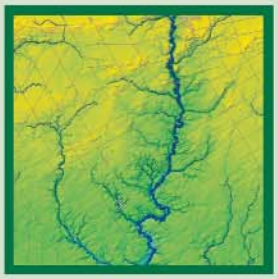
EXECUTIVE SUMMARY



# Long Point Region Watershed

Characterization Report ▪ January 2008

DRINKING WATER SOURCE PROTECTION

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Ontario

*This report is made possible through the support of the Government of Ontario*

**Kettle Creek Conservation Authority (KCCA)**
**Catfish Creek Conservation Authority (CCCA)**
**Long Point Region Conservation Authority (LPRCA)**
**Grand River Conservation Authority (GRCA)**

*The Watershed Characterization Reports were prepared by the drinking water source protection project staff of the four conservation authorities in the Lake Erie Source Protection Region.*

# 1. Introduction

## The Clean Water Act

The Clean Water Act was passed by the Ontario legislature in October 2006 to implement many of the recommendations of the provincial inquiry into the Walkerton tainted water tragedy.

The Act, its regulations and other provincial guidance documents outline a process to develop a source protection plan for the Long Point Region watershed. This work will be guided by the Lake Erie Region Source Protection Committee.

A source water protection plan is an agreement among the people and the communities of a watershed about the ways to protect water quality and quantity for drinking water systems.

The source protection planning process will:

- identify existing water supply and water quality issues;
- identify sources of drinking water and vulnerable areas in a watershed;
- identify the threats to source water quality and quantity;
- establish the risk posed by threats in vulnerable areas; and
- outline policies and programs to eliminate existing significant threats and to ensure no future drinking water threats become significant threats.

## Documents

In order to accomplish this goal, several documents will be prepared:

- a watershed characterization report;
- a terms of reference for the source protection committee;
- a technical assessment report; and
- a source protection plan.

The first document – the watershed characterization report – is an overview of the current state of the watershed. It includes information on the natural system (bedrock geology, surface geology, forests, wetlands, etc.) and the human system (urban areas, population growth, land use, water systems, etc.). The report describes the links between the natural and human systems.

This executive summary provides an overview of the material in the full Long Point Region Watershed Characterization report.

## A note to readers

Both the full characterization report and this summary are draft documents. They will both be updated as more information becomes available.

# 2. Watershed overview

## Watershed description

The Long Point Region is a collection of 12 major streams in an area of 2,900 square kilometres. All 12 drain into Lake Erie and they have a combined length of 3,700 kilometres. The region also has 225 kilometres of Lake Erie shoreline, including the international renowned Long Point sand spit.

The region measures 100 kilometres by 60 kilometres at its widest and deepest locations.

The surface elevation ranges from 357 metres above sea level in the northwest (west of Norwich), to 173.5 metres above sea level along the Lake Erie shoreline.

Much of the land, made up of either sand or clay plains, is relatively flat. There are areas of moderate relief near Tillsonburg, Otterville, Courtland and Waterford where moraines cross the region.

Early settlers were attracted to the area due to the presence of flat plains, which were more easily cleared. Other attractions were the transportation afforded by Lake Erie, the abundance of fish, wildlife and fur, as well as the more moderate climate. The subsequent alteration of the plains and the surrounding heavily forested lands has had a significant impact on the surface and groundwater quality and quantity.

## Population

According to the 2001 census, the total population of the Long Point Region was 99,000. Many of the residents live in the rural areas. The largest urban areas are the towns of Simcoe (14,000) and Tillsonburg (14,000); other urban areas include Port Dover, Delhi and Port Burwell.

About 78 per cent of the land is farmed. The 2001 census showed there were 43,100 head of cattle, 149,100 head of swine and 2.98 million head of poultry.

# 2. Watershed overview (cont'd)

## Uses of the watercourses

From the early days of settlement to the present, the streams of the Long Point Region – and particularly those in the western portion in the Norfolk Sand Plain – have been important sources of water and power.

Many of the communities of the Long Point Region developed around mill sites. The streams have long been used as a source of water for farm irrigation and, in fact, they still play a critical role in the agricultural life of the region, particularly in the Norfolk Sand Plain.

Although most of the streams have a limited role in navigation, they play an important role in transportation in the region. Busy port communities, featuring both commercial and recreational activity, have grown around the mouths of several of the streams such as the Lynn River (Port Dover), Big Creek (Port Rowan) and Big Otter Creek (Port Burwell).

The waters of the Lake Erie Region, especially the many kilometres of shoreline along Lake Erie, are an important part of the region's thriving tourism and recreation industry.

## Drinking water sources

The municipalities of the Long Point Region watershed take their drinking water from three types of sources.

### Groundwater

Groundwater is the largest source of supply in the watershed. Most wells in the region take their water from the overburden areas – the sand, gravel and soil lying atop bedrock.

These communities rely on groundwater sources:

- Norfolk County: Simcoe, Waterford and Delhi-Courtland
- Oxford County: Mount Elgin, Dereham Centre, Norwich, Otterville-Springford, Tillsonburg

### Inland surface water

- The Lehman Reservoir on North Creek in Delhi provides part of the water supply for the Delhi-Courtland system.

### Lake Erie

Communities along the Lake Erie shoreline draw their water from the lake:

- Norfolk County: Port Dover, Port Rowan
- Haldimand County: An intake and treatment plant near the village of Nanticoke serve Hagersville, Jarvis and Townsend and the Lake Erie Industrial Park.
- Elgin County: The Elgin Area Primary, which serves the built-up areas of East Elgin as well as the City of London, supplies water to two communities in the Long Point Region – Port Burwell and Vienna.

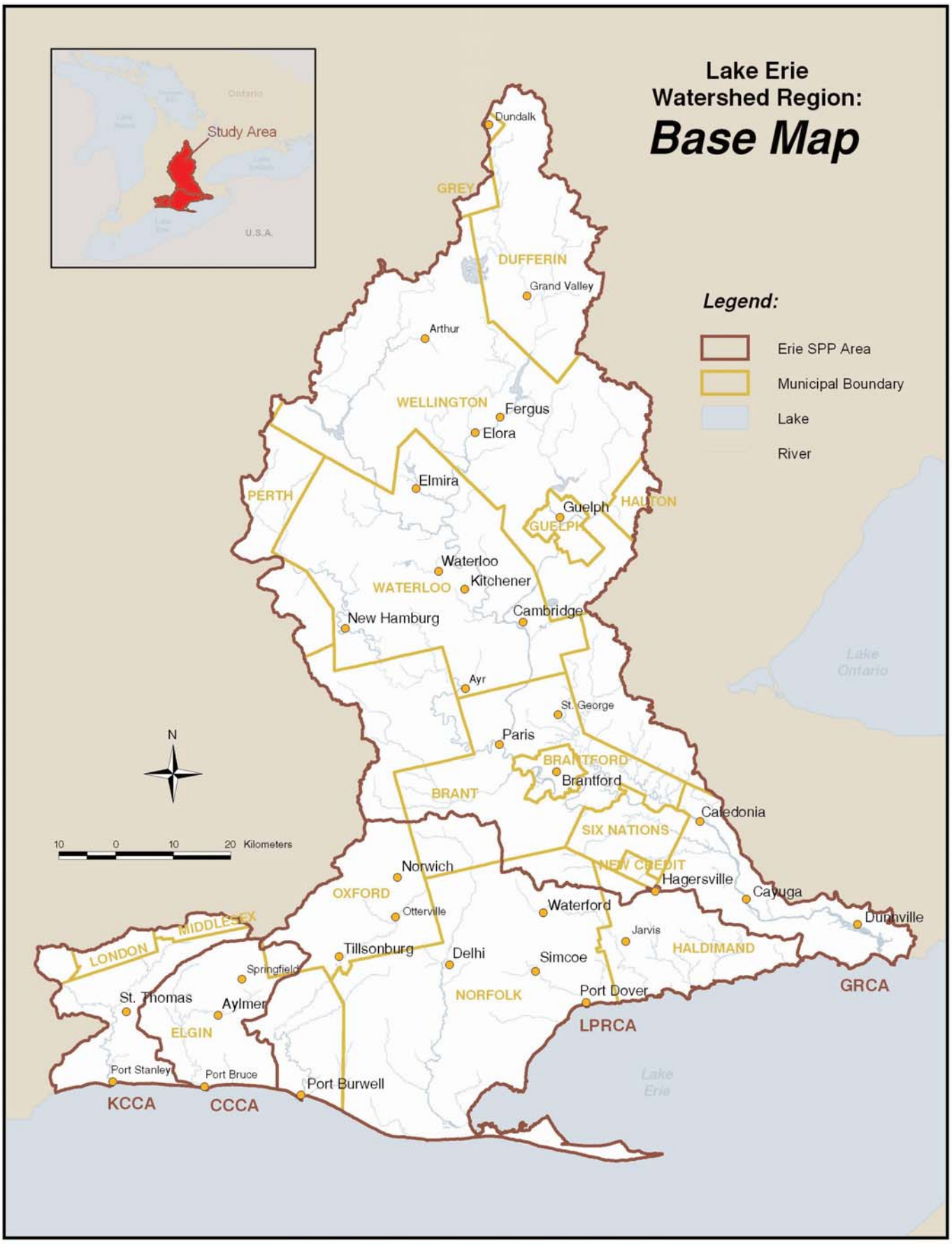
(**Note**: Matters relating to the Elgin Area system will be addressed in the Source Protection Plan for the Kettle Creek Source Protection Area.)

# 3. Lake Erie Source Protection Region

Under the Clean Water Act, Conservation Authorities have been grouped together into Source Protection Regions for the purpose of sharing resources and expertise. The Long Point Region watershed is part of the Lake Erie Region which also includes the Kettle Creek, Catfish Creek and Grand River watershed areas.

There are several reasons why these four conservation authorities have come together to form the Lake Erie Region:

- all of the watersheds drain into Lake Erie
- they share some geographic attributes
- some of the urban areas within Catfish, Kettle and Long Point share one Lake Erie intake
- they share some political ties. Several municipalities have territory in two or three of these watersheds, so having one source protection region simplifies municipal involvement in the planning process.


Lake Erie
Watershed Region:
Base Map
Study Area
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Legend:
Erie SPP Area
Municipal Boundary
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DUFFERIN
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Dunnville
Jarvis
HALDIMAND
MIDDLESEX
LONDON
Tillsonburg
Delhi
Simcoe
Springfield
St. Thomas
Aylmer
NORFOLK
Port Dover
GRCA
LPRCA
ELGIN
Port Stanley
Port Bruce
Port Burwell
KCCA
CCCA
Lake Ontario
Lake Erie

# 4. Geology and groundwater

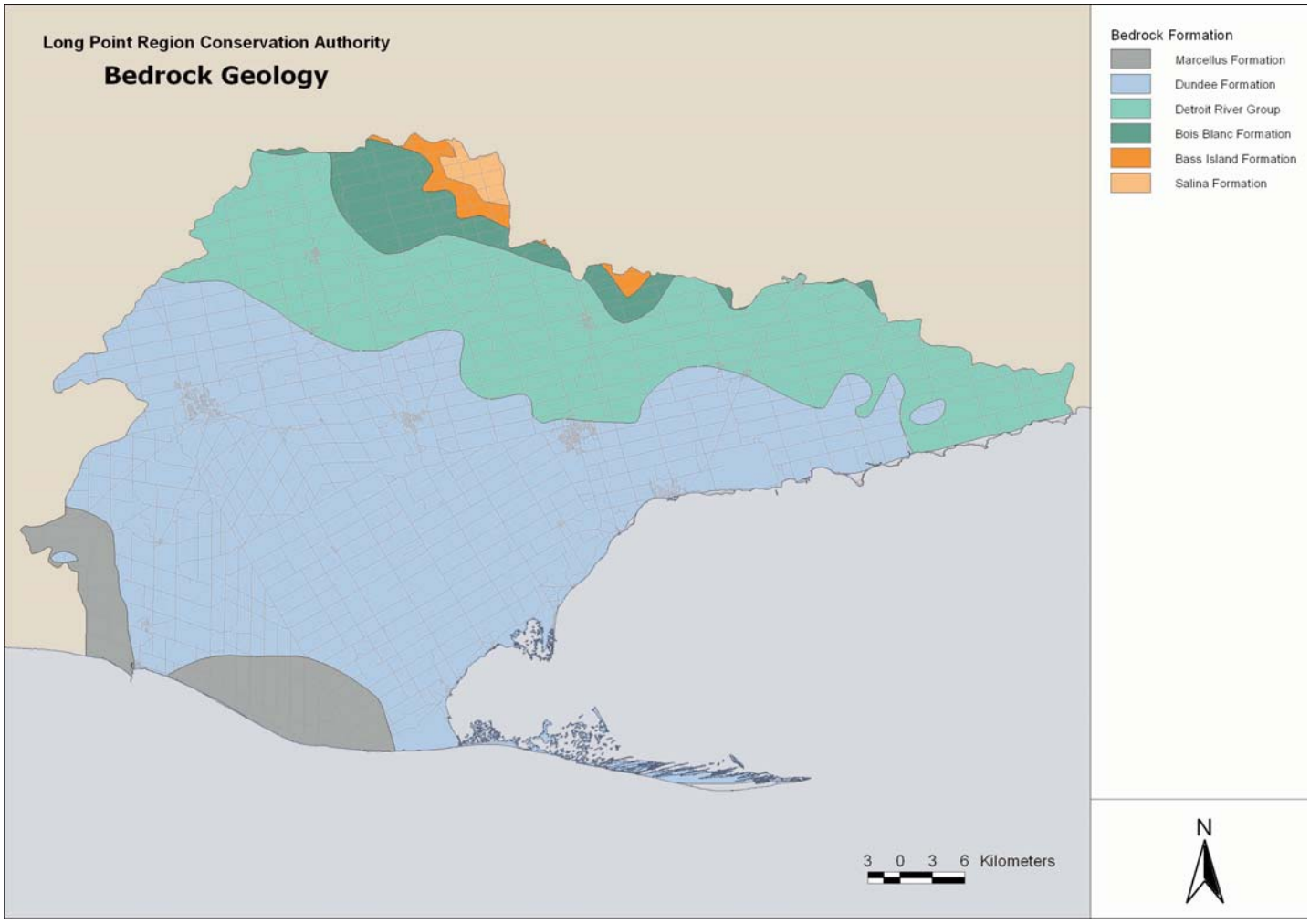
## Bedrock geology

The bedrock underlying Long Point Region is primarily composed of limestone and dolostone deposited between 380 and 425 million years ago. There are 10 bedrock formations within Long Point Region. From oldest to youngest these are the Salina, Bertie and Bass Island, Oriskamy, Bois Blanc, Onondaga, Amherstburg, Lucas, Dundee and Marcellus formations. The Amherstburg and Lucas formations are then grouped together to form the Detroit River Group. The layers of bedrock dip gently to the south.

In sedimentary rocks such as those in the Long Point Region, groundwater movement commonly occurs in fractures and spaces (crevasses, vugs) in the rock. Within Long Point Region, the Dundee Formation and Detroit River Group aquifers are generally used for private wells, especially in the east where the overburden is the Haldimand Clay Plain. In this area, there is often insufficient groundwater in the overburden because of the clay plain's density.

The Dundee Formation is also known to contain karst features. Karst is a type of terrain formed when slightly acidic groundwater dissolves carbonate (limestone) rocks. This results in the formation of sinkholes, some of which are up to 15 metres in diameter and 8 metres deep. These areas are highly susceptible to groundwater contamination because surface water and contaminants tend to flow directly into the aquifers via sinkhole drains.

Groundwater within the Dundee Formation and the Detroit River Formation is not strongly affected by recharge waters and has therefore tended to pick up some of the chemical constituents from the surrounding bedrock. This has resulted in elevated, naturally-occurring concentrations of sulphur, salts and other minerals which can lead



# 4. Geology and groundwater (cont'd)

to an unpleasant taste and smell. Many of these constituents can be removed through water treatment processes.

## Surface (Quaternary) geology

The surface features of the watershed reflect the events that occurred as the glaciers retreated. At times, much of the region was covered with water from the melting glaciers, giving rise to its distinctive topography.

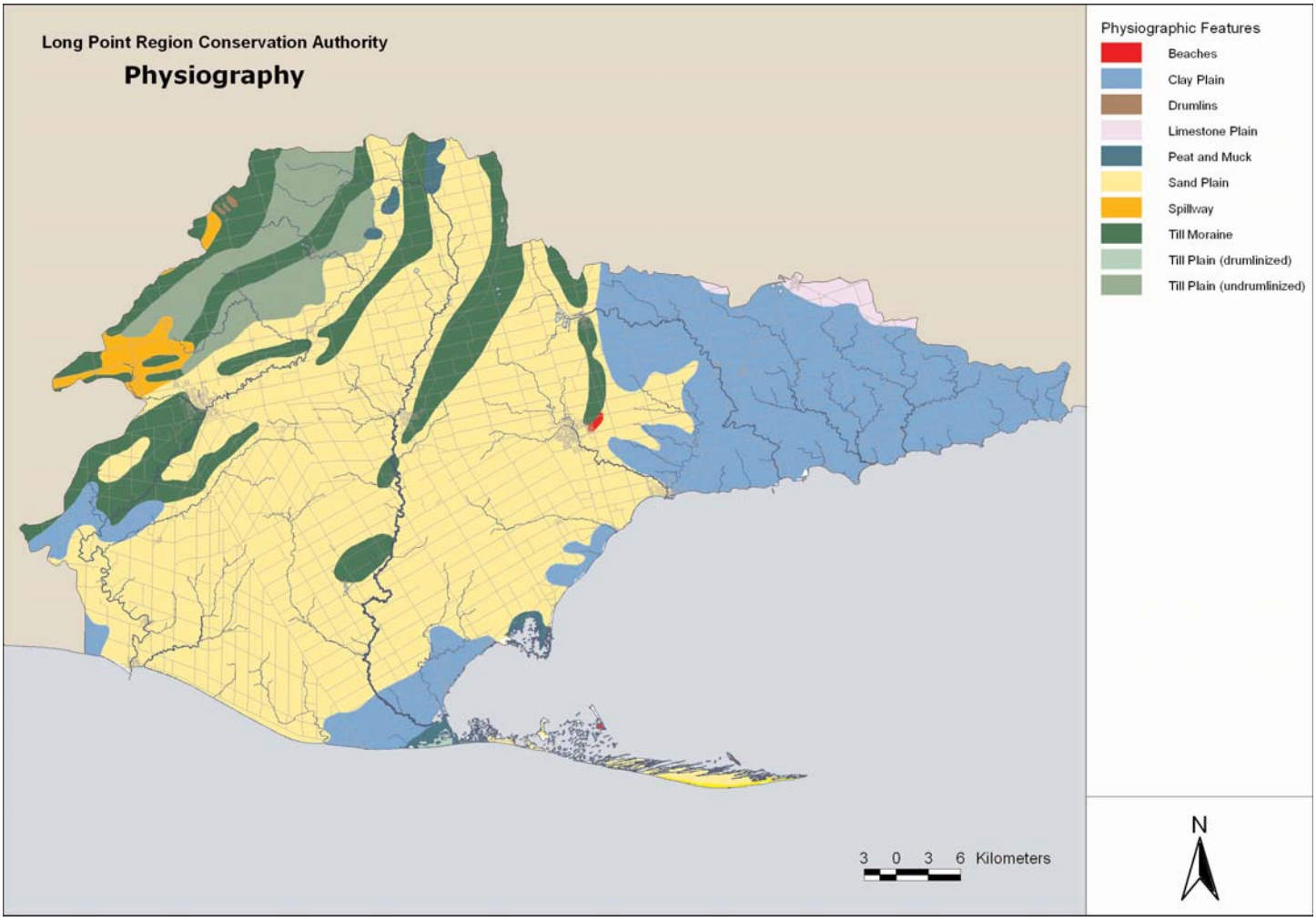
There are three distinct physiographic regions within Long Point Region:

### Horseshoe Moraine and Mount Elgin

The Horseshoe Moraine and Mount Elgin regions are located in the northwest portion of Long Point Region. The ground surface in this area is covered by Port Stanley Till, a thick, silty clay-rich till unit. These two regions also contain several elongated moraines that provide low to moderate relief. In some areas, it is discernible as slightly hummocky topography. These moraines include the St. Thomas, Norwich, Tillsonburg, Courtland, Mabee, Paris and Galt moraines. Many wells in this area use groundwater found in discontinuous sandy aquifers located between the till layers.

### Norfolk Sand Plain

The Norfolk Sand Plain, located throughout the western and central extents of the region, is a low-relief, silty sand and gravel plain. It ranges in thickness from less than a metre to over 25 metres in isolated areas. The sand plain was deposited as a delta in glacial Lakes Whittlesey and Warren, roughly 13,000 years ago. The sand plain is also rich in water and is intensively used for both mixed farming and cash crops. However, the fact that the soils are more permeable also means that it is easier for contaminants to enter the ground and reach wells. Many private



# 4. Geology and groundwater (cont'd)

wells are completed in the unconfined, shallow sand aquifer, however municipal wells draw their water from a deeper, confined overburden aquifer.

### Haldimand Clay Plain

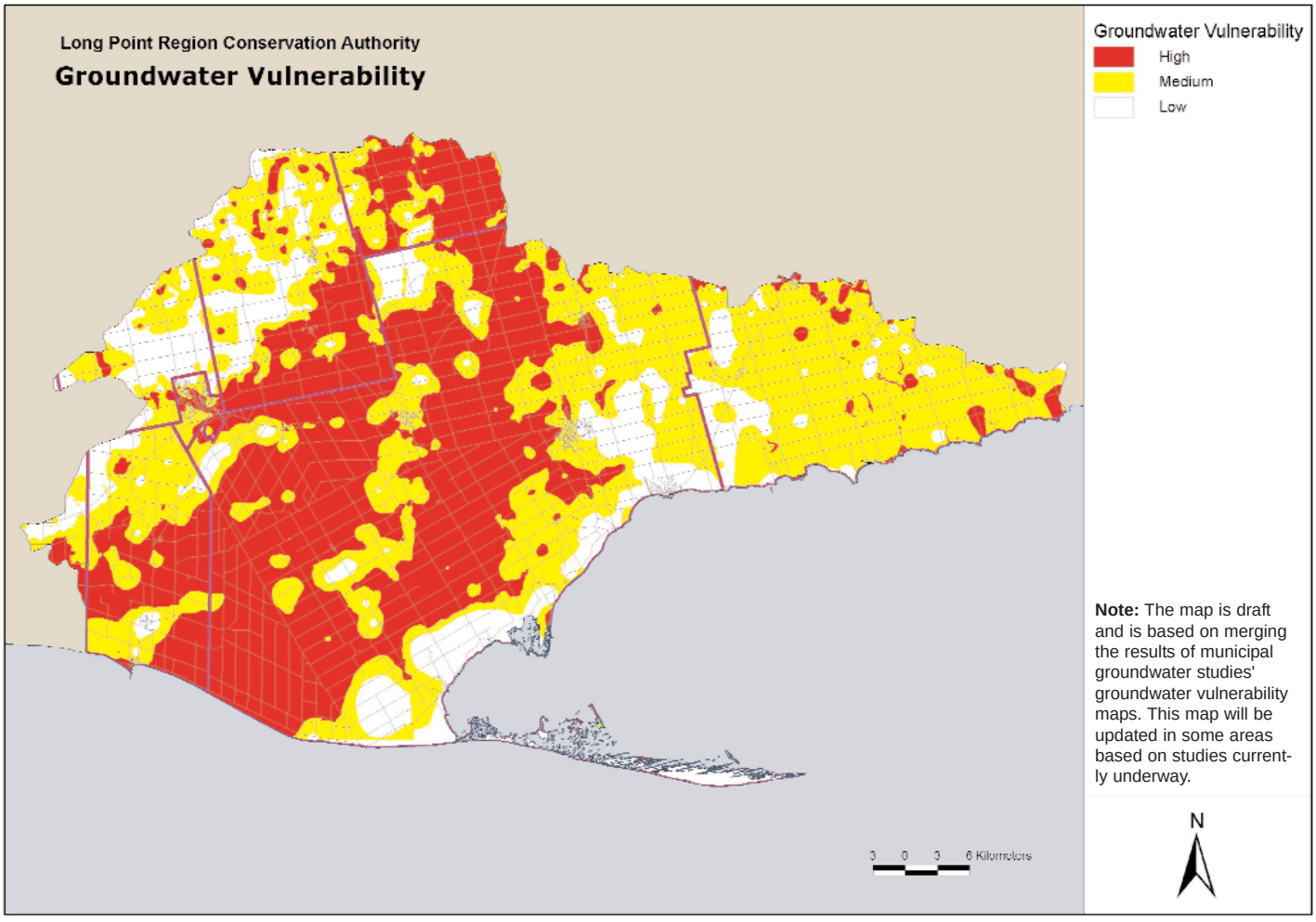
The Haldimand Clay Plain, located in the eastern portion of Long Point Region, consists of fine-grained silts and clays deposited at the bottom of a deep glacial lake basin. It is characterized by heavy clay soils which are relatively impermeable, resulting in a high level of runoff and little groundwater recharge. Much of the land is poorly drained and is used predominantly as livestock pastures and for soybean, corn and hay production. In this area, groundwater is generally obtained from the bedrock of the Dundee Formation and the Detroit River Group because sufficient quantities of water cannot be obtained from the overburden. Groundwater drawn from the bedrock aquifers in this area is often poor in quality as a result of naturally elevated concentrations of sulphur, salts and minerals in the water.

There is a direct relationship between the surface geology and the groundwater and surface water hydrology across the study area. In general, areas with clay and fine-grained soils such as the Haldimand Clay Plain tend to have more streams because of the low infiltration capacity of the clay-rich soils.

In contrast, the Norfolk Sand Plain, with its coarser sand and gravel materials, tend to have fewer streams and tributaries because more precipitation percolates down into the ground to recharge the groundwater system.

## Areas susceptible to groundwater contamination

Where overburden sediments are coarse-grained or shallow and the water table is high, groundwater can often become impacted by waste or chemicals applied or spilled at ground surface.



# 4. Geology and groundwater (cont'd)

Most municipal wells and some private wells use deeper aquifers. They may be protected from surface influences by thick, overlying layers of denser till or clay materials.

The aquifer vulnerability map shows the relative susceptibility of groundwater contamination for the shallow aquifers that are most commonly used for private drinking water.

In the western portion of the region aquifers generally have a low vulnerability to impacts from surficial land uses. These deeply-situated aquifers are located within the Port Stanley Till and generally have a thick layer of clay-rich overburden which provides a degree of protection from downward migrating chemicals.

The central and eastern portions of the region have a higher relative vulnerability to impacts from surficial land use. The central areas corresponds with the shallow sand aquifer within the Norfolk Sand Plain, which is particularly susceptible to groundwater contamination. This aquifer has little to no overburden protection from surficial activities and is particularly influenced by road salt, septic systems, manure and chemicals associated with farming and manufacturing.

To the east, in Haldimand County, primary groundwater resources are found in the Dundee and Detroit River Group bedrock formations. The dense soils of the Haldimand Clay Plain provide some protection to the bedrock aquifers. Zones of moderate vulnerability in this area are a result of thin overburden cover and areas of high vulnerability are generally locations of bedrock outcrop. Areas with thicker overburden cover have a lower relative vulnerability.'

# 5. Hydrology and surface water

## Overview

The Long Point Region consists of several major watershed groups. Most of the western watersheds are within the Norfolk Sand Plain, an area characterized by low runoff, high soil infiltration and sustained base flows.

The eastern watersheds are within the Haldimand Clay Plain, an area characterized by high runoff and low soil infiltration. The eastern watersheds have a higher number of tributaries, are shallower and tend to dry up during the summer.

The Long Point Region has among the highest number of permitted surface and ground water users of any area in Southern Ontario. Demand for irrigation water during the summer months can affect stream flow throughout the region, particularly in the Norfolk Sand Plain. Several hundred small dams have been constructed on virtually every tributary of Big Creek and Big Otter Creek and other small watercourses in the watershed, to store water for irrigation.

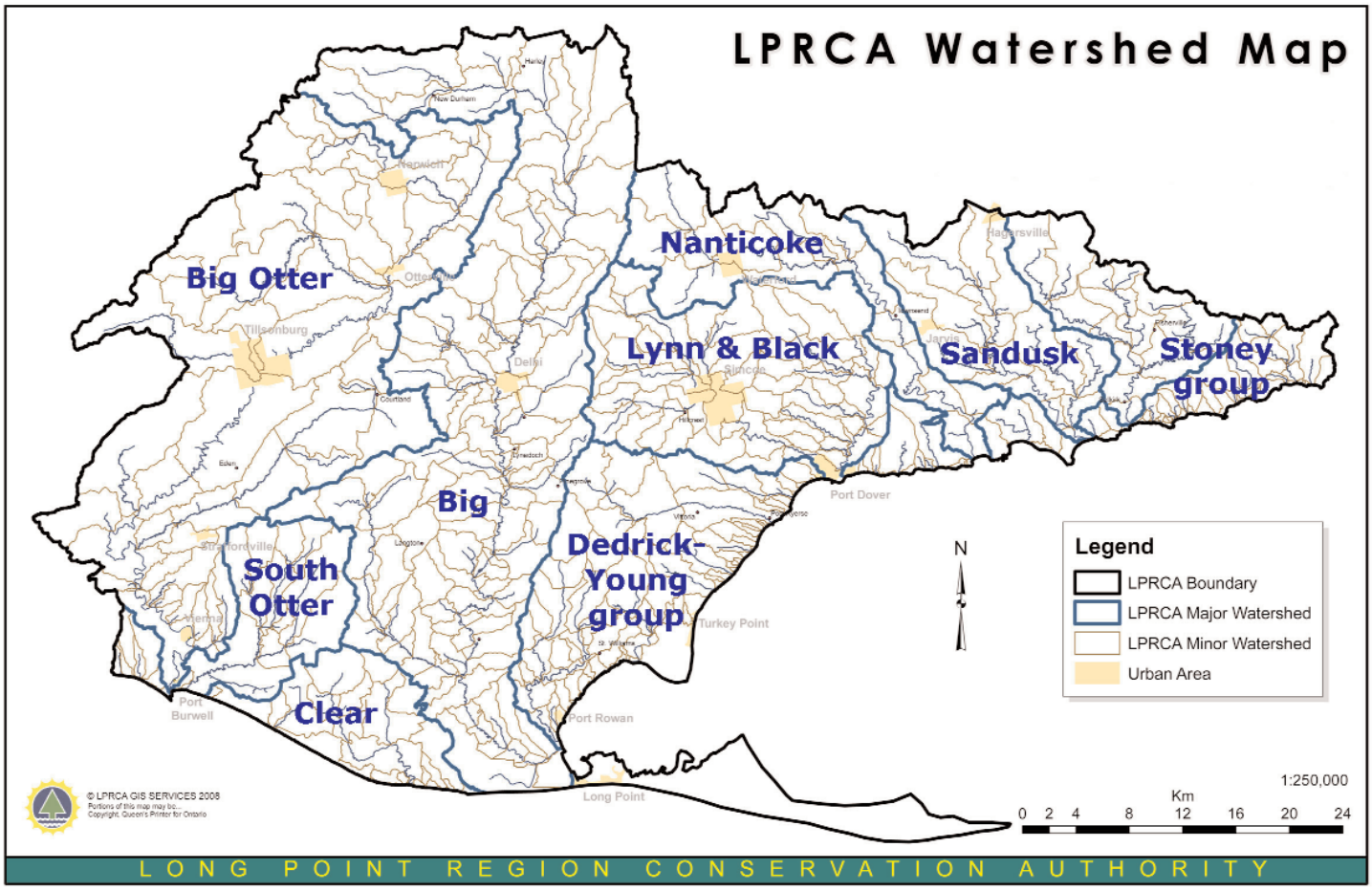
## Watersheds (west to east)

### Big Otter Creek

Big Otter Creek is the second largest watershed in the region, draining approximately 712 square kilometres. The upper part of the watershed is in till plain. The creek flows south through the Norfolk Sand Plain, through Norwich, Otterville, and Tillsonburg before entering Lake Erie at Port Burwell. The watershed is characterized by moderate runoff, soil infiltration, and base flows. The largest tributary, Little Otter Creek is a cold water stream draining 117 square kilometres that joins Big Otter Creek near Straffordville.

### South Otter and Clear creeks

South Otter Creek drains approximately 111 square kilometres. Clear Creek drains an area of approximately 106 square kilometres to the east of South Otter Creek. Both creeks are within the Norfolk Sand Plain and are characterized by low runoff, high infiltration, and groundwater fed base flows.



# 5. Hydrology and surface water (cont'd)

### Big Creek

Big Creek is the largest watershed in the Long Point Region with a total area of 750 square kilometres. The creek flows south through Delhi, where North Creek joins it. Venison Creek joins downstream of Walsingham before Big Creek enters Lake Erie near Port Rowan.

### Dedrick-Young group

The Dedrick-Young Creek watershed group drains a combined area of 263 square kilometres. The main watercourses in this group are Dedrick, Young, and Hay creeks, but this area also includes some small Lake Erie tributaries. The watershed is mainly within the sand plain. With groundwater fed base flows, the area contains several significant cold water streams.

### Lynn River-Black Creek

The Lynn River flows from north of Simcoe southeasterly to Lake Erie at Port Dover. It is joined by Black Creek in Port Dover just prior to draining into Lake Erie. The combined drainage area of this watershed group is approximately 285 square kilometres.

The Lynn River, a cool water fishery, is largely in the Norfolk Sand Plain. The area is characterized by low runoff, high soil infiltration, and sustained base flows. Black Creek, a warm water fishery, is in the Haldimand Clay Plain with high runoff and low base flows.

### Nanticoke Creek

Nanticoke Creek, which drains about 180 square kilometres, begins as a cool water fishery in the Norfolk Sand Plain with groundwater-fed base flows. From there it enters a series of lakes, ponds, and wetlands called the Waterford Ponds. It changes to a warm water fishery after it passes into the Haldimand Clay Plain past Waterford. It enters Lake Erie at Nanticoke.

### Sandusk Creek

Sandusk Creek is a small watershed of 158 square kilometres in the Haldimand Clay Plain, with high runoff, low soil infiltration, and low base flows.

### Stoney, Evans, Hickory and Fories-Stelco group

This watershed group covers a combined area of approximately 207 square kilometres. It includes Stoney, Evans, Hickory, and Fories-Stelco Creeks, as well as some small Lake Erie tributaries. Each of these creeks drains an area of Haldimand Clay Plain, with high runoff and low soil infiltration. There is little to no base flow during the summer months.

# 5. Hydrology and surface water (cont'd)

## Major groundwater recharge areas

There are three distinct regions of recharge in the Long Point area.

### Northwest

The northwest corner of the watershed is characterized by an area of moderate recharge. The surface materials are generally a fine-grained till material with low permeability interspersed with pockets of coarse-gained deposits with higher permeability.

### Norfolk Sand Plain

The central-western portion of the watershed, in the Norfolk Sand Plain, is an important area of very high recharge. The soils are coarse-grained sands with a high permeability. High amounts of recharge in the Norfolk Sand Plain contribute to the shallow overburden groundwater system located within this area.

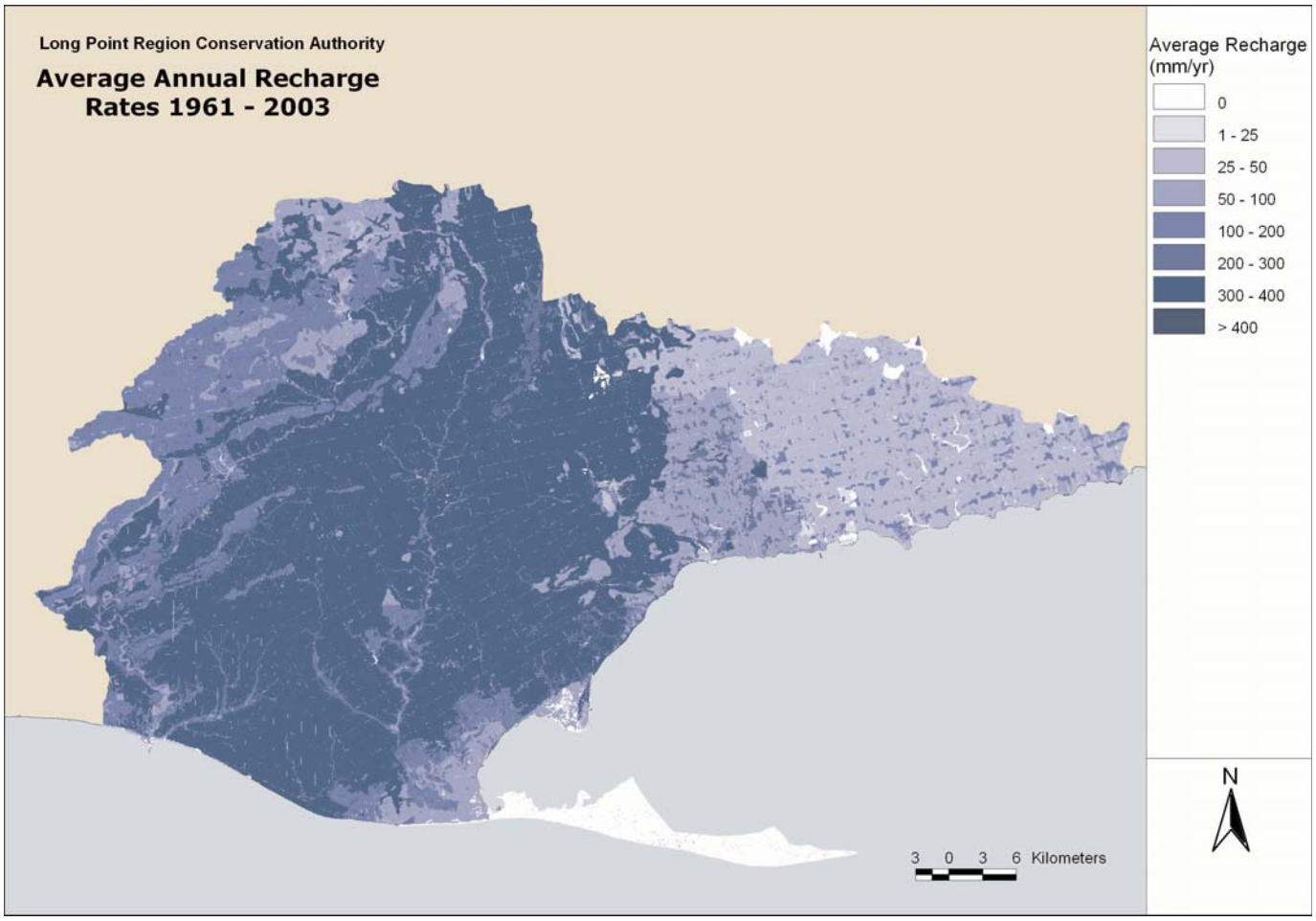
### Haldimand Clay Plain

The eastern part of the watershed, the Haldimand Clay Plain, is covered by fine-grained clay-rich material with low permeability. That limits recharge to the deeper groundwater system.

## Major groundwater discharge areas

Groundwater can surface in springs or seeps which add flow to streams. In the Long Point Region, this is most common in the Norfolk Sand Plan where groundwater discharge adds cold water to many streams. However, during periods of high irrigation, when water is removed from both the surface and groundwater systems, this can affect the amount of water that is able to discharge to the surface system.

In the eastern portion of the watershed region, in the Haldimand Clay Plain, watercourses are driven by runoff with little base flow provided by groundwater discharge.



# 6. Reservoirs and reservoir operations

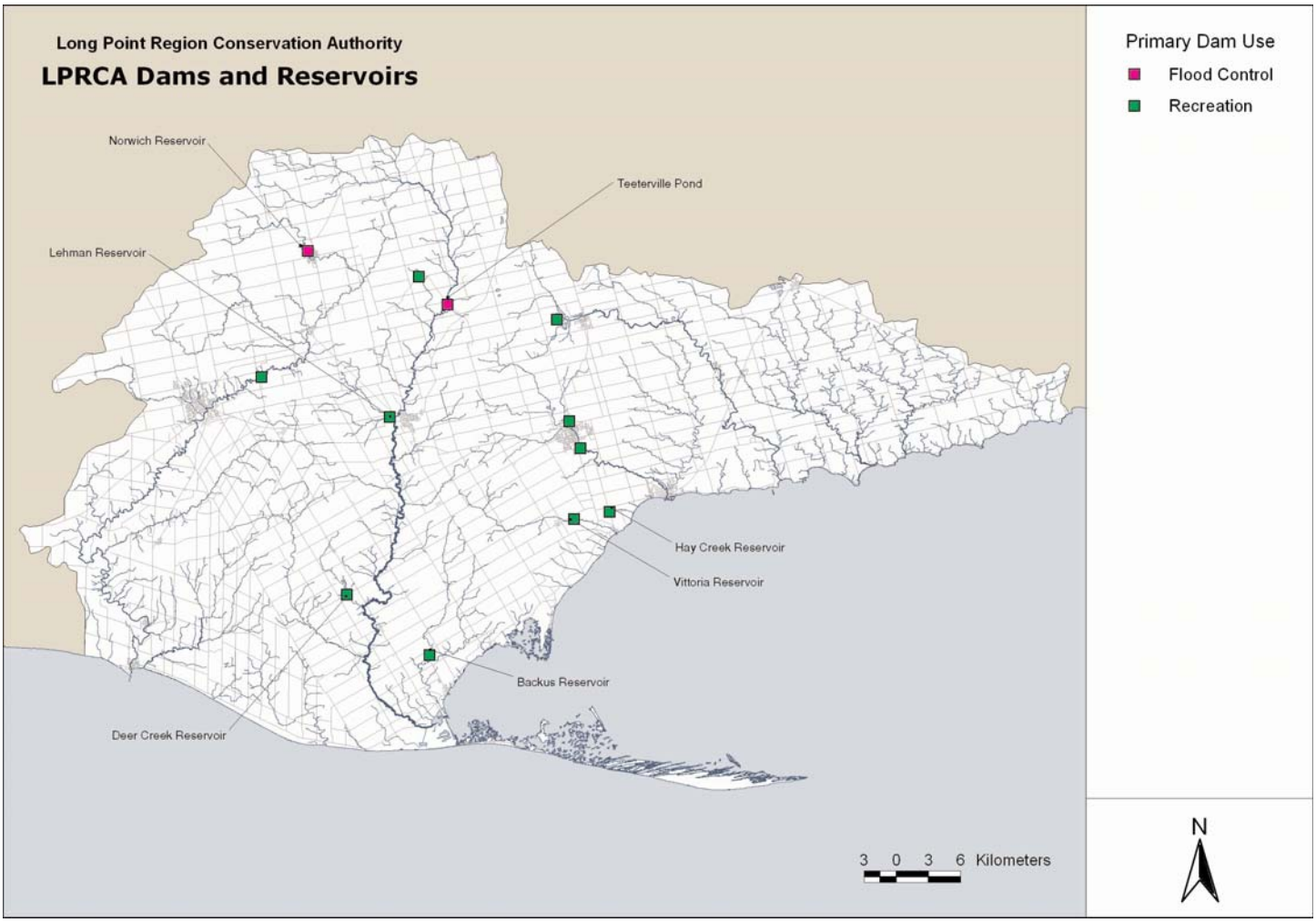
Several hundred privately owned and operated small dams have been constructed on virtually every tributary of Big Creek and Big Otter Creek and other small watercourses in the watershed, to store water as a source for irrigation.

They were constructed mainly in the last half of the 20th century. There are also several old mill dams that were constructed in the 1800s and replaced or maintained in various states since.

In addition, the LPRCA operates a number of small dams for multipurpose uses, including flood control, low flow augmentation, drinking water supply, irrigation, recreation and wildlife habitat.

Some of the notable dams in the watershed include:

- Teeterville Reservoir on Big Creek, used for recreation, flood control and low-flow augmentation.
- Lehman Reservoir on North Creek (Big Creek tributary) in Delhi, used for water supply and recreation.
- Deer Creek reservoir (Big Creek tributary) used for recreation and private water supply for the Deer Creek Conservation Area
- Quance Dam (Crystal Lake) on the Lynn River in Simcoe
- Misner Dam (Silver Lake) on the Lynn River in Port Dover
- Hay Creek Dam, used for recreation
- Vittoria Pond on Young Creek used for recreation
- Waterford dam on Nanticoke Creek used for flood control, low flow augmentation and recreation.



# 7. Population

## Population trends and projections

The 2001 census reported that the total population of Long Point Region was approximately 99,000 people, the majority living in the rural areas.

The largest town in the watershed is Simcoe in Norfolk County, with a 2001 population of approximately 14,180. The town is expected to accommodate over 24 per cent of Norfolk's growth over the next several decades.

The smaller centres of Port Dover (5,530) and Delhi (4,000) in Norfolk County are expecting to accommodate six per cent and 10 percent, respectively, of the county's overall growth over the next 50 years.

The Town of Tillsonburg, in Oxford County, has a population of approximately 14,000 people, and is expected to accommodate over 21 per cent of the Oxford's growth until 2031.

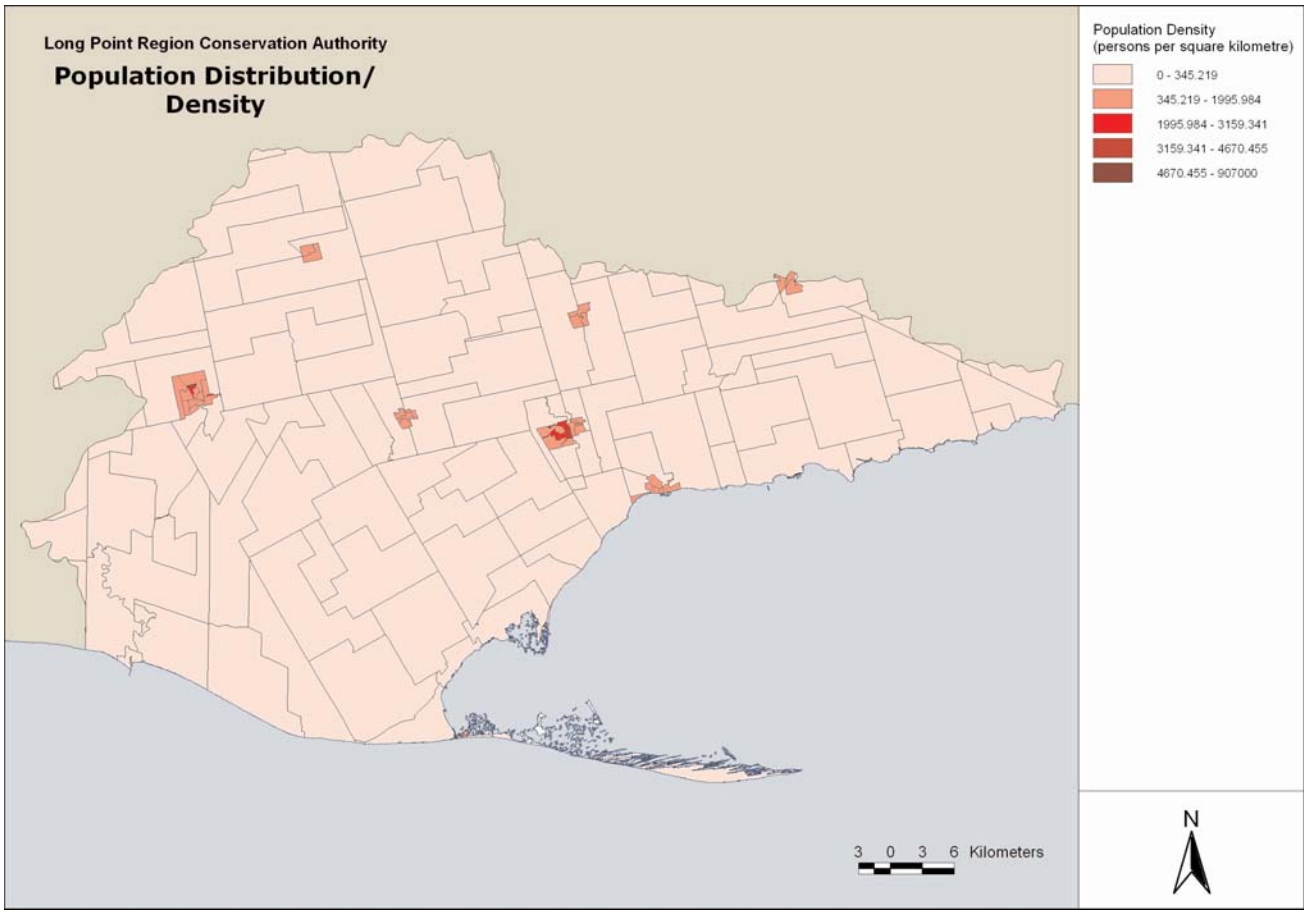
The province has not identified the municipalities within Long Point Region as being urban growth centres (with the exception of Brant County where growth is expected to occur outside the Long Point Region watersheds), and as such will not experience the same level of growth as larger centres to the north.

The majority of the growth in Long Point Region will be in Norfolk County and the Town of Tillsonburg in Oxford County. Most of the growth within Norfolk County will occur in the serviced towns of Port Dover, Simcoe and Port Rowan, rather than in rural areas.

The portion of Haldimand County falling in Long Point Region has a mainly rural population with limited growth growth.

**Population forecasts**

| County | 2001 | 2031 | Increase |
|---|---|---|---|
| Elgin | 6,872 | 11,138 | 62% |
| Oxford | 23,655 | 32,738 | 38% |
| Norfolk | 59,211 | 74,907 | 26% |
| Haldimand | 13,254 | 16,588 | 25% |
| Brant | 1,074 | 1,139 | 6% |
| **Total** | **99,217** | **127,606** | **29%** |



# 8. Land cover and land use

## Settlement history

Early First Nations inhabitants of the Long Point Region were primarily hunters, although they produced agricultural products such as squashes, tobacco, corn, beans and other vegetables.

Formal British and European settlement began in the late 1700s in what was called the "Long Point Settlement."

Farmers were initially attracted to the relatively open plains of Norfolk. The heavily forested areas surrounding the plains presented much more of a challenge. The amount of forest cover declined from over 70 per cent in the 1850s to less than 15 per cent in the 1960s. Reforestation and other forms of regeneration have regained some of that loss to the point where this area now has a cover of 20 percent.

By the mid-1800s some of the crop land started to become less productive due to erosion and loss of nutrients. The loss of useful crop land due to wind and water erosion prompted the establishment of the first Provincial Forest Station at St. Williams in 1908.

The towns and villages developed around the water powered mills, inns and taverns. The communities of Simcoe, Waterford, Tillsonburg, Fredericksburg (now Delhi), Port Rowan, Port Dover, Vittoria, Nanticoke, Port Ryerse, Normandale and St. Williams were already established by the 1840s. As these communities developed, so did the problems of water pollution associated primarily with sewage and food processing wastes being dumped into the watercourses.

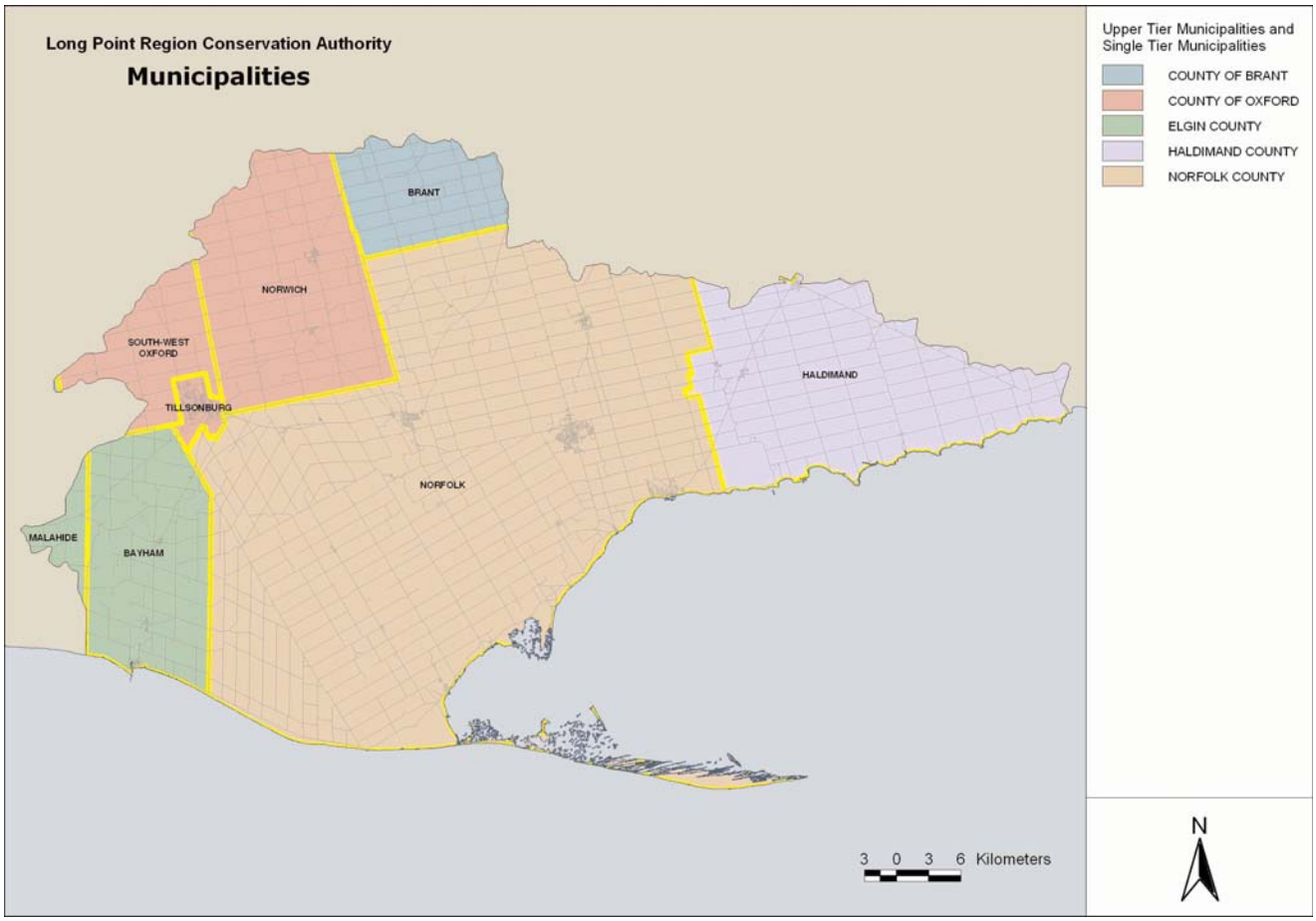
## Municipal structure

Long Point Region contains, in whole or in part, ten upper and lower tier municipalities.

Three of the municipalities are single-tier counties: Brant, Haldimand and Norfolk.

Oxford County includes Southwest Oxford and Norwich townships, as well as the Town of Tillsonburg.

Elgin County includes the Township of Malahide and Municipality of Bayham.



# 8. Land cover and land use (cont'd)

## Urban areas

The Long Point Region is characterized by a few small urban commercial, industrial and residential centres, surrounded by less-populated rural land used for intensive agricultural production. Tillsonburg and Simcoe are the largest urban centres, each with a population of about 14,000. Other towns and villages include Delhi, Waterford, Port Dover, Port Rowan and Port Burwell.

Many of the lakeside towns are thriving tourist centres with marinas and other service industries.

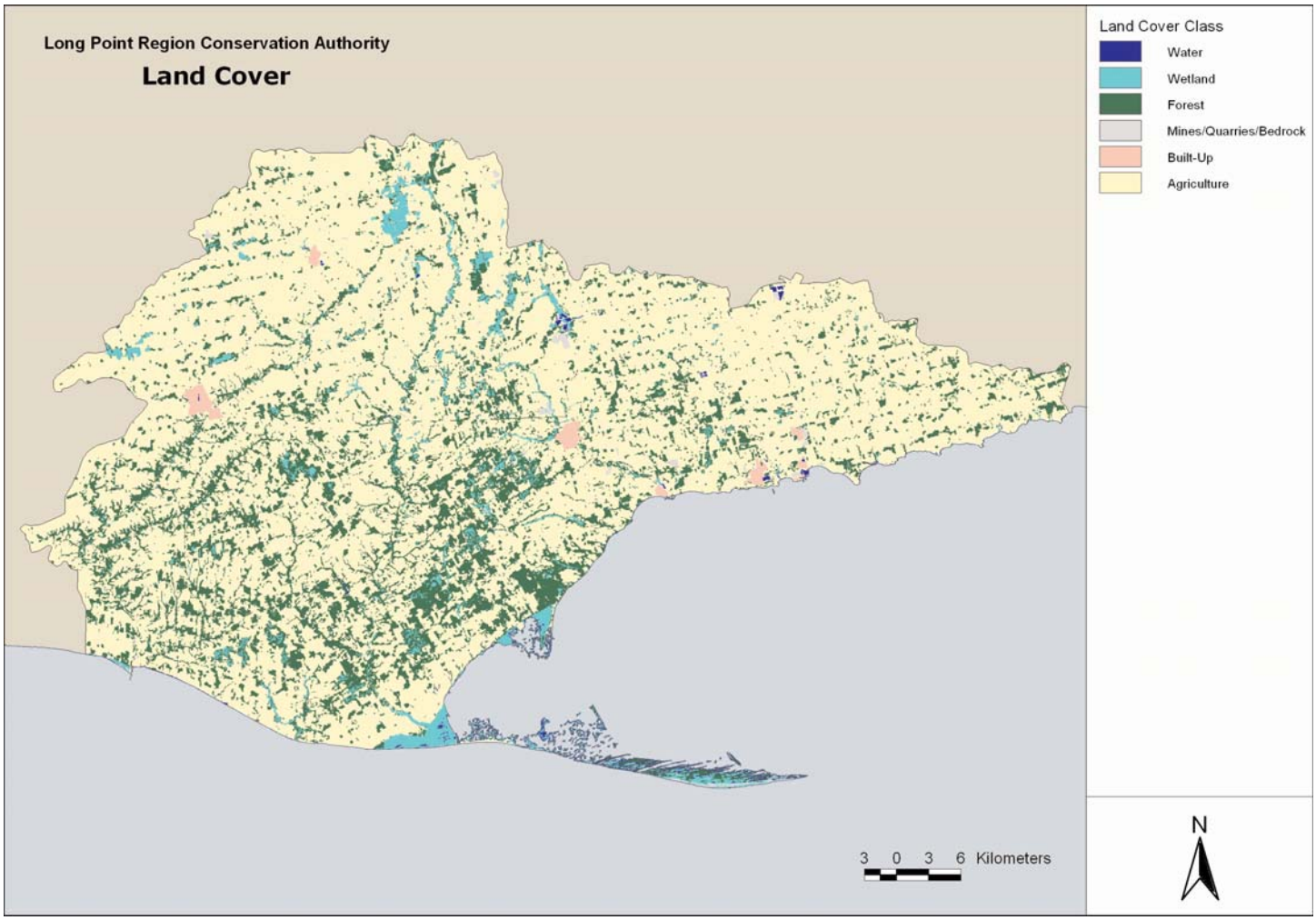
Another significant developed area is the Lake Erie Industrial Park and the nearby Townsend Community. The industrial park, which features a steel mill, oil refinery, coal-fired power plant and other industries, is a focal point for industrial development in Haldimand County. A water intake serving several Haldimand communities is located offshore of the industrial park.

## Agriculture: crops and pasture

Agriculture is the most significant land use in the watershed, with 78 per cent of the land area designated and used for agricultural purposes. Both livestock and agricultural crops are prominent practices, with 61 per cent overall in cropped agricultural land. There are a total of 43,100 head of cattle, 149,100 head of swine and 2,979,200 head of poultry across the watershed. The majority of crops grown in the watershed are soybean (27.3 percent), corn (26.8 percent), and grains (17.4 percent).

The Norfolk Sand Plain has substantial amounts of root crops, vegetables, some fruits and nursery crops. These high value crops require very careful management; soil nutrient levels must be maintained within a narrow range to achieve optimal quality as well as yield.

Vegetables and crops such as tobacco and potatoes gen-



# 8. Land cover and land use (cont'd)

erally have smaller field sizes but higher water requirements than other row crops. The concentration in the sand plain also poses risks to reduced water availability for crops due to fast infiltration rates. Supplemental water from irrigation is required during dry weather.

Approximately 35 per cent of the farms reported using irrigation, accounting for 15.3 per cent of the cropped land area. However, in one basin more than half of the farms irrigate, accounting for as much as 27 per cent of the cropped land area.

The clay plain however, has very little or no agricultural land supporting root crops, vegetables or field crops. There higher percentages of soybeans and hay growing here than in the sand plain area.

## Commercial and industrial land

Commercial growth is focused on redevelopment of the downtown cores as well as larger commercial growth along the Highway 3 and 19 corridors through Simcoe, Delhi and Tillsonburg.

Industrial growth is focused in the same communities, as well as the large Lake Erie Industrial Park in Haldimand County.

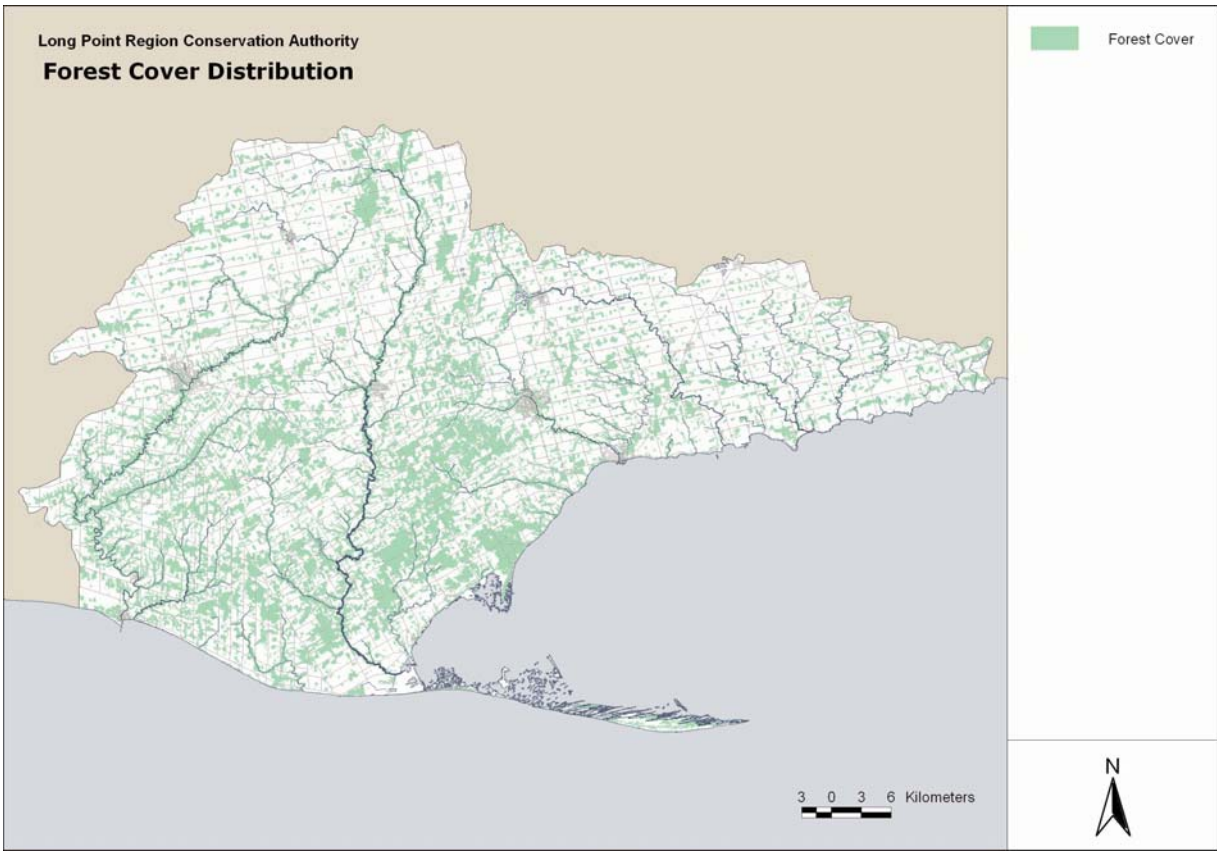
Most of the lands designated for growth are within or immediately adjacent to the existing urban areas as well as the Lake Erie Industrial Park.

There are relatively few areas that would be classified as brownfield sites.

## Forest and vegetation

Woodlands occupy about 20 per cent or approximately 577 square kilometres of the total area.

Deciduous forests are the most common with maple, beech, ash and oak the most common species. However, there are significant forest pockets which are representative of the broader Carolinian zone which include species such as tulip tree, black gum, sassafras, black oak and cucumber tree. These tree species are rare in Canada and occur naturally only in southern parts of Ontario north of Lake Erie.



# 8. Land cover and land use (cont'd)

## Mining, aggregate and petroleum resources

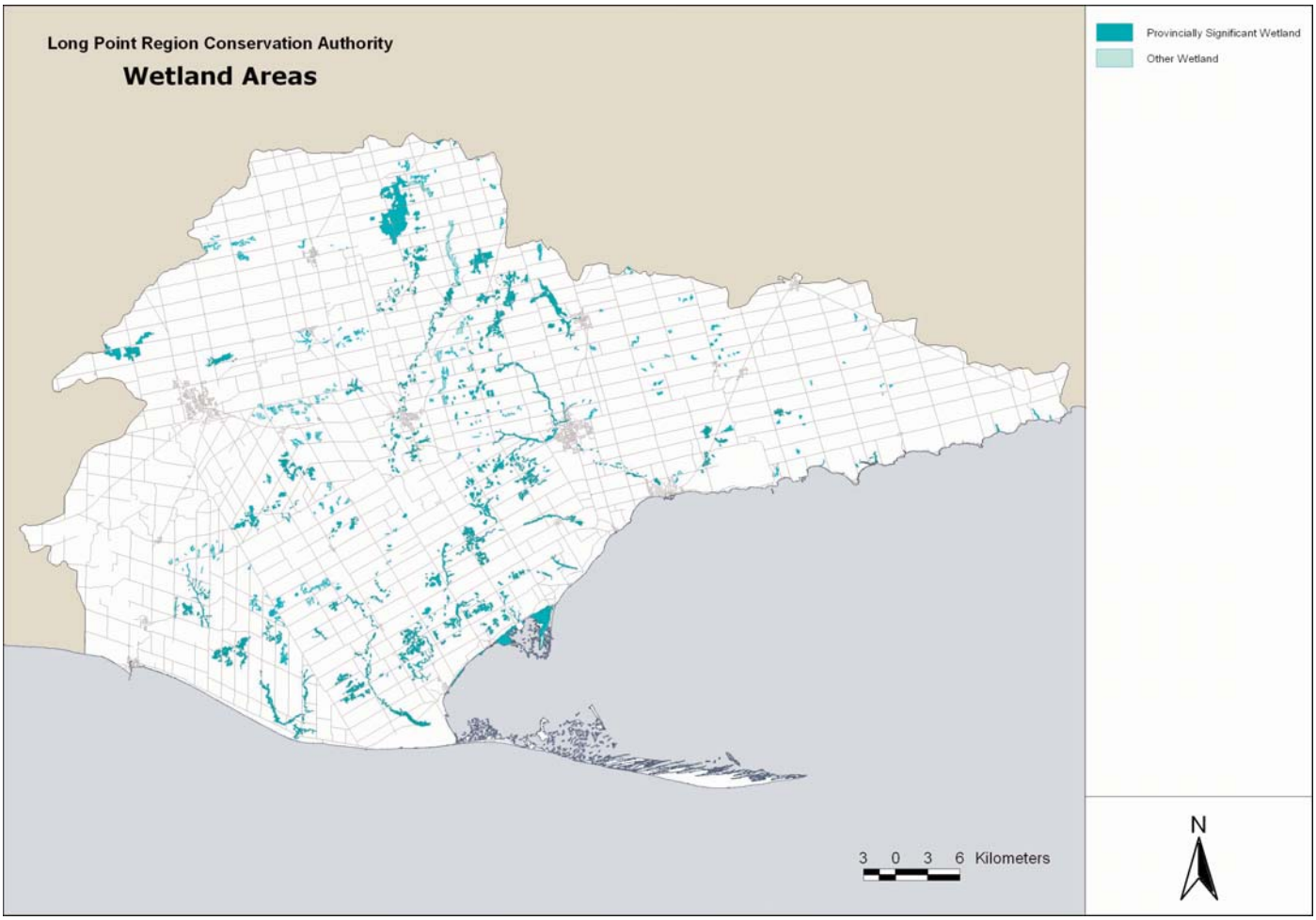
Petroleum resources and mineral aggregates play an important economic role in this area. Existing and potential petroleum and mineral aggregate resource activities are protected, and the extractive industry permitted to operate as free from land use conflict as possible, by policies of the municipalities while ensuring minimal environmental impact and social disruption. The policies also recognize that exhausted pits and quarries and mineral and petroleum resource lands need to be rehabilitated for appropriate uses that are compatible with the surrounding area and environment.

Bedrock Resource Areas, and Sand and Gravel Resource Areas, as identified by the Ministry of Natural Resources, are mapped in the Official Plans for protection and appropriate development. There is no mining activity in the Long Point Region.

## Wetlands

Wetlands are a significant feature of the watershed. Although a large percentage of the original wetlands have been lost through clearing, filling and drainage, there are still almost 160 square kilometres of evaluated wetlands in the Long Point Region watersheds. The Long Point wetland complex, which includes the wetlands at the mouth of Big Creek, covers 75 square kilometres.

The inland wetlands protect surface and groundwater resources. These wetlands absorb heavy rainfall and runoff events and release these waters slowly over time, either as surface flow or as recharge to the groundwater aquifers. The vegetation of the wetland also helps by filtering out contaminants.



# 9. Water use

## Overview

Calculating water use involves compiling information from a wide variety of sources. Some water users, such as municipalities, report their annual consumption. In other cases it is necessary to extrapolate total water consumption from information about typical use patterns for categories of consumers, such as rural residents.

Estimates were determined using the best available data, including Census of Population, Census of Agriculture, municipalities, and the Permit to Take Water (PTTW) database, as well as expert opinion of water managers.

Large water users –- those taking more than 50,000 litres a day – must have a permit from the Ontario Ministry of the Environment. However, this only establishes the maximum allowable taking and does not necessarily reflect the actual taking.

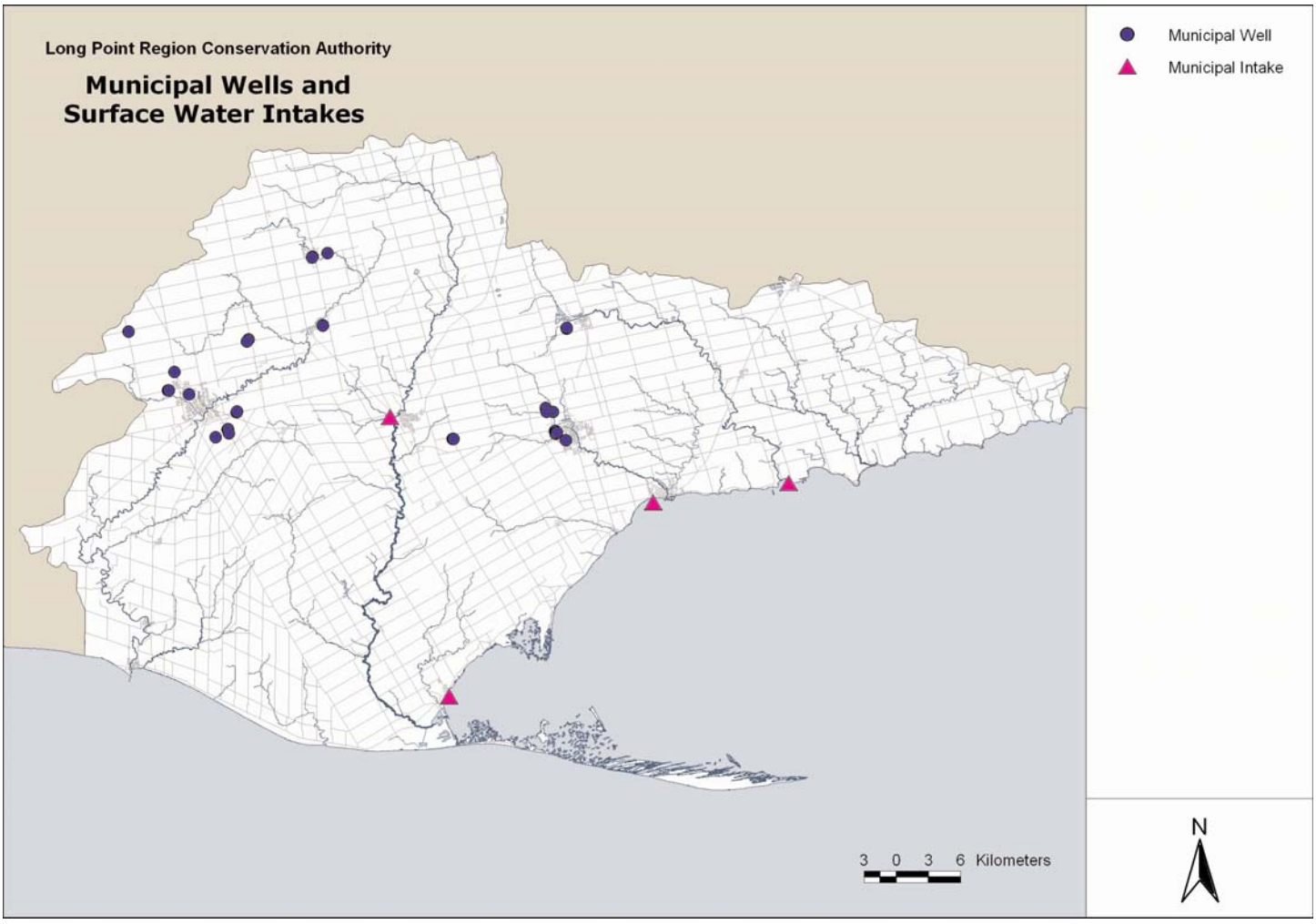
## Municipal use and sources

Municipal water use is the supply of water provided through a central distribution system operated by a municipality. Municipal water use includes urban domestic use, whether indoor or outdoor, and also includes uses for industrial, commercial, institutional or other uses.

The Long Point Region is predominantly in the Norfolk Sand Plain, making groundwater easily accessible for municipal supply, as well as for other uses. Municipal water use is estimated at 10.4 million cubic metres per year in this watershed for about 60,000 residents.

### County of Oxford

- Township of South-West Oxford – Mount Elgin – one well serving 370 people
- Township of Southwest Oxford – Dereham Centre – one well serving 48 people



# 9. Water use (cont'd)

- Township of Norwich – Norwich – two wells serving 3,200 people
- Township of Norwich – Otterville and Springford – four wells serving 1,600 people
- Town of Tillsonburg – 10 wells serving 14,000 people

### County of Norfolk

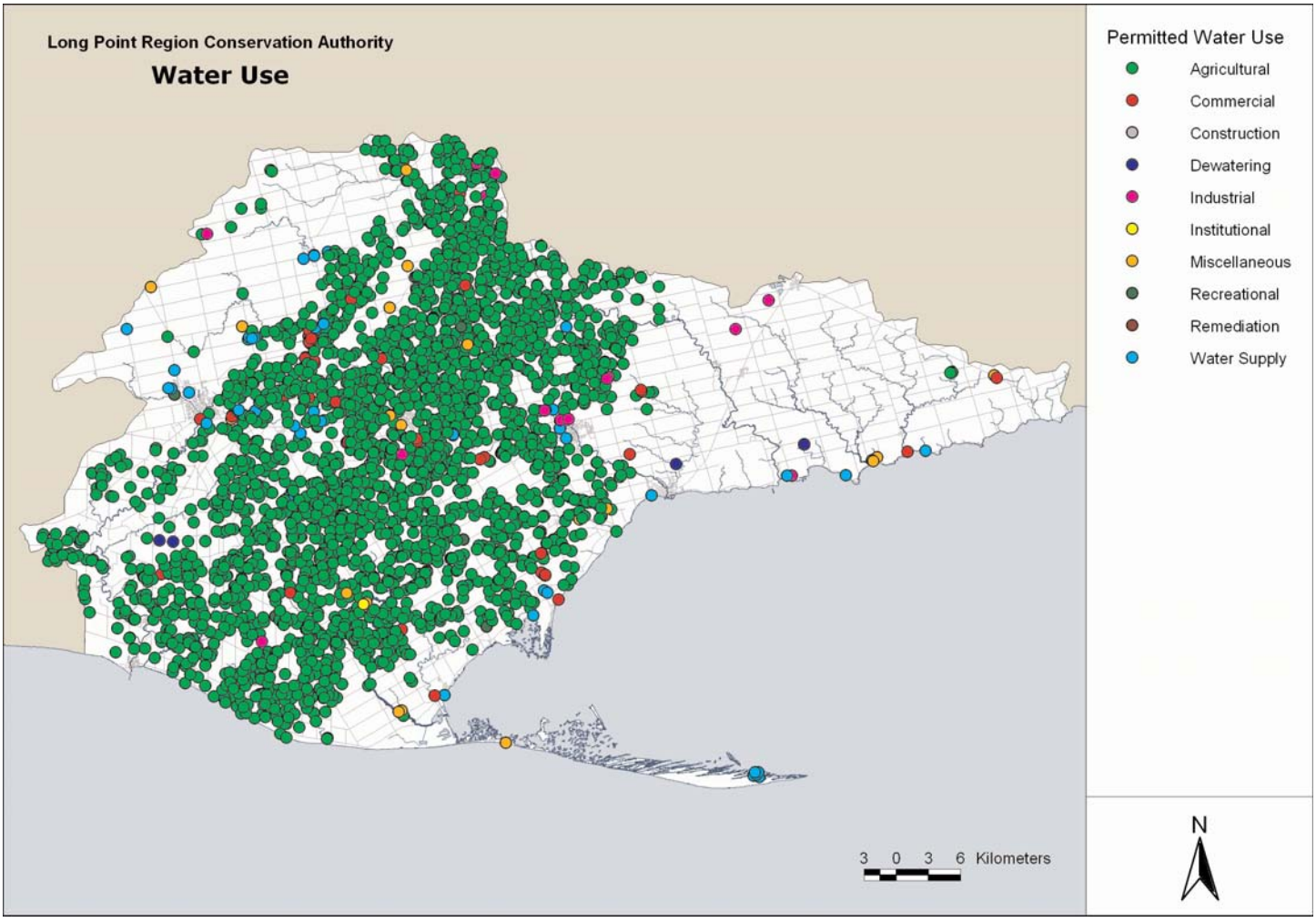
- Delhi and Courtland – two wells and a surface water intake in Lehman Reservoir (North Creek, a tributary of Big Creek) serving 6,000 people.
- Simcoe – nine wells serving 14,500 people
- Waterford - two wells serving 3,400 people
- Port Dover – Lake Erie intake serving 9,700 people
- Port Rowan and St. Williams – Lake Erie intake serving 1,280 people

### County of Haldimand

- Nanticoke And Trunk Main Water Treatment Plant – drawing water from an intake in Lake Erie. It serves 5,000 people in Nanticoke, Hagersville, Jarvis and Townsend as well as industries in the Lake Erie Industrial Park. This intake is under consideration to supply a pipeline proposed to serve other communities in Haldimand as well as Six Nations, Brant, Brantford, Norfolk, New Credit and Waterloo Region by 2031.

### Elgin County

- Elgin Area Primary Water Supply System – one Lake Erie intake near Port Stanley serving the communities of Port Burwell and Vienna in the Municipality of Bayham. (**Note**: Matters relating to the Elgin Area system will be addressed in the Source Protection Plan for the Kettle Creek Source Protection Area.)



# 9. Water use (cont'd)

## Rural domestic

Unserviced domestic water use is all water uses for domestic uses (indoor and outdoor residential) that are not on a municipal distribution system. Generally, these are rural communities and water could be taken from private wells. The estimation of unserviced domestic water use was based on population estimates and per capita water use rates for rural residents.

This water use is assumed to be relatively constant throughout the year. There are an about 7,613 domestic wells in the region, with 1,531 (20 per cent) bedrock wells and 5,922 (78 per cent) overburden wells.

The rural population in the Long Point Region is estimated to be 58,600 and draws 3.5 million cubic metres of water per year.

## Agriculture

Agricultural water use falls into two categories:

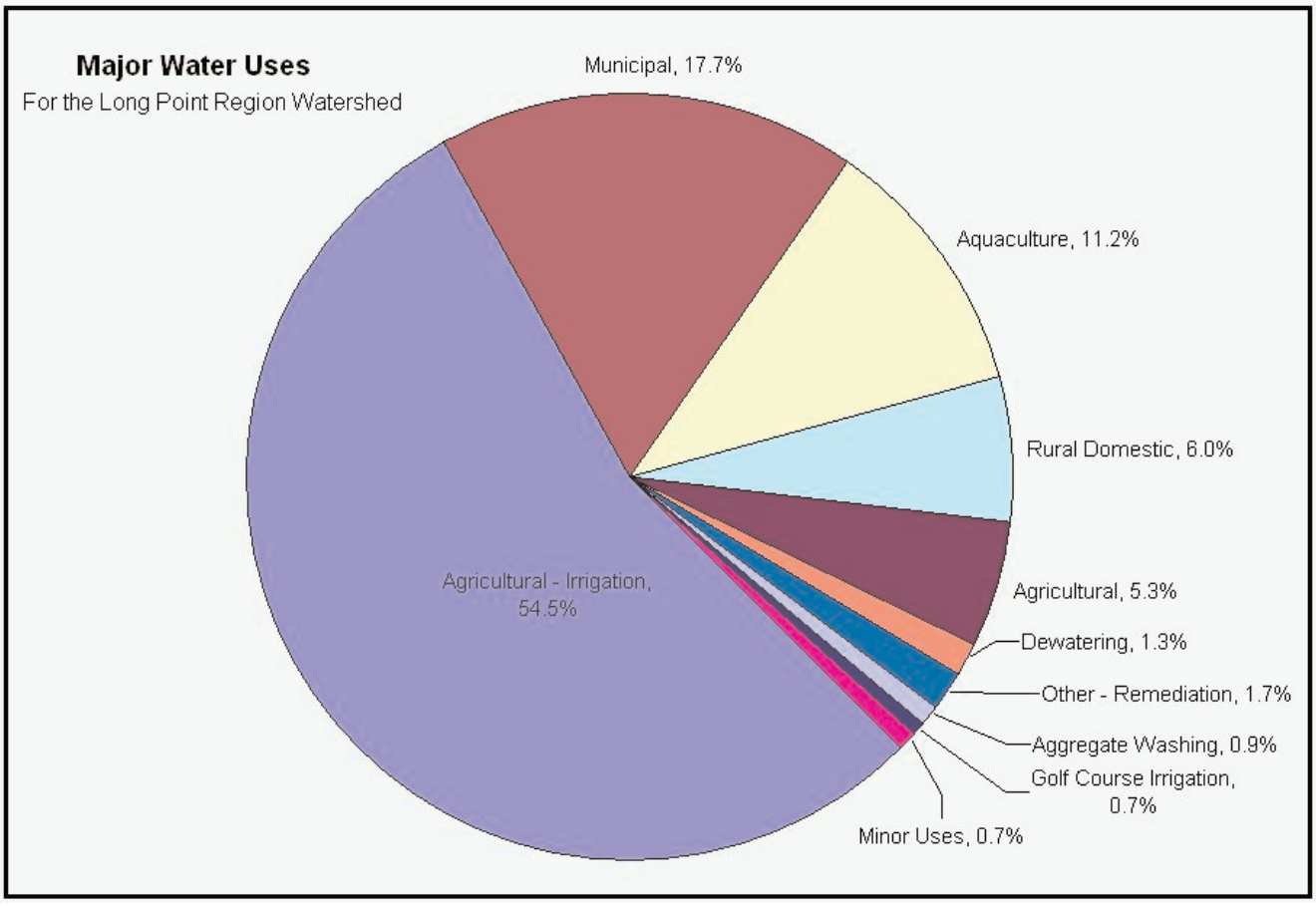
- crop irrigation
- livestock and farming operations

Permits are required for crop irrigation, which generally occurs during the summer. It represents a considerable portion of water takings in the Long Point Region.

Of the sources of water for agricultural irrigation, 65 per cent (1,761) are groundwater and 35 per cent (959) are surface water. Irrigation activity accounts for approximately 32.0 million cubic metres of water per year.

During the summer, water used for agricultural irrigation is often much more than the combined total of all other water takings on a monthly basis. During an extreme dry year, which requires more irrigation than an average year, this demand for water is much more pronounced.

Water for livestock and other farming operations is generally year-round. Permits to Take Water are not required for these uses. The estimated use of water for livestock is 3.1 million cubic metres per year.



# 9. Water use (cont'd)

## Industrial

Industrial permits to take water are mostly for aggregate washing and dewatering, however there are smaller operations such as food processing and manufacturing. These industrial uses account for 2.4 per cent of all water use, with dewatering at 1.3 percent, aggregate washing at 0.9 per cent and other minor industrial uses at 0.2 per cent of the total water uses. Other industrial water requirements are often incorporated in the municipal supply if they are connected to the system, and these uses are not accounted for in this estimate. For example, the Lake Erie Industrial Park is on the Haldimand (Nanticoke) municipal system and is not required to get a separate permit.

## Commercial

Commercial water use includes golf courses and aquaculture operations. Golf course irrigation accounts for 0.7 per cent of the total water uses, or about 2.5 per cent of the non-municipal and non-agricultural irrigation water uses. Aquaculture operations with a surface water permit generally divert water from a stream into holding tanks or ponds and return it back to the watercourse downstream of the fish farm, with minimal losses. From groundwater sources, aquaculture will remove groundwater for the holding tanks and discharge it into a nearby surface water system.

# 10. Waste treatment and disposal

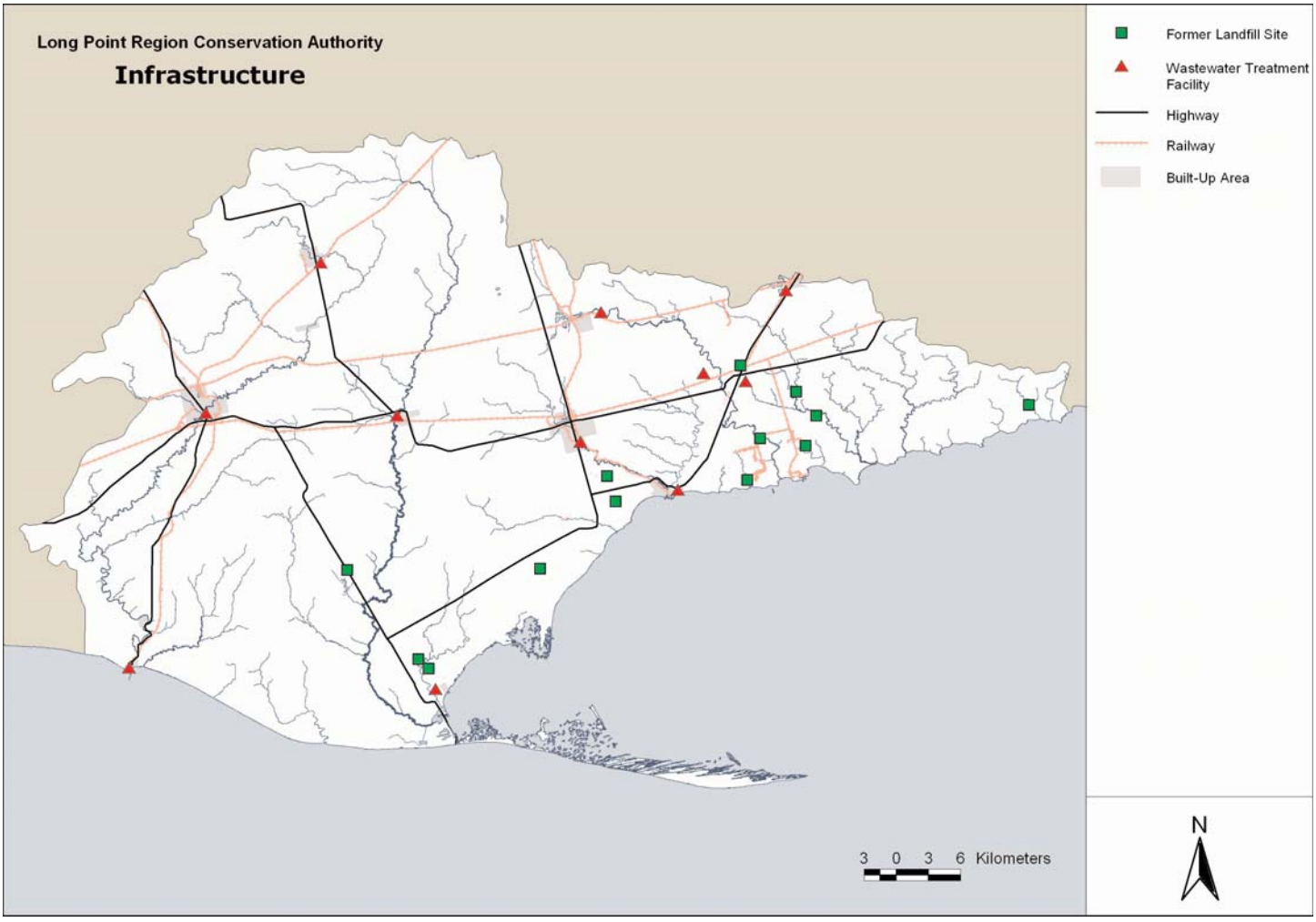
## Sewage treatment

There are 12 municipal wastewater treatment plants in the Long Point Region. Many of these municipal sites are undergoing studies to determine their capacity and needs for upgrades. The remaining areas of development are serviced by private sewage treatment (normally tile beds) or pump-outs which are trucked to the municipal sites.

## Landfills

There are no public landfills currently operating within the Long Point Region watershed. Two transfer stations operate in Simcoe and South Walsingham. There are 13 closed landfill sites in the Long Point Region. Many of the closed sites are being monitored to ensure that they do not impact the groundwater

There is also one active refinery landfarm at the Esso refinery in the Lake Erie Industrial Park for oily sludges and digested biosolids from the wastewater treatment plant on the property. In addition a landfill site may be in operation on the nearby Stelco property.



# 11. Water quality: surface

## Surface water quality monitoring

The Long Point Region Conservation Authority (LPRCA) monitors 10 sites as part of the Provincial Water Quality Monitoring Network, which have all been historically sampled. In addition to these sites, eight monitoring sites were added as part of the Long Point Region Conservation Authority's capacity building in 2005. The provincial program allows for eight samples to be taken each year. Samples from the new sites are analyzed by a private laboratory. All sites are examined for routine chemistry including nutrients, suspended solids, major ions and anions (such as chloride and sodium), pH, and metals (such as lead and manganese). Temperature is also routinely collected through the remote deployment of data-loggers in priority river reaches.

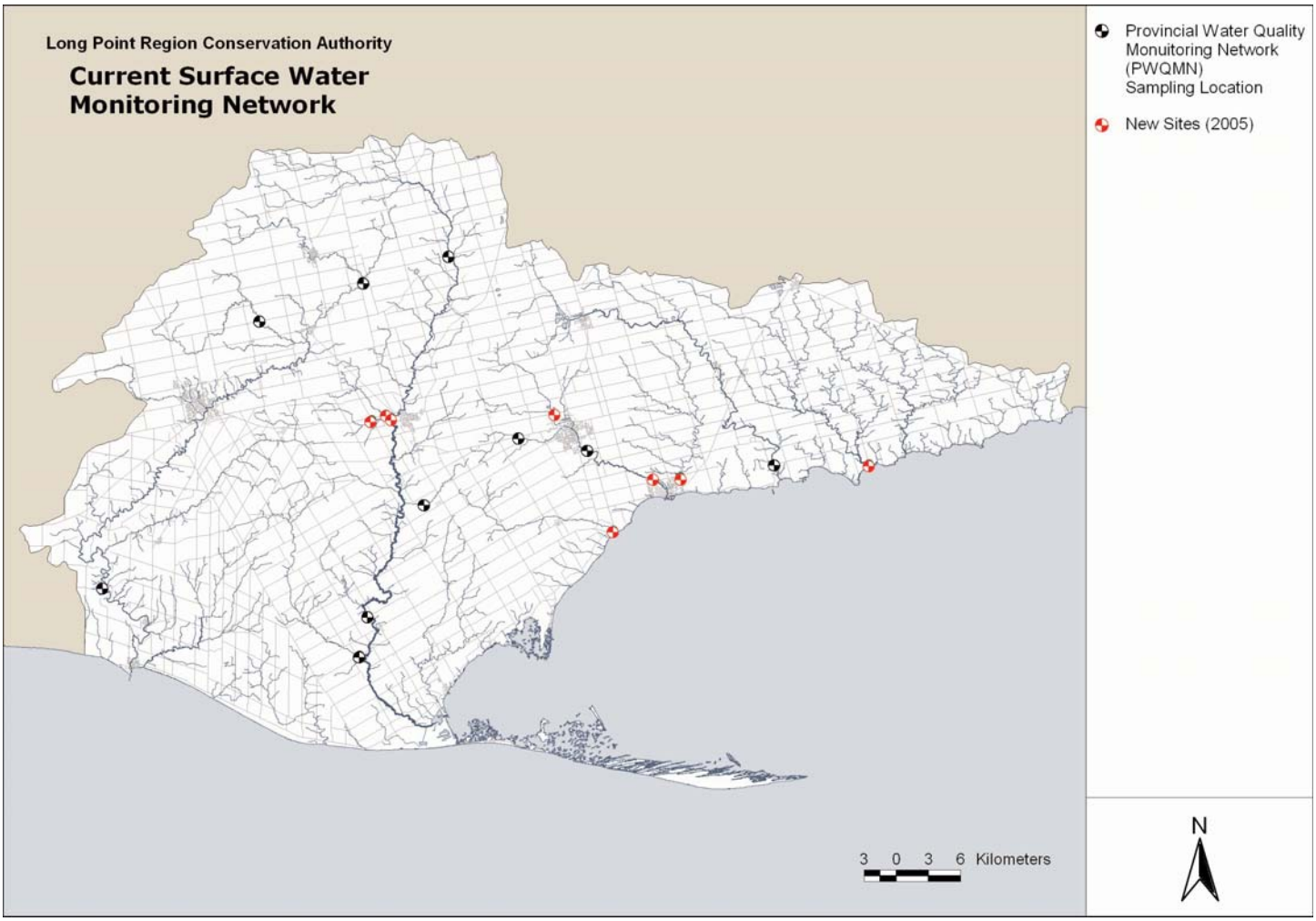
## Surface water quality conditions and trends

Water quality issues within the Long Point Region watersheds include high nutrient (e.g. phosphorus and nitrogen) and suspended sediment levels that contribute to prolific aquatic plant growth (i.e. high primary productivity).

The nutrient enrichment and prolific aquatic weed growth can lead to significant fluctuations in dissolved oxygen during the summer months, making some rivers unsuitable for aquatic habitat.

### Non-filterable residues

The geology and current land use practices within the Long Point Region appear to be driving some of the chronic surface water quality issues. For example, watersheds draining the clay and till plains tend to have the highest



# 11. Water quality: surface (cont'd)

non-filterable residue and nutrient concentrations (e.g. Big Otter Creek, Nanticoke Creek and Sandusk Creek).

Non-filterable residue levels are of greatest concern within the Big Otter Creek and Nanticoke Creek watersheds. Big Otter reacts very quickly to event flows, resulting in increased erosion and sedimentation and has been identified as one of Canada's largest sources of sediment contamination to Lake Erie.

### Nutrients

Nutrient levels, primarily phosphorus and nitrate, are high within several watersheds across the Long Point Region. The Big Otter Creek watershed has high levels of both nitrate and phosphorus throughout the watershed, with Spittler Creek being the most impaired region. Throughout the Nanticoke Creek watershed high phosphorus is a major water quality issue. Land use, including intensive agricultural production, urban development, wastewater treatment plant effluent, the underlying geology and the topography within both the Big Otter Creek and Nanticoke Creek watersheds are all likely contributing to the degradation in water quality.

The Big Creek Watershed experiences high nitrate levels within the upper watershed and high phosphorus levels within the lower watershed. However, due to the wetlands within the lower portion of the watershed, which help to reduce flows during run-off, Big Creek is not considered to be a major contributor of nutrients or sediments to Lake Erie.

Urban development is also contributing to the overall high nutrient levels found within the Long Point Region. This impact is of greatest concern within the Lynn River watershed, which is reflected by extremely high concentrations of nitrite, ammonia and phosphorus found within the River, directly downstream of the town of Simcoe and its Water Pollution Control Plant . Currently Norfolk County is carrying out studies to better understand the impact the Simcoe plant effluent is having on the Lynn River.

### Chloride

Chloride levels throughout the Long Point Region have significantly increased over time especially downstream of the urban centers, which is likely a result of road salt application.

### Cold water streams

Within the Long Point Region there are watersheds which sustain healthy cold water fisheries and have fairly good water quality such as the Dedrick-Young Creek watershed, which has been identified as a biologically significant salmonid habitat area.

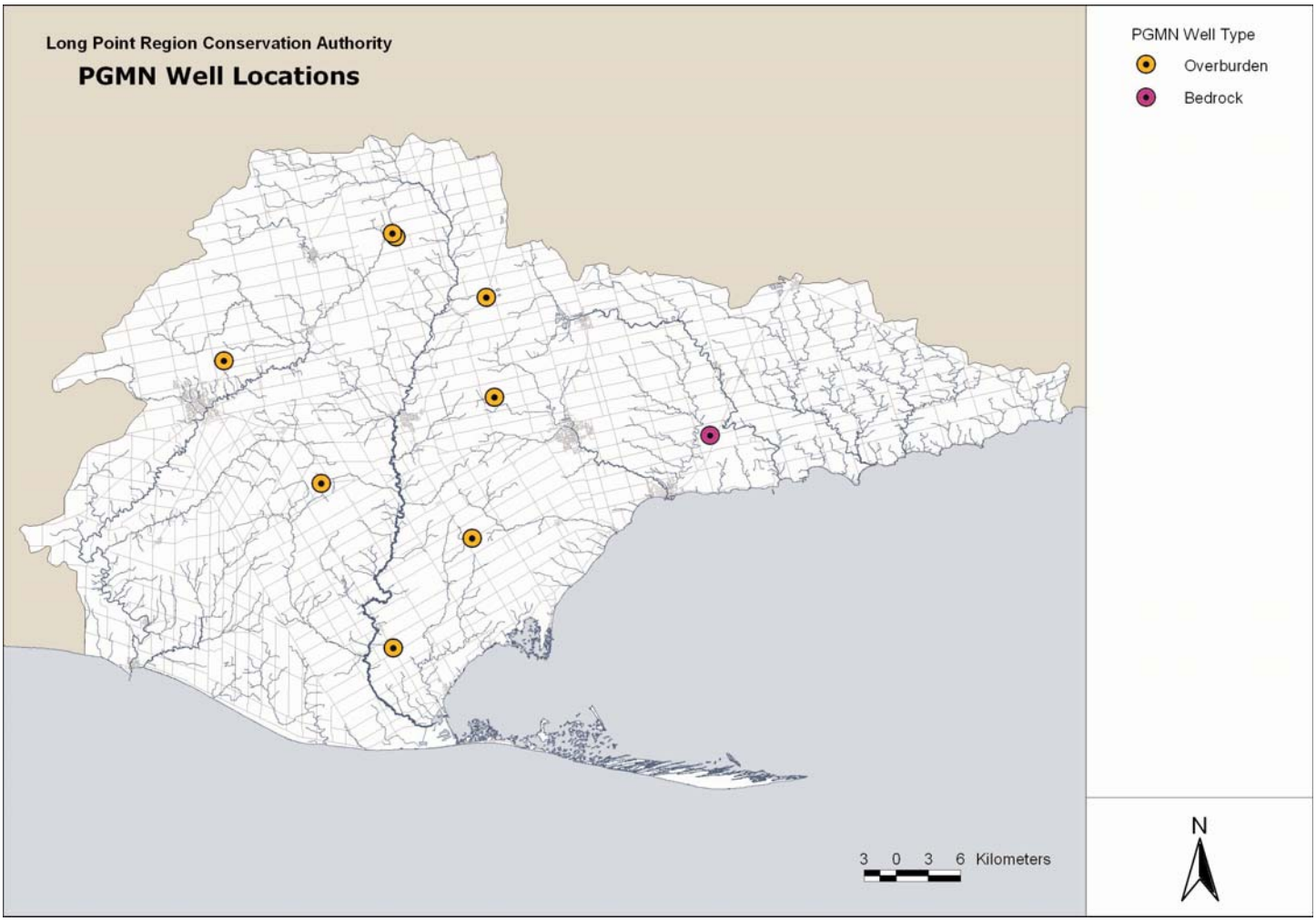
Although the natural base-flow for streams in the Norfolk Sand Plain (such as Young Creek) is continuous through the low flow summer months, the numerous permits to take water, online impoundments and tile or municipal drains, could eventually have a negative effect on base-flow levels, which in turn could negatively impact water quality.

# 11. Water quality: groundwater

## Groundwater quality monitoring

Groundwater is primarily monitored in Long Point Region through the Provincial Groundwater Monitoring Network (PGMN), a network of wells distributed throughout the province that provide insight on long-term ambient trends and conditions. There are currently 11 monitoring wells at nine locations throughout the central portion of the Region. Ten of the 11 wells are in overburden and one is completed in bedrock. At this time, the wells are primarily used to monitor changes in water levels. However since 2006, an annual water quality sampling program has been initiated through the PGMN in which collected samples are analyzed for a suite of chemical parameters.

Additionally, under Ontario Regulation 170/03, each municipal well is required to be sampled by the municipality on an ongoing basis for bacteria (i.e. total coliform, e. coli) and a suite of organic (i.e. pesticides, chemicals) and inorganic (i.e. sodium, chloride, nitrate) chemicals. Results are compiled into an annual report and publicly posted, often on the municipality's website. Where results exceed the Ontario Drinking Water Standards (MOE, 2006), corrective action is taken by the municipality.



# 11. Water quality: groundwater (cont'd)

## Groundwater quality conditions and trends

Within Long Point Region, there have been no long-term groundwater quality monitoring programs, but there have been several studies which have characterized groundwater quality through small-scale sampling programs. A study of groundwater quality in ten hamlets in the Norfolk Sand Plain found that some of the communities were more susceptible to degraded groundwater quality from septic system effluent and the application of fertilizer and road salt.

Another study of untreated groundwater at selected domestic residences in Oxford County showed the quality of groundwater was generally good. However, it also found elevated concentrations of chloride and nitrate in the shallow sand aquifer, likely reflecting contamination from fertilizer and road salt. The bedrock aquifer was found to have elevated concentrations of total dissolved solids and sulphur dioxide, although these parameters tend to occur naturally in the bedrock aquifer.

Several trends have also become apparent through programs such as municipal well sampling under the Drinking Water Systems Regulation (O. Reg. 170/03). Increasing concentrations of sodium and chloride, stemming from the application of road salt, are a common problem in many municipal wells across Ontario. A number of Ontario municipal wells have also been affected by chemicals such as those used in manufacturing, farming and industrial applications. This has resulted in the requirement of additional treatment processes or the abandonment of municipal wells.

Since groundwater is derived from the downward migration of surface water, the quality of groundwater is dependent on the quality of the recharge water. Often, clean, safe drinking water is generally hundreds of years old, having often entered the groundwater system prior to the introduction of heavy chemical use and waste production at the surface. As the quality of surface waters which recharge the groundwater system becomes more heavily impacted by chemicals and waste by-products (i.e. from road salt, manure, manufacturing, pesticide use), it can be expected that the increasing trend in human-related chemicals in the groundwater system will continue until better land use and management practices are put into place.

# 12. Drinking water issues

## Potential groundwater quality issues

Groundwater takes on the characteristics of its surroundings. If it is trapped in an aquifer, it will take on chemicals from the surrounding rock, such as sulphur or iron.

And, of course, human activities can have an effect on the quality of groundwater. Chemicals used in factories, manure and fertilizers used on farms, organic material from septic tanks, salt applied to roads – these can all show up in groundwater.

Since 1998 the Ontario government and municipalities in the watershed have been conducting groundwater studies, to determine the quantity and quality of groundwater supplies.

The studies identified the characteristics of the aquifers, defined protection zones for the areas around municipal wells, catalogued potential threats to groundwater quality and analysed water use.

The studies also identified the varieties of contaminants that show up in groundwater sources.

### Bacteria and viruses

These pathogens can come from human and animal waste from sewage sludge, septic tanks and manure. The best known bacteria, E.coli, is found in both human and animal waste and can sometimes make its way into a well from these sources.

However, most die off and decompose within 100 to 250 days which means that for groundwater-based systems, the area of greatest concern is the area closest to the well, especially for wells in the shallow overburden. Pathogens are unlikely to survive long enough to show up in groundwater from bedrock aquifers or deep wells in overburden aquifers.

Municipal water treatment systems are designed to kill pathogens in groundwater.

A well in Norwich was closed in 2005 because of high bacteria levels.

### Nitrates

Nitrates are a form of nitrogen and are found in human and animal waste, as well as many commercial fertilizers. They are highly soluble, stable and capable of migrating considerable distances if they are leached into a groundwater source. They cannot be removed by commonly used treatment methods.

The Ontario Drinking Water Standards say that nitrate levels should be no higher than 10 milligrams per litre.

A water treatment plant in Tillsonburg has been upgraded to deal with nitrates in the water.

### Chloride

The most common source of chloride is road salt, which is highly soluble and can readily build up in an aquifer. It cannot be removed by commonly used treatment methods. In the Long Point Region watershed rising chloride levels have been detected in wells in Simcoe near the municipal salt storage facility. Norfolk County has introduced a program to reduced salt use.

### Petroleum products

These products can be harmful in drinking water at only a few parts per billion. While petroleum products seldom travel more than several hundred metres from their source, they can persist in the environment for years. Gasoline storage tanks, especially from the 1950s and 1960s, are one source. A well in Simcoe was decommissioned in the 1990s because of benzene contamination.

### Chlorinated solvents

Chemicals such as paint removers, dry cleaning fluids and metal degreasers are highly toxic, very persistent and highly mobile in groundwater. Heavier than water, they tend to pool at the bottom of an aquifer and can be very difficult to detect or remove. One that has been detected is TCE or trichloroethylene.

While these products can be removed by treatment, a well in Delhi was taken out of operation because of TCE contamination.

### Pesticides

Many pesticides are biodegradable, although they can be toxic at low concentrations. Some of their breakdown products are also dangerous. However, more research is needed to understand the behavior of these chemicals in the water treatment process.

# 12. Drinking water issues (cont'd)

## Potential surface water issues

There are five surface water intakes serving communities in the Long Point Region.

Three intakes are in the Lake Erie Region and draw from Lake Erie: Port Rowan, Port Dover, Nanticoke.

The fourth Lake Erie Region intake is inland in the Lehman Reservoir in Delhi

The final intake draws from Lake Erie in the Kettle Creek watershed and serves the Elgin Area Primary Water Supply System, which takes in Elgin County communities within the Long Point Region.

### Lake intakes

Generally the water quality at the three Lake Erie intakes in the Long Point Region tends to be fairly good, although information is only available for two of the intakes: Port Rowan and Port Dover.

Potential water quality issues for the Port Rowan water supply include the highly variable turbidity levels at the intake, which can interfere with the conventional treatment process, and the elevated true colour levels, which can be indicative of potential taste and odour problems within the finished water.

**(Note**: Issues related to the intake for the Elgin Area Primary Water Supply System are discussed in the Characterization Report for the Kettle Creek watershed. Those issues will be addressed in the Source Protection Plan for the Kettle Creek Source Protection Area.)

### Delhi intake

The Delhi Drinking Water Intake is the only inland surface water supply within the Long Point Region. The potential surface water quality issues for the Delhi drinking water supply include, the highly variable turbidity levels at the intake, which can interfere with the conventional treatment process, and the elevated true colour levels, which can be indicative of potential taste and odour problems within the finished water.

### Spills

Large chemical spills in the vicinity of the Lake Erie intakes or upstream of the Lehman Reservoir are likely the greatest concern to the Long Point Region surface drinking water supplies. Incidents involving industrial chemicals, such as gasoline or diesel could result in high levels of chemicals that may impact the drinking water supply. In the event of a spill, timely notification is required to implement suitable response protocols (i.e. closing intake).

# 13. Glossary

**Aquifer**

A saturated, permeable geologic unit that can transmit significant quantities of water under ordinary hydraulic gradients.

A *confined aquifer* is one completely filled with pressurized water and separated from the land surface by a relatively impermeable confining bed, such as shale.

An *unconfined aquifer* is one where the water-table marks its upper limit.

**Aquitard**

A water-saturated sediment or rock whose permeability is so low it cannot transmit any useful amount of water. It may function as a confining bed.

**Bedrock**

The solid rock that underlies loose material, such as soil, sand, clay, or gravel. Most bedrock layers are hundreds of millions of years old.

**Brownfield**

Brownfields are abandoned or underused industrial or commercial properties where redevelopment is complicated by actual or perceived environmental contamination.

**Carolinian Zone**

The southernmost part of Ontario, generally south of a line drawn between Toronto and Grand Bend. The climate, moderated by the Great Lakes, is able to support animal and plant species normally found in the Carolinas in the U.S. Many of the species are rare or non-existent in the rest of Canada.

**Moraine**

An accumulation of till either carried on a glacier or left behind after the glacier has receded.

An *end moraine is* a ridge of till deposited along the front edge of a glacier.

A *kame moraine* is an irregularly shaped hill or mound composed of sorted or stratified sand and gravel that is deposited in contact with glacial ice.

The *Horseshoe Moraines* are a series of moraines encircling most of southwestern Ontario, with the 'top' of the horseshoe near Georgian Bay and the tips of the 'legs' at the south, near Lake Erie.

**Overburden**

Unconsolidated soil and other materials such as silt, sand, clay, gravel and stones which lie above bedrock.

**Till**

Unstratified, unsorted glacial sediment deposited directly by a glacier.