 6 km north of the Municipality on the shore of Lake Huron. The Morris Tract Provincial Nature Reserve is located to the east of Goderich just outside of the Municipality.

Central Huron lies within the Deciduous Forest Region where woodlands consist primarily of beech and sugar maple, together with basswood, red maple and oak on the northern limit of the Carolinian Forest (CCC, 2013). In areas where agriculture dominates, terrestrial features and areas are generally associated with valley lands

along watercourses and within wetlands. There are no Forest Management Units assigned by the Ontario government for this part of the province. Forests are managed jointly by the OMNR, municipalities and Conservation Authorities. The portion of Central Huron occupied by forest cover is approximately 76 km^2 of woodlands or 10% of the land coverage (LIO, 2013).

The Municipality of Central Huron falls primarily within Wildlife Management Units (WMU) 85a, 85b and 85c (OMNR, 2013b). WMU contain important sustaining areas for wildlife such as feeding, wintering and calving sites for deer and concentration and nesting areas for raptors, herons and waterfowl. Hunting of white-tailed deer, wild turkey and waterfowl is common in permitted areas within the Municipality of Central Huron.

Habitats within the Municipality of Central Huron have the potential to directly or indirectly support the needs of some 57 designated species at risk (SAR) listed under the provincial *Endangered Species Act* (ESA) (Government of Ontario, 2007), or the federal *Species at Risk Act* (SARA) (Government of Canada, 2002). Endangered species potentially occurring within the Municipality of Central Huron include provincially endangered American badger, eastern cougar, eastern small-footed myotis (bat), little brown myotis (bat), northern myotis (bat), barn owl, Henslow's sparrow, loggerhead shrike, yellow-breasted chat, queensnake, wood turtle, American eel, redside dace, shortnose cisco, gypsy cuckoo bumble bee, American ginseng and butternut and federally endangered (but not provincially endangered) tricolored bat, lake chubsucker, pugnose shiner and wavy-rayed lampmussel.

The Municipality of Central Huron is located within the St. Lawrence Drainage Area. The most prominent drainage features in the Municipality of Central Huron are the Maitland and Bayfield rivers. The Maitland River discharges to Lake Huron at the Town of Goderich and the Bayfield River discharges to Lake Huron at the Village of Bayfield. Many smaller rivers, creeks and agricultural drains along the Lake Huron shoreline flow east to west directly into Lake Huron. Forty-five species of fish and 14 species of mussels have been confirmed in the Bayfield River (Schnaithmann et al., 2012). The Maitland River supports recreational fishing including rainbow trout, salmon and smallmouth bass (MVCA, 2013b). The Municipality of Central Huron contains approximately 4,000 ha of wetlands, which is 8.8% of the land coverage.

Potable water in the Municipality of Central Huron for municipal, rural domestic, agricultural and industrial use is drawn from the overburden and shallow bedrock aquifers. The MOECC Water Well Information System database 1,117 well records for the Municipality of Central Huron. There are no records of water wells sourcing potable water aquifers at repository depths in the Municipality of Central Huron.

Air, soil and surface water quality within the Municipality of Central Huron are expected to be within the normal range for southwestern Ontario, aside from areas that might be influenced locally by anthropogenic sources. Sources of background radioactivity in Central Huron 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 southwestern Ontario.

The Ontario Archaeological Sites Database through Past Portal identified 20 known archaeological sites in the Municipality of Central Huron. Sites identified at the periphery of the Municipality of Central Huron include early (Pre-Contact) campsites, Middle to Late Woodland sites and historic Euro-Canadian sites (OMTCS, 2015). There are 17 municipal or provincial designated heritage properties in the Municipality of Central Huron. The presence of local heritage sites would need to be confirmed in discussion with the community and First Nation and Métis communities and organizations in the vicinity.

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Report Signature Page

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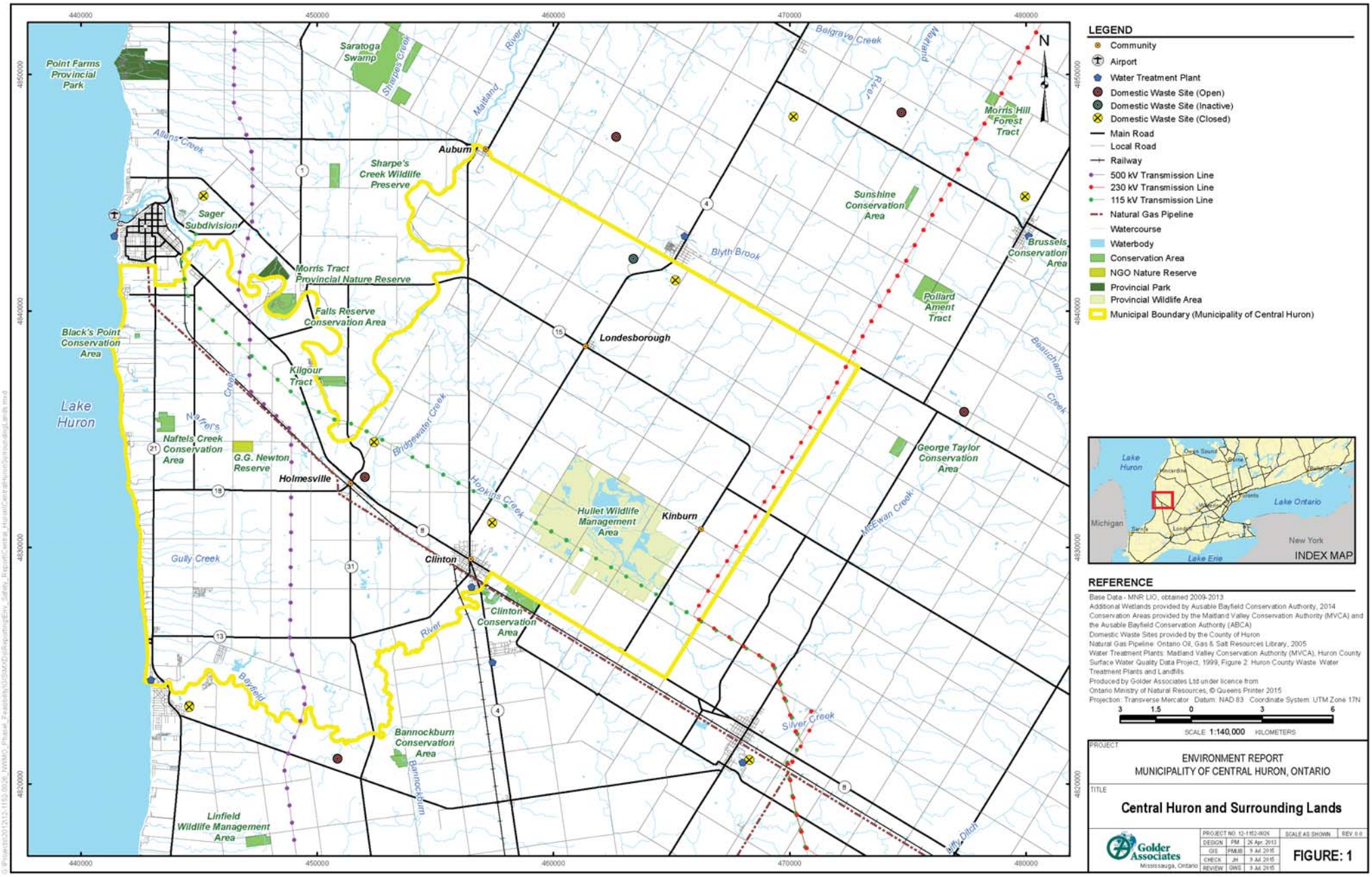
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FIGURES



LEGEND

- Community
- Airport
- Water Treatment Plant
- Domestic Waste Site (Open)
- Domestic Waste Site (Inactive)
- Domestic Waste Site (Closed)
- Main Road
- Local Road
- Railway
- 500 kV Transmission Line
- 230 kV Transmission Line
- 115 kV Transmission Line
- Natural Gas Pipeline
- Watercourse
- Waterbody
- Conservation Area
- NGO Nature Reserve
- Provincial Park
- Provincial Wildlife Area
- Municipal Boundary (Municipality of Central Huron)

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Additional Wetlands provided by Ausable Bayfield Conservation Authority, 2014
Conservation Areas provided by the Maitland Valley Conservation Authority (MVCA) and the Ausable Bayfield Conservation Authority (ABCA)
Domestic Waste Sites provided by the County of Huron
Natural Gas Pipeline: Ontario Oil, Gas & Salt Resources Library, 2005
Water Treatment Plants: Maitland Valley Conservation Authority (MVCA), Huron County Surface Water Quality Data Project, 1999, Figure 2: Huron County Waste Water Treatment Plants and Landfills.
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

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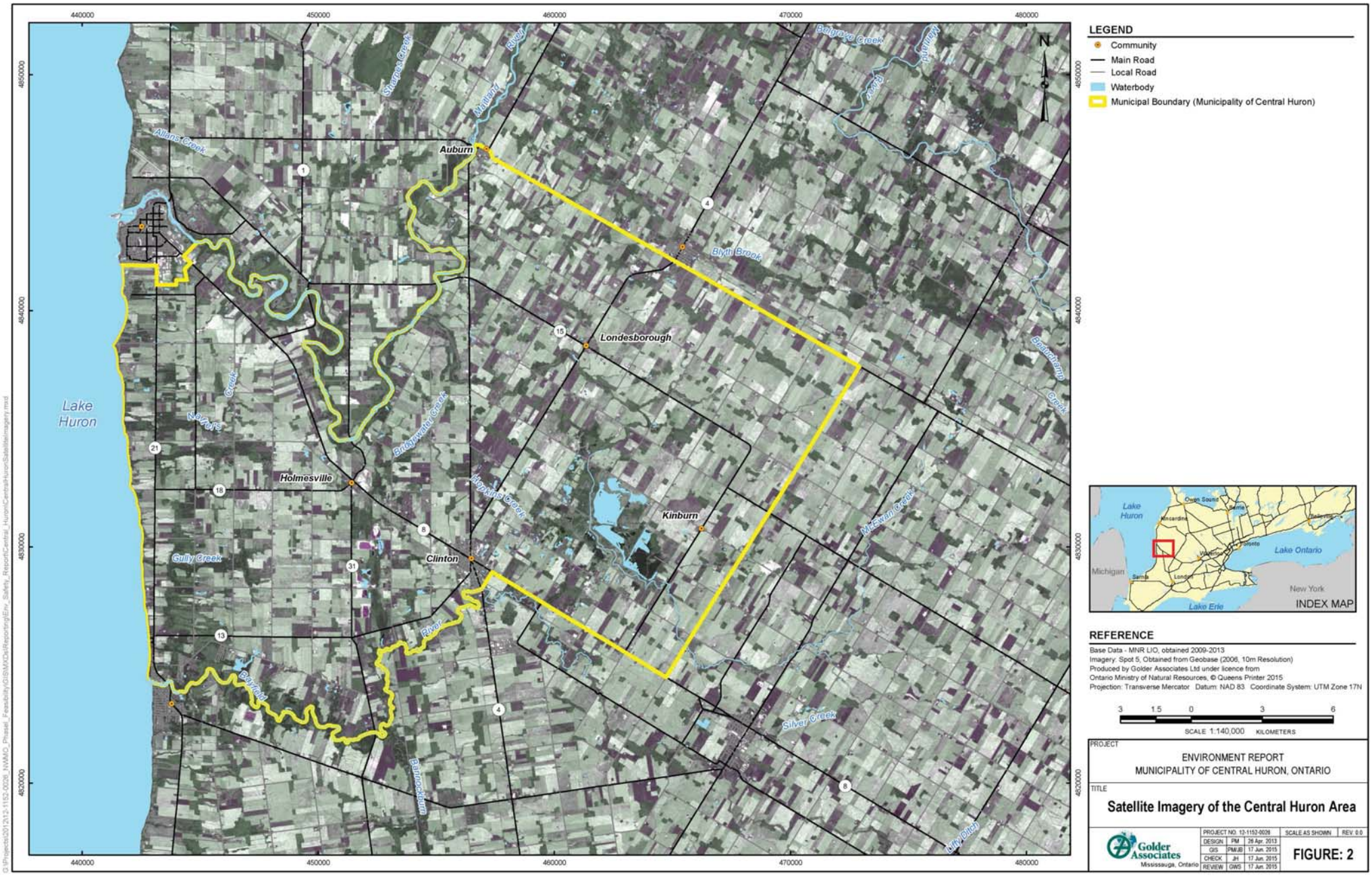
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

TITLE
Central Huron and Surrounding Lands

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0024			SCALE AS SHOWN	REV 0.0
DESIGN	PM	26 Apr. 2013	
GIS	PMUB	9 Jul. 2015	
CHECK	JH	9 Jul. 2015	
REVIEW	GWS	9 Jul. 2015	

FIGURE: 1



LEGEND

- Community
- Main Road
- Local Road
- Waterbody
- Municipal Boundary (Municipality of Central Huron)

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Imagery: Spot 5, Obtained from Geobase (2006, 10m Resolution)
Produced by Golder Associates Ltd under licence from
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Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

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PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

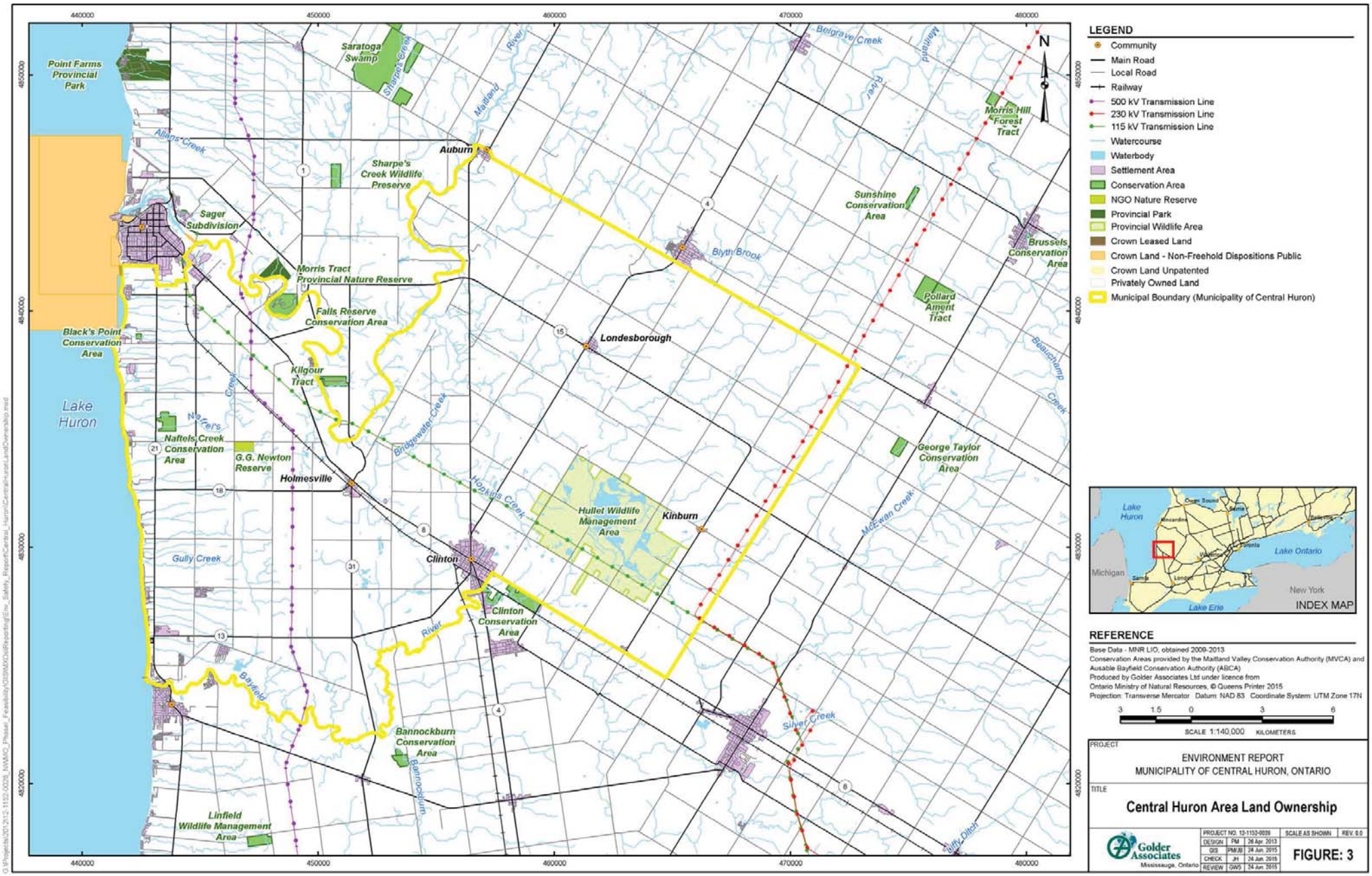
TITLE
Satellite Imagery of the Central Huron Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	28 Apr. 2013		
GIS	PMHB	17 Jun. 2015		
CHECK	JH	17 Jun. 2015		
REVIEW	GWS	17 Jun. 2015		

FIGURE: 2

G:\Projects\2012\12-1152-0026_NWMO_Phase1_Feasibility\GIS\MXD\Report\pdf\Ev_Safety_Report\Central_Huron\Central Huron Satellite Imagery.mxd



REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Conservation Areas provided by the Maitland Valley Conservation Authority (MVCA) and Ausable Bayfield Conservation Authority (ABCA)
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

3 1.5 0 3 6
SCALE 1:140,000 KILOMETERS

PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

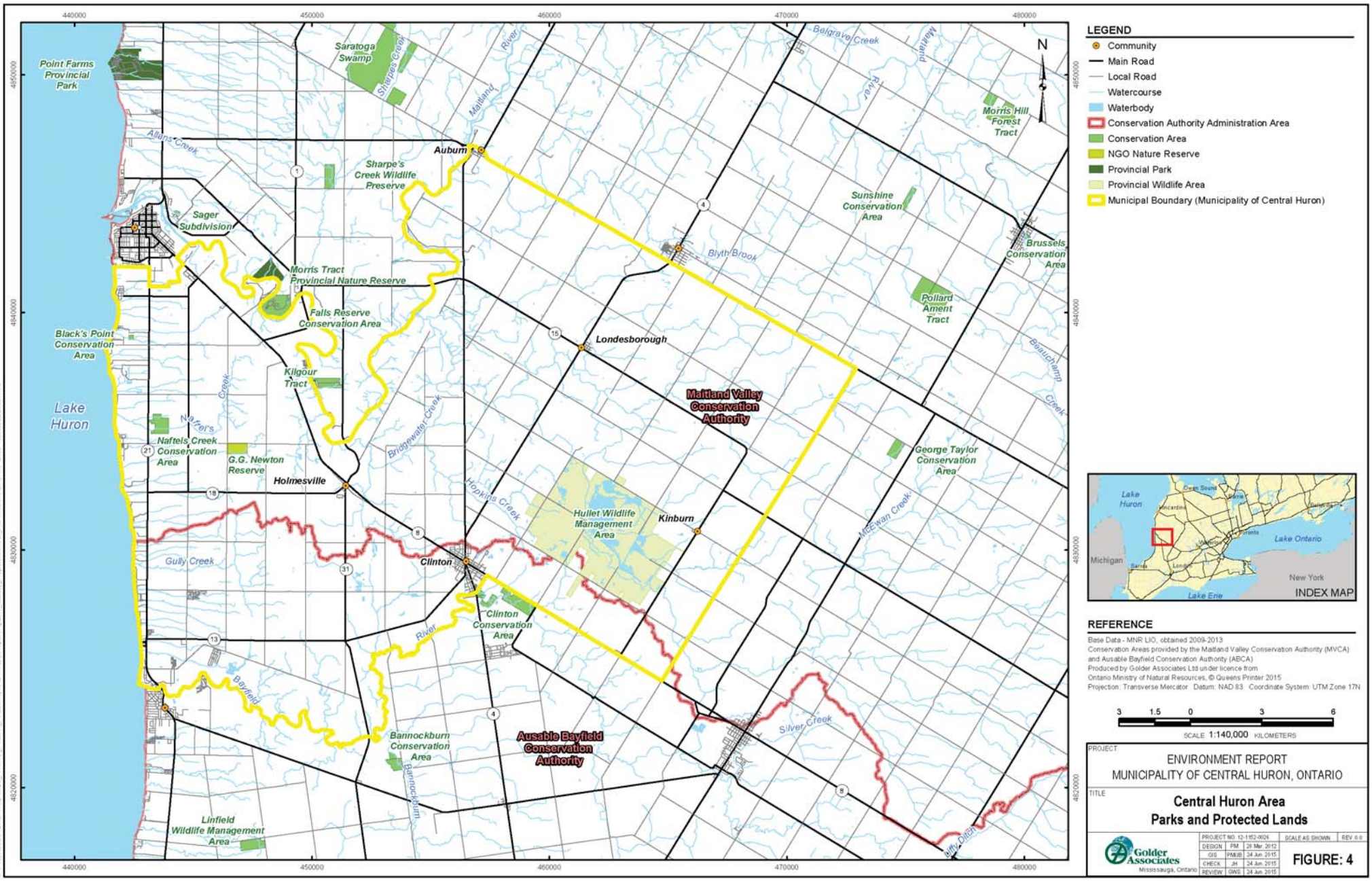
TITLE
Central Huron Area Land Ownership

Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1152-0029			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	26 Apr. 2013	
GIS	PMcB	24 Jun. 2015	
CHECK	JH	24 Jun. 2015	
REVIEW	GWS	24 Jun. 2015	

FIGURE: 3

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LEGEND

- Community
- Main Road
- Local Road
- Watercourse
- Waterbody
- Conservation Authority Administration Area
- Conservation Area
- NGO Nature Reserve
- Provincial Park
- Provincial Wildlife Area
- Municipal Boundary (Municipality of Central Huron)

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Conservation Areas provided by the Maitland Valley Conservation Authority (MVCA) and Ausable Bayfield Conservation Authority (ABCA)
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

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SCALE 1:140,000 KILOMETERS

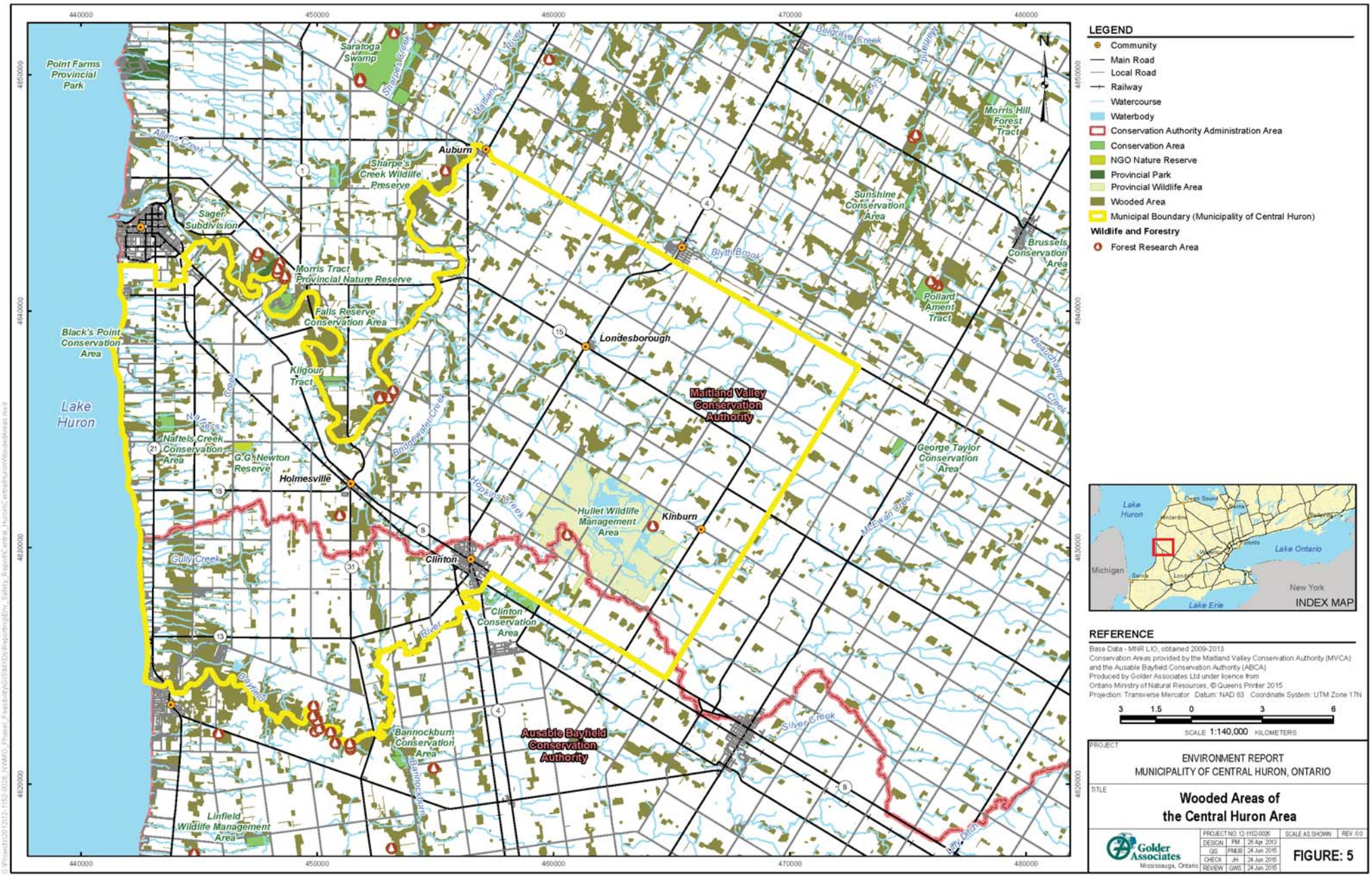
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

TITLE
Central Huron Area
Parks and Protected Lands

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0024			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	26 Mar. 2012	
GIS	PMUB	24 Jun. 2015	
CHECK	JH	24 Jun. 2015	
REVIEW	GWS	24 Jun. 2015	

FIGURE: 4



LEGEND

- Community
- Main Road
- Local Road
- Railway
- Watercourse
- Waterbody
- Conservation Authority Administration Area
- Conservation Area
- NGO Nature Reserve
- Provincial Park
- Provincial Wildlife Area
- Wooded Area
- Municipal Boundary (Municipality of Central Huron)

Wildlife and Forestry

- Forest Research Area

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Conservation Areas provided by the Maitland Valley Conservation Authority (MVCA) and the Ausable Bayfield Conservation Authority (ABCA)
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

3 1.5 0 3 6

SCALE 1:140,000 KILOMETERS

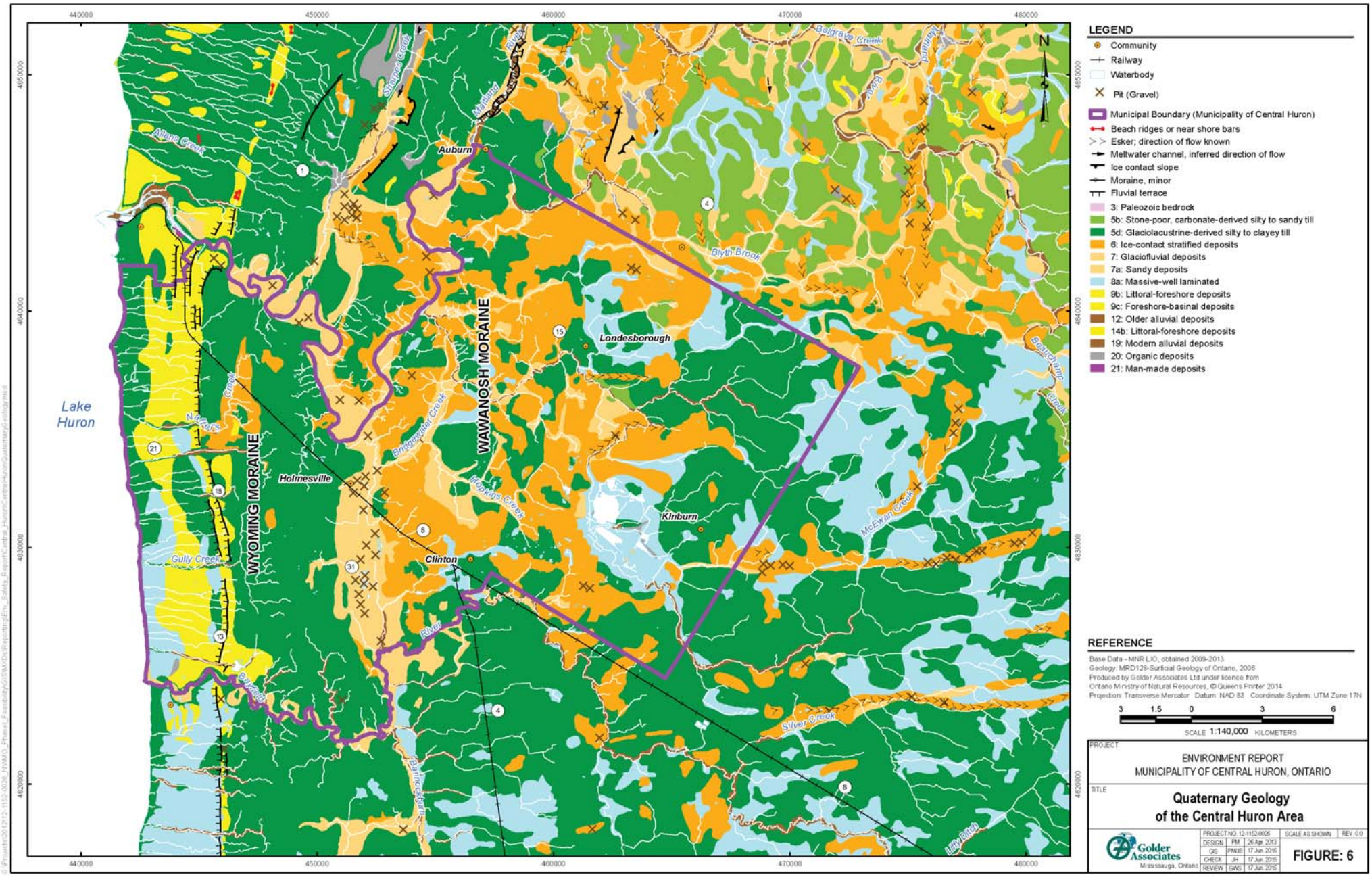
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

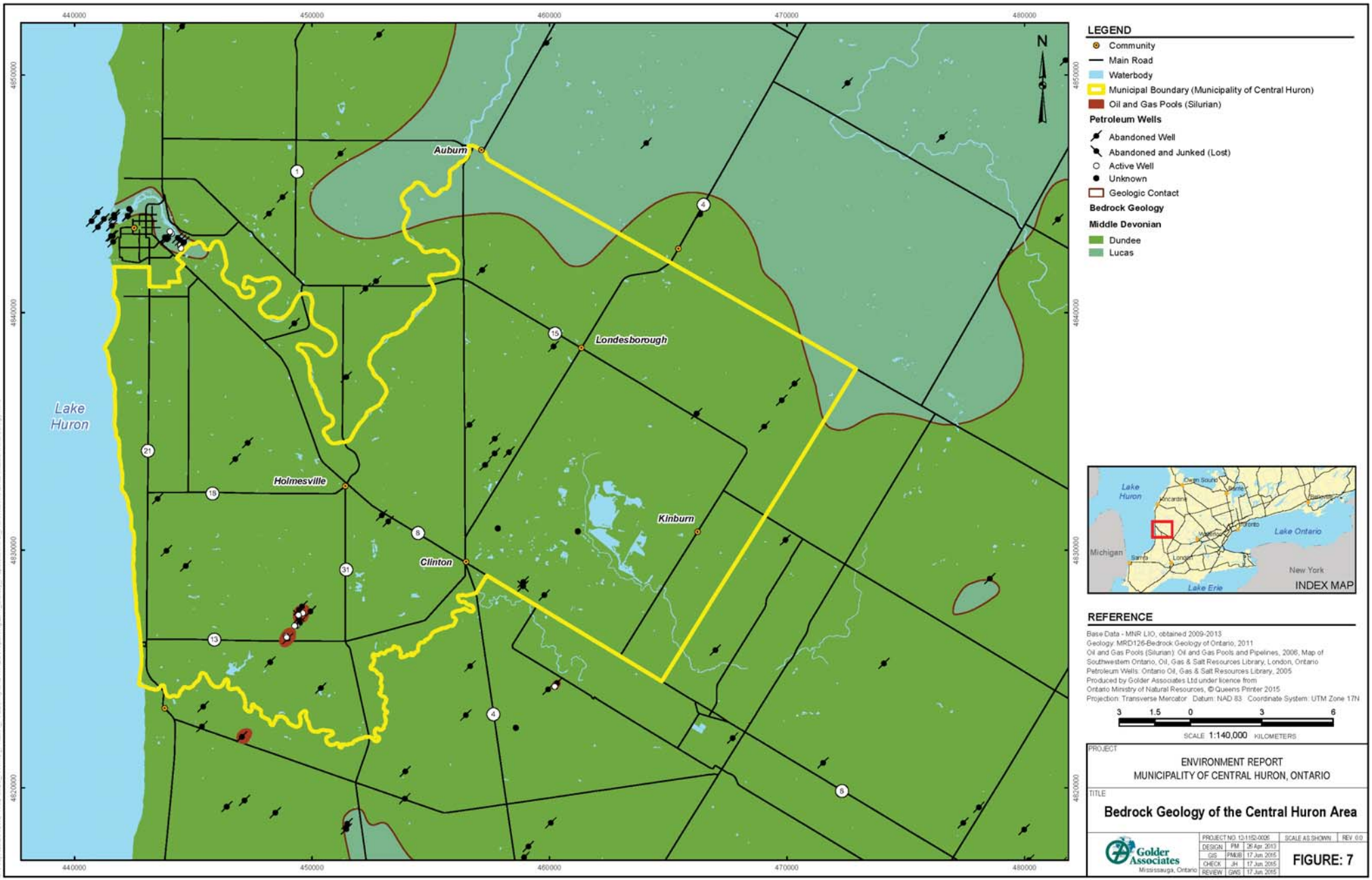
TITLE
Wooded Areas of the Central Huron Area

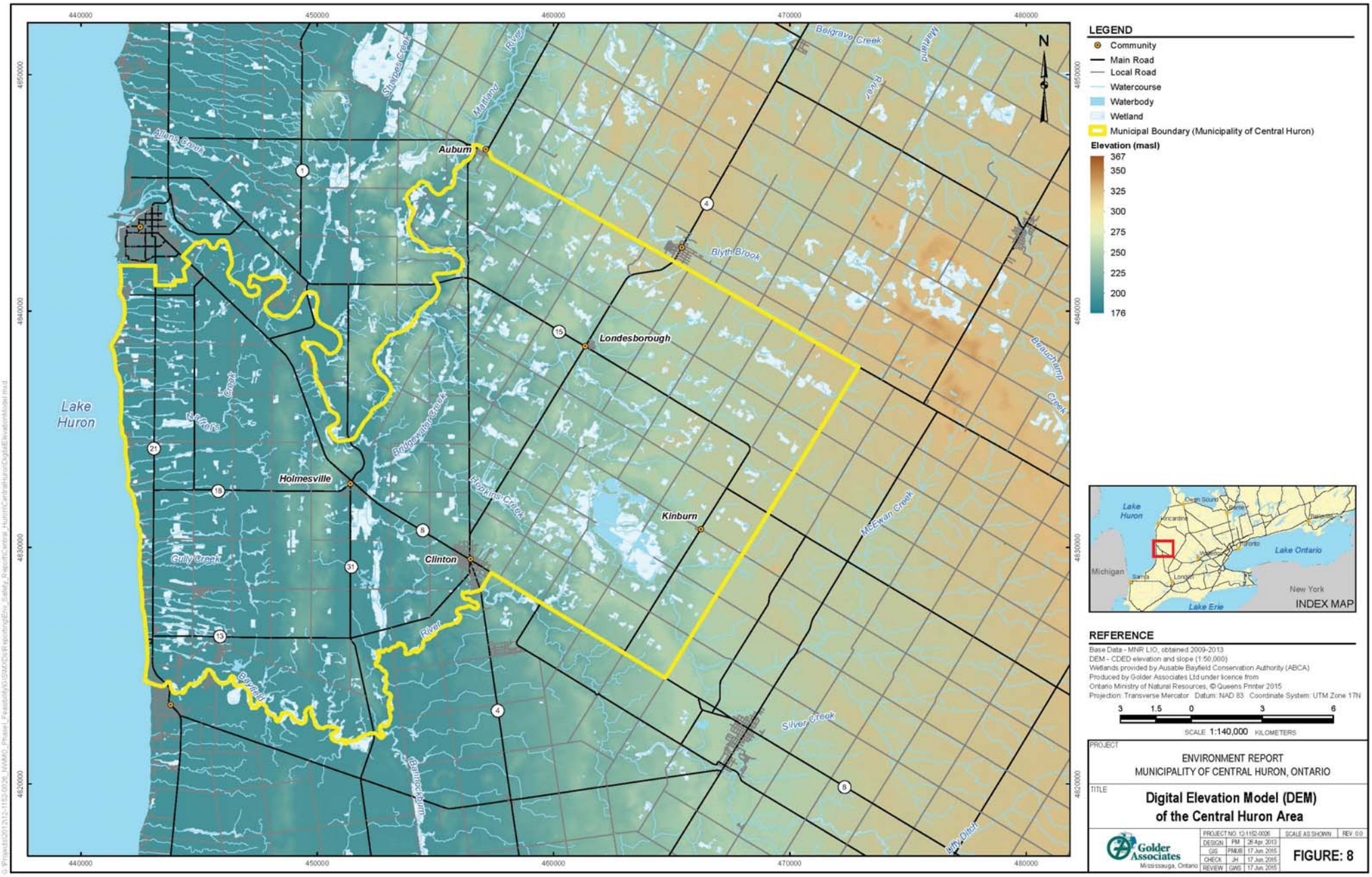
Golder Associates
Mississauga, Ontario

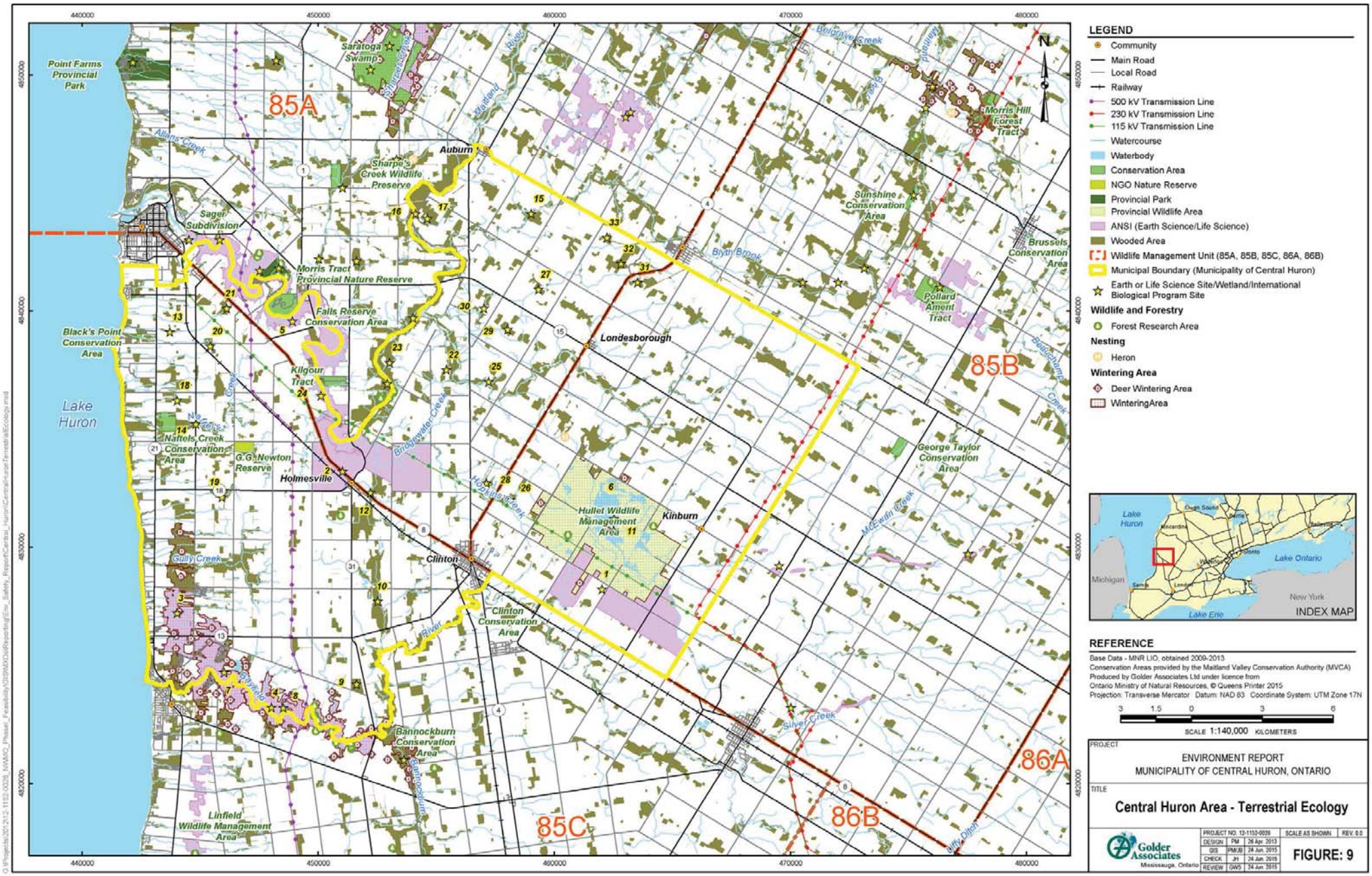
PROJECT NO. 12-1152-0006			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	26 Apr 2013	
GIS	PMLB	24 Jun 2015	
CHECK	JH	24 Jun 2015	
REVIEW	GNS	24 Jun 2015	

FIGURE: 5


440000
450000
460000
470000
480000
4850000
4840000
4830000
4820000
N
Lake Huron
WYOMING MORAINE
WAWANOSH MORAINE
Auburn
Londesborough
Holmesville
Kinburn
Clinton
Shipka Creek
Maitland River
Belgrave Creek
Maitland River
Alma Creek
Blyth Brook
Bayfield River
Gully Creek
Nairn Creek
Bridgewater Creek
Hopkins Creek
McEwan Creek
Boucharm Creek
Silver Creek
Barnetdale Drain
Limy Ditch
LEGEND
Community
Railway
Waterbody
Pit (Gravel)
Municipal Boundary (Municipality of Central Huron)
Beach ridges or near shore bars
Esker; direction of flow known
Meltwater channel, inferred direction of flow
Ice contact slope
Moraine, minor
Fluvial terrace
3: Paleozoic bedrock
5b: Stone-poor, carbonate-derived silty to sandy till
5d: Glaciolacustrine-derived silty to clayey till
6: Ice-contact stratified deposits
7: Glaciofluvial deposits
7a: Sandy deposits
8a: Massive-well laminated
9b: Littoral-foreshore deposits
9c: Foreshore-basinal deposits
12: Older alluvial deposits
14b: Littoral-foreshore deposits
19: Modern alluvial deposits
20: Organic deposits
21: Man-made deposits
REFERENCE
Base Data - MNR LIO, obtained 2009-2013
Geology: MRD128-Surficial Geology of Ontario, 2006
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2014
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N
3 1.5 0 3 6
SCALE 1:140,000 KILOMETERS
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO
TITLE
Quaternary Geology
of the Central Huron Area
Golder Associates
Mississauga, Ontario
PROJECT NO. 12-1152-0006
DESIGN PM 26 Apr 2013
GIS PMUB 17 Jun 2015
CHECK JH 17 Jun 2015
REVIEW GNS 17 Jun 2015
SCALE AS SHOWN
REV. 0.0
FIGURE: 6


440000
450000
460000
470000
480000
4850000
4840000
4830000
4820000
N
Auburn
Londesborough
Holmesville
Kinburn
Clinton
Lake Huron
1
4
15
21
8
31
13
6
LEGEND
Community
Main Road
Waterbody
Municipal Boundary (Municipality of Central Huron)
Oil and Gas Pools (Silurian)
Petroleum Wells
Abandoned Well
Abandoned and Junked (Lost)
Active Well
Unknown
Geologic Contact
Bedrock Geology
Middle Devonian
Dundee
Lucas
Lake Huron
Owen Sound
Barrie
Kincardine
Toronto
Lake Ontario
Michigan
Sarnia
London
New York
Lake Erie
INDEX MAP
REFERENCE
Base Data - MNR LIO, obtained 2009-2013
Geology: MRD126-Bedrock Geology of Ontario, 2011
Oil and Gas Pools (Silurian): Oil and Gas Pools and Pipelines, 2006, Map of Southwestern Ontario, Oil, Gas & Salt Resources Library, London, Ontario
Petroleum Wells: Ontario Oil, Gas & Salt Resources Library, 2005
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N
3 1.5 0 3 6
SCALE 1:140,000 KILOMETERS
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO
TITLE
Bedrock Geology of the Central Huron Area
Golder Associates
Mississauga, Ontario
PROJECT NO. 12-1152-0006
SCALE AS SHOWN
REV 0.0
DESIGN PM 26 Apr. 2013
GIS PMUB 17 Jun. 2015
CHECK JH 17 Jun. 2015
REVIEW GNS 17 Jun. 2015
FIGURE: 7


440000
450000
460000
470000
480000
4850000
4840000
4830000
4820000
N
Lake Huron
Auburn
Londesborough
Holmesville
Kinburn
Clinton
Blyth Brook
Belgrave Creek
Maitland River
Maitland
Strattes Creek
Allens Creek
Jeffords Creek
Bridgewater Creek
Hopkins Creek
McEwan Creek
Gully Creek
Bayfield River
Silver Creek
Bannockburn
Benchamp Creek
Hay Ditch
LEGEND
Community
Main Road
Local Road
Watercourse
Waterbody
Wetland
Municipal Boundary (Municipality of Central Huron)
Elevation (masl)
367
350
325
300
275
250
225
200
176
Lake Huron
Owen Sound
Kincardine
Toronto
Lake Ontario
Michigan
Sarnia
London
New York
Lake Erie
INDEX MAP
REFERENCE
Base Data - MNR LIO, obtained 2009-2013
DEM - CDED elevation and slope (1:50,000)
Wetlands provided by Ausable Bayfield Conservation Authority (ABCA)
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N
3 1.5 0 3 6
SCALE 1:140,000 KILOMETERS
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO
TITLE
Digital Elevation Model (DEM)
of the Central Huron Area
Golder Associates
Mississauga, Ontario
PROJECT NO. 12-1152-0006
DESIGN PM 26 Apr. 2013
GIS PMcIB 17 Jun. 2015
CHECK JH 17 Jun. 2015
REVIEW GMS 17 Jun. 2015
SCALE AS SHOWN
REV. 0.0
FIGURE: 8



LEGEND

- Community
- Main Road
- Local Road
- Railway
- 500 kV Transmission Line
- 230 kV Transmission Line
- 115 kV Transmission Line
- Watercourse
- Waterbody
- Conservation Area
- NGO Nature Reserve
- Provincial Park
- Provincial Wildlife Area
- ANSI (Earth Science/Life Science)
- Wooded Area
- Wildlife Management Unit (85A, 85B, 85C, 86A, 86B)
- Municipal Boundary (Municipality of Central Huron)
- Earth or Life Science Site/Wetland/International Biological Program Site

Wildlife and Forestry

- Forest Research Area

Nesting

- Heron

Wintering Area

- Deer Wintering Area
- WinteringArea

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Conservation Areas provided by the Maitland Valley Conservation Authority (MVCA)
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

3 1.5 0 3 6

SCALE 1:140,000 KILOMETERS

PROJECT

ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

TITLE

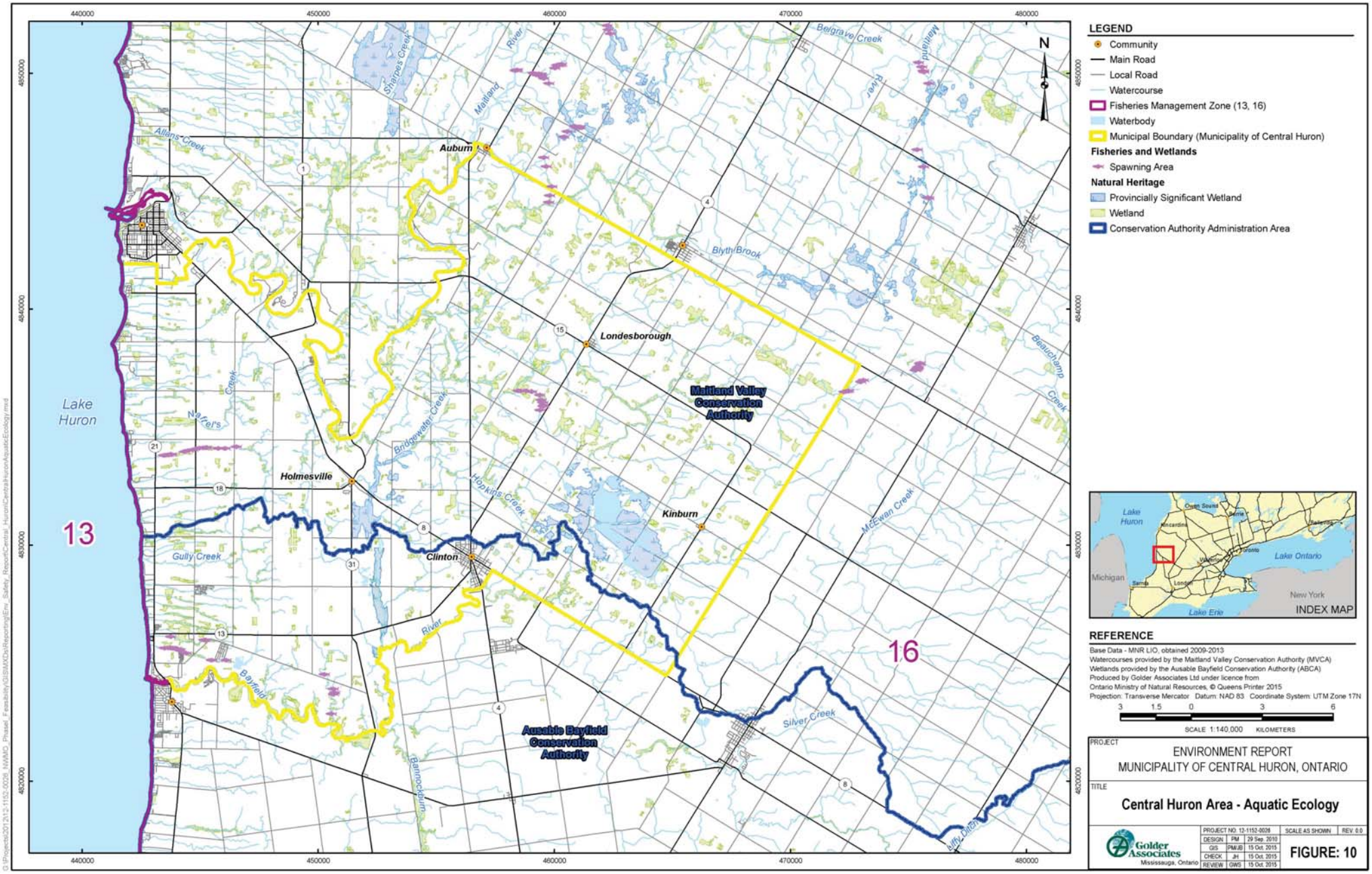
Central Huron Area - Terrestrial Ecology

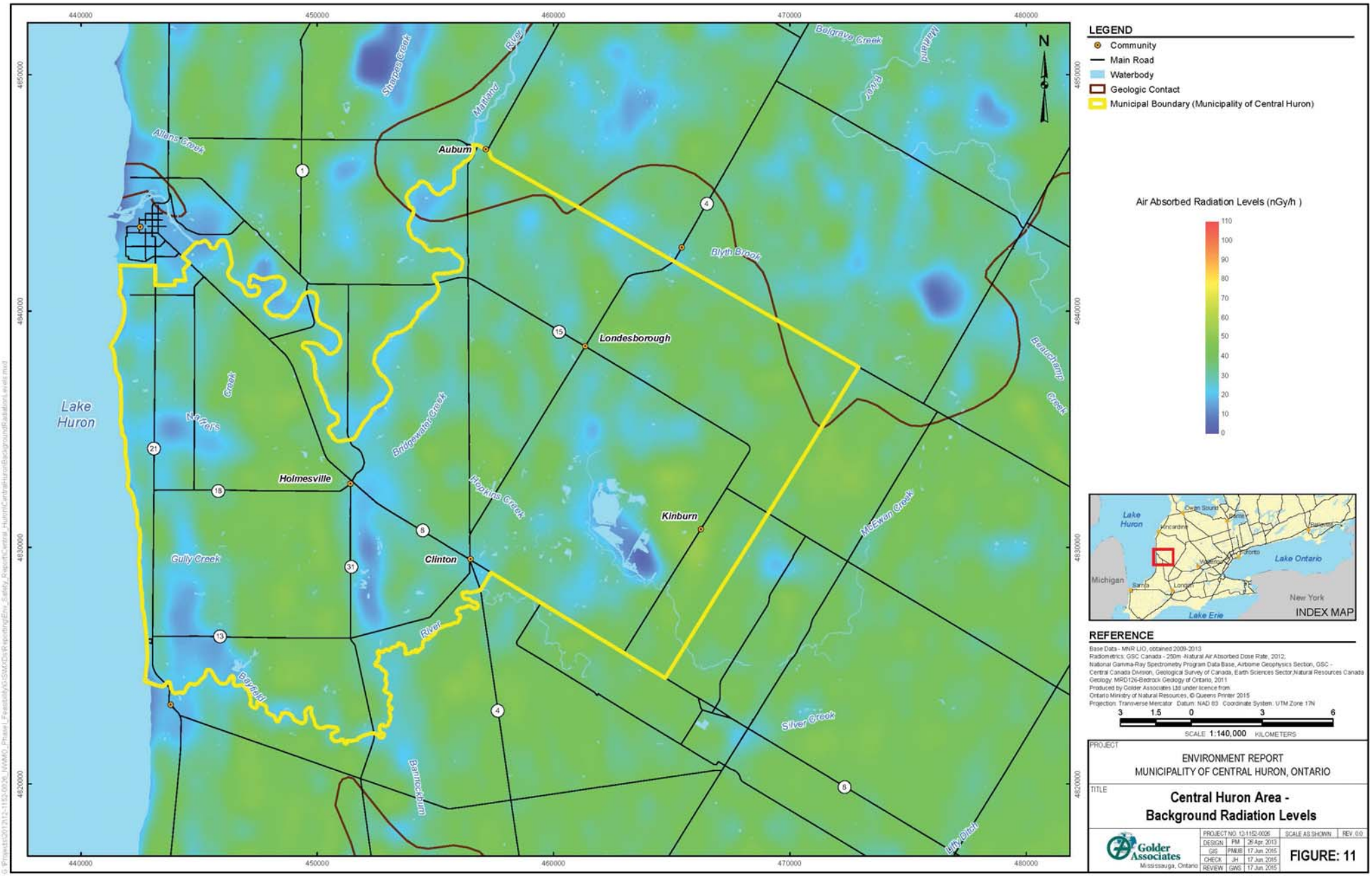
Golder Associates
Mississauga, Ontario

PROJECT NO. 13-1152-0029			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	26 Apr. 2013	
GIS	PM/JB	24 Jun. 2015	
CHECK	JH	24 Jun. 2015	
REVIEW	GWS	24 Jun. 2015	

FIGURE: 9

G:\Projects\13\1152\1152-0029_MMPO_Phase_Feasibility\05MXD\Reporting\Env_Safety_Report\Central_Huron\Central_Huron_Terrestrial_Ecology.mxd


440000
450000
460000
470000
480000
4850000
4840000
4830000
4820000
N
Lake Huron
13
16
Auburn
Londesborough
Holmesville
Kinburn
Clinton
Maitland Valley Conservation Authority
Ausable Bayfield Conservation Authority
Maitland River
Sharnes Creek
Belgrave Creek
Allens Creek
Blyth Brook
Nafziger's Creek
Bridgewater Creek
Hopkins Creek
McEwan Creek
Beauchamp Creek
Gully Creek
Bayfield River
Silver Creek
Bannockburn
Jiffy Ditch
LEGEND
Community
Main Road
Local Road
Watercourse
Fisheries Management Zone (13, 16)
Waterbody
Municipal Boundary (Municipality of Central Huron)
Fisheries and Wetlands
Spawning Area
Natural Heritage
Provincially Significant Wetland
Wetland
Conservation Authority Administration Area
Lake Huron
Owen Sound
Barrie
Kincardine
Toronto
Lake Ontario
Michigan
Sarnia
London
New York
Lake Erie
INDEX MAP
REFERENCE
Base Data - MNR LIO, obtained 2009-2013
Watercourses provided by the Maitland Valley Conservation Authority (MVCA)
Wetlands provided by the Ausable Bayfield Conservation Authority (ABCA)
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N
3 1.5 0 3 6
SCALE 1:140,000 KILOMETERS
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO
TITLE
Central Huron Area - Aquatic Ecology
Golder Associates
Mississauga, Ontario
PROJECT NO. 13-1152-0026
SCALE AS SHOWN
REV. 0.0
DESIGN PM 29 Sep. 2015
GIS PM/JB 15 Oct. 2015
CHECK JH 15 Oct. 2015
REVIEW GWS 15 Oct. 2015
FIGURE: 10



LEGEND

- Community
- Main Road
- Waterbody
- Geologic Contact
- Municipal Boundary (Municipality of Central Huron)

Air Absorbed Radiation Levels (nGy/h)

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

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
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
Geology: MRD126-Bedrock Geology of Ontario, 2011
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

3 1.5 0 3 6

SCALE 1:140,000 KILOMETERS

PROJECT

ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

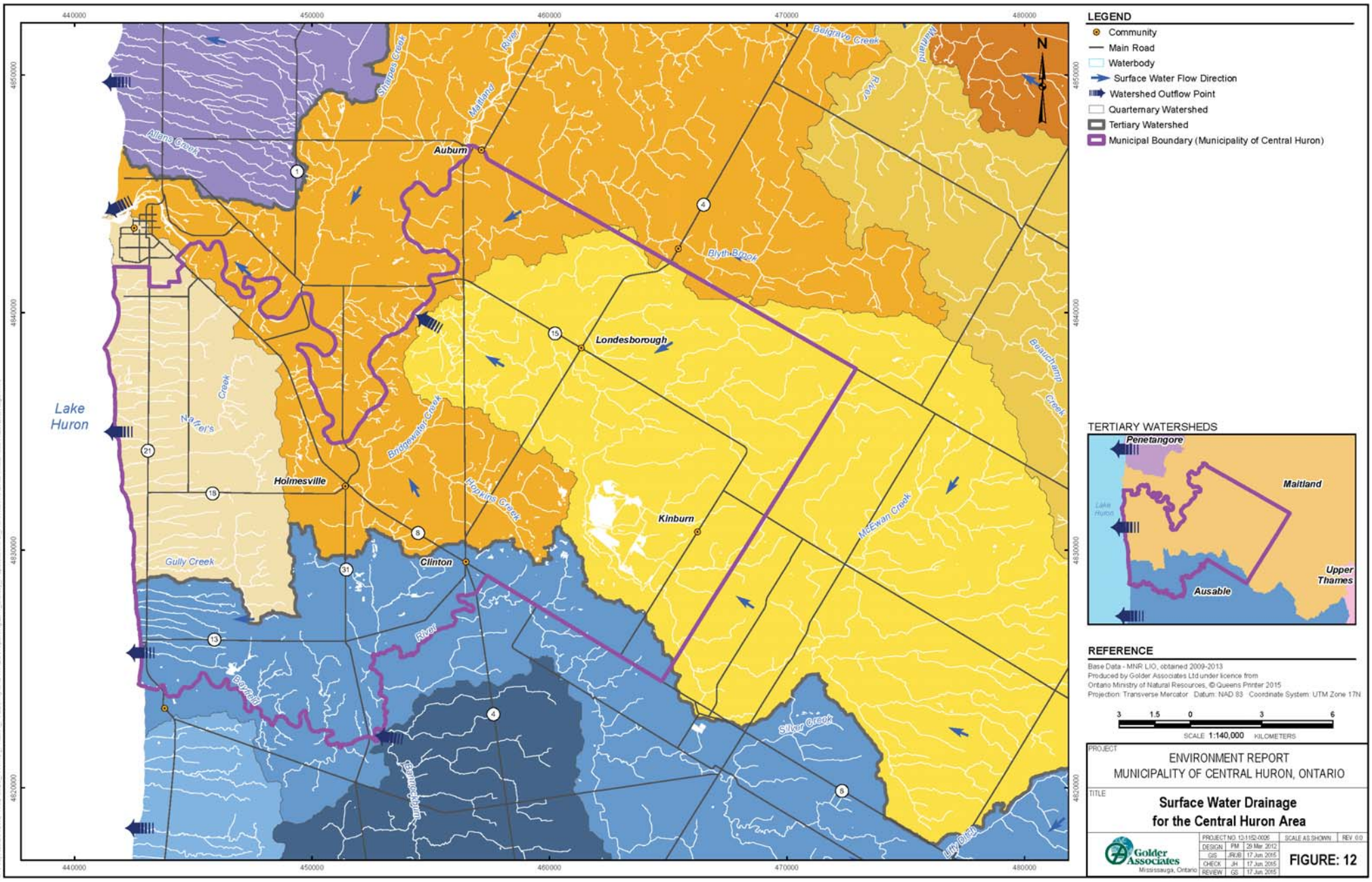
TITLE

Central Huron Area -
Background Radiation Levels

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0006			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	26 Apr. 2013	
GIS	PMUB	17 Jun. 2015	
CHECK	JH	17 Jun. 2015	
REVIEW	GMS	17 Jun. 2015	

FIGURE: 11



LEGEND

- Community
- Main Road
- Waterbody
- Surface Water Flow Direction
- Watershed Outflow Point
- Quarternary Watershed
- Tertiary Watershed
- Municipal Boundary (Municipality of Central Huron)

TERTIARY WATERSHEDS

REFERENCE

Base Data - MNR LIO, obtained 2009-2013
Produced by Golder Associates Ltd under licence from
Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N

3 1.5 0 3 6

SCALE 1:140,000 KILOMETERS

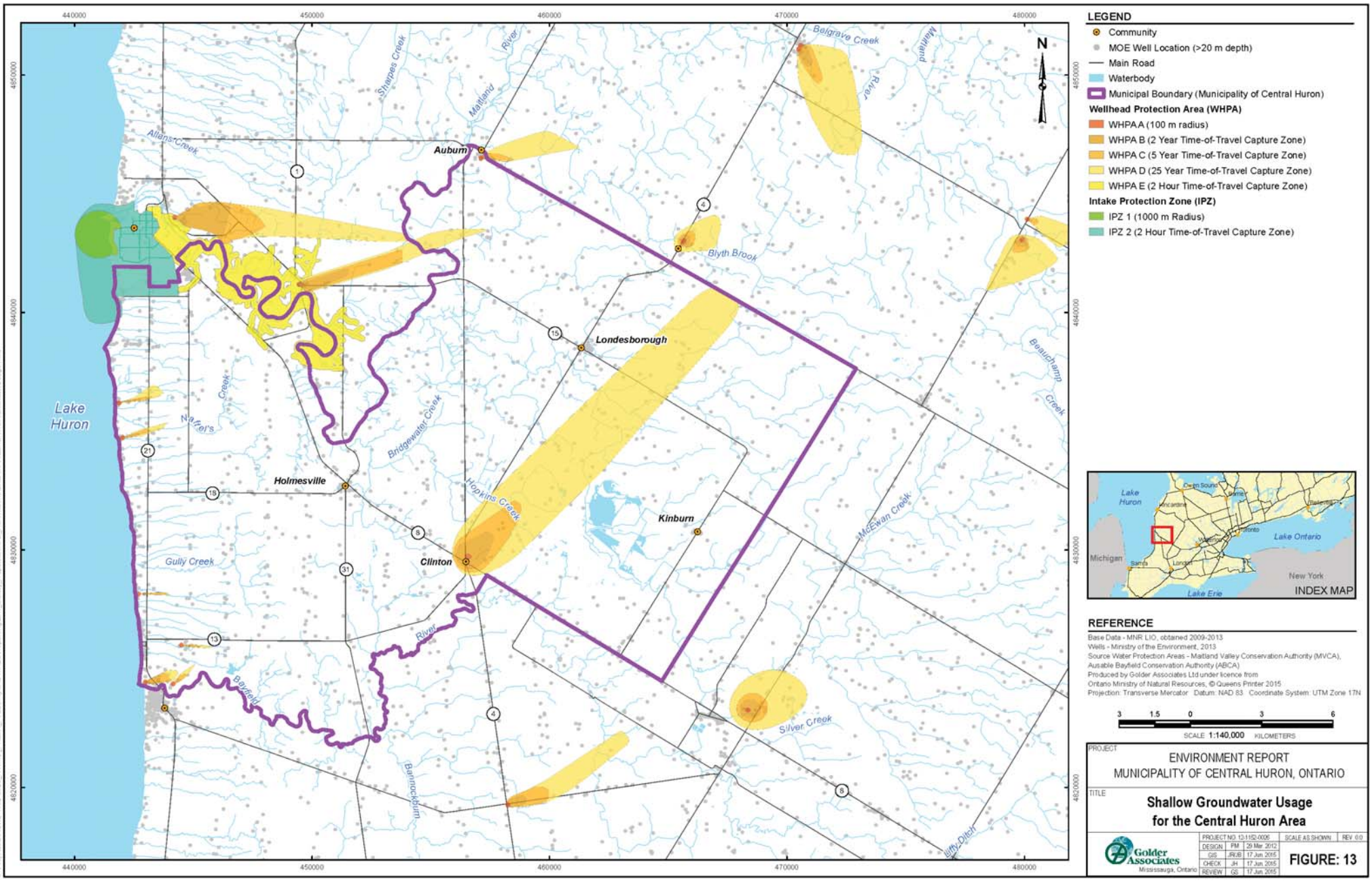
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

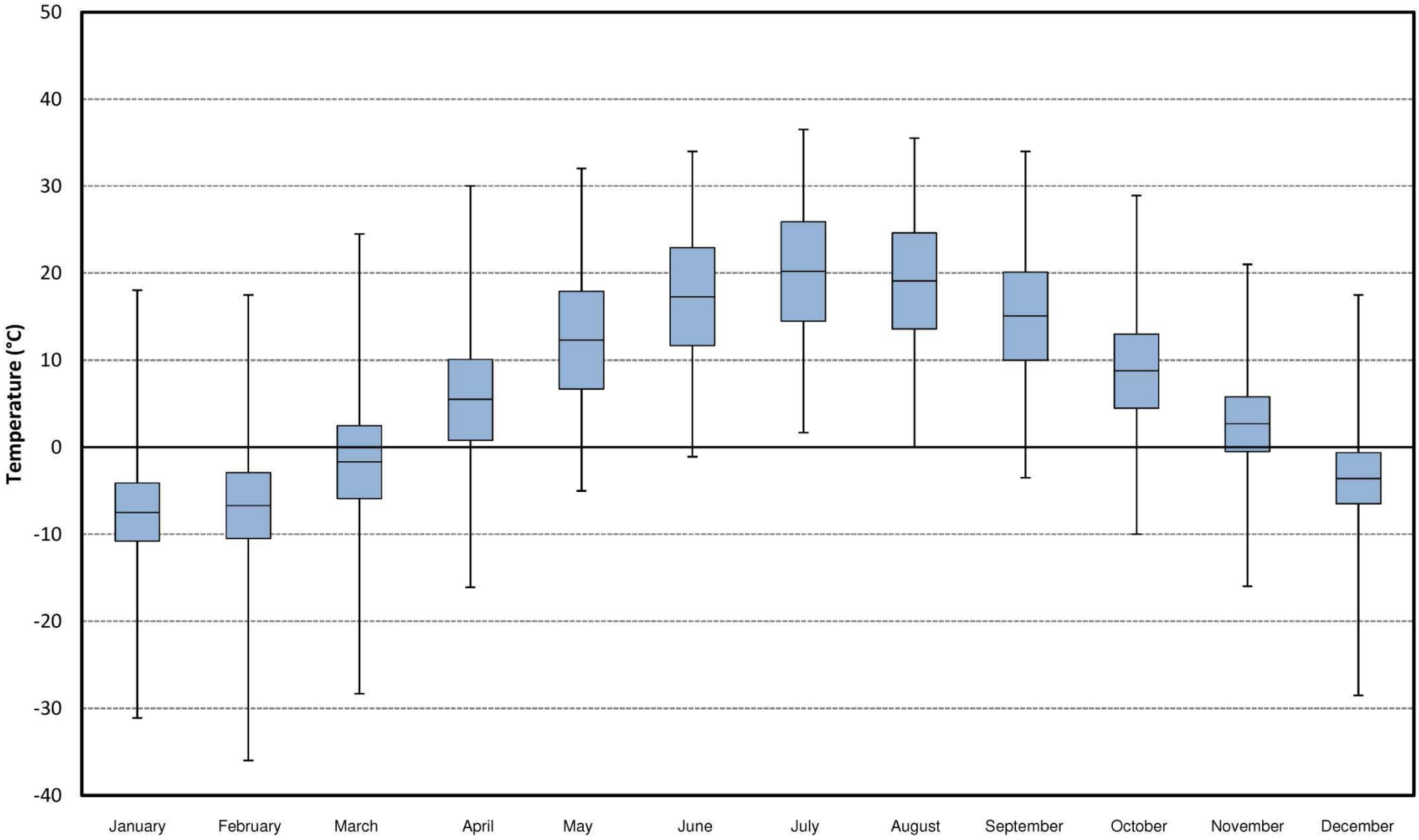
TITLE
Surface Water Drainage for the Central Huron Area

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0006			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	29 Mar 2012	
GIS	JNVB	17 Jun 2015	
CHECK	JH	17 Jun 2015	
REVIEW	GS	17 Jun 2015	

FIGURE: 12


440000
450000
460000
470000
480000
4850000
4840000
4830000
4820000
N
Lake Huron
Auburn
Londesborough
Holmesville
Clinton
Kinburn
Blyth Brook
Belgrave Creek
Maitland River
Shanes Creek
Allens Creek
Bridgewater Creek
Hopkins Creek
McEwan Creek
Beauchamp Creek
Gully Creek
Bayfield River
Barnockburn
Silver Creek
Mill Ditch
LEGEND
Community
MOE Well Location (>20 m depth)
Main Road
Waterbody
Municipal Boundary (Municipality of Central Huron)
Wellhead Protection Area (WHPA)
WHPA A (100 m radius)
WHPA B (2 Year Time-of-Travel Capture Zone)
WHPA C (5 Year Time-of-Travel Capture Zone)
WHPA D (25 Year Time-of-Travel Capture Zone)
WHPA E (2 Hour Time-of-Travel Capture Zone)
Intake Protection Zone (IPZ)
IPZ 1 (1000 m Radius)
IPZ 2 (2 Hour Time-of-Travel Capture Zone)
Lake Huron
Owen Sound
Barrie
Kincardine
Toronto
Lake Ontario
Michigan
Sarnia
London
New York
Lake Erie
INDEX MAP
REFERENCE
Base Data - MNR LIO, obtained 2009-2013
Wells - Ministry of the Environment, 2013
Source Water Protection Areas - Maitland Valley Conservation Authority (MVCA), Ausable Bayfield Conservation Authority (ABCA)
Produced by Golder Associates Ltd under licence from Ontario Ministry of Natural Resources, © Queens Printer 2015
Projection: Transverse Mercator Datum: NAD 83 Coordinate System: UTM Zone 17N
3 1.5 0 3 6
SCALE 1:140,000 KILOMETERS
PROJECT
ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO
TITLE
Shallow Groundwater Usage for the Central Huron Area
Golder Associates
Mississauga, Ontario
PROJECT NO. 13-1152-0006
SCALE AS SHOWN
REV. 0.0
DESIGN PM 29 Mar 2012
GIS JN/JB 17 Jun 2015
CHECK JH 17 Jun 2015
REVIEW GS 17 Jun 2015
FIGURE: 13



LEGEND

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

DATA SOURCE

Environment Canada

PROJECT

ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

TITLE

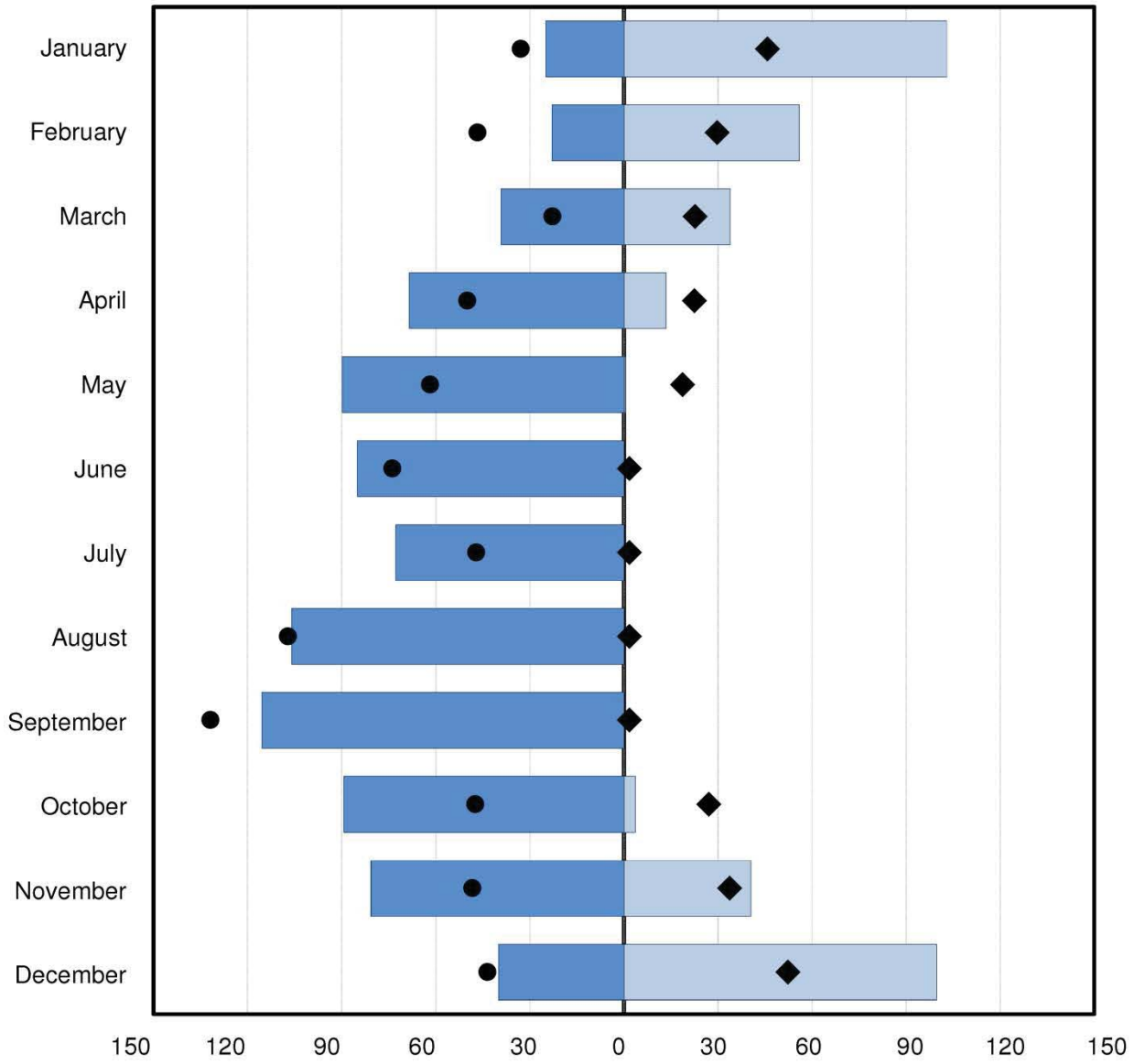
Temperature Data Summary for Blythe 1971-2000

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	28 Mar. 2011		
GIS	PM/JB	25 Jun. 2015		
CHECK	JH	25 Jun. 2015		
REVIEW	GWS	25 Jun. 2015		

FIGURE: 14

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



LEGEND

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

DATA SOURCE

Environment Canada

PROJECT

ENVIRONMENT REPORT
MUNICIPALITY OF CENTRAL HURON, ONTARIO

TITLE

Precipitation Data Summary for Blythe 1971-2000

Golder Associates
Mississauga, Ontario

PROJECT NO. 12-1152-0026			SCALE AS SHOWN	REV. 0.0
DESIGN	PM	7 Jun. 2012		
GIS	PM/JB	25 Jun. 2015		
CHECK	JH	25 Jun. 2015		
REVIEW	GWS	25 Jun. 2015		

FIGURE: 15

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

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North America	+ 1 800 275 3281
South America	+ 56 2 2616 2000

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