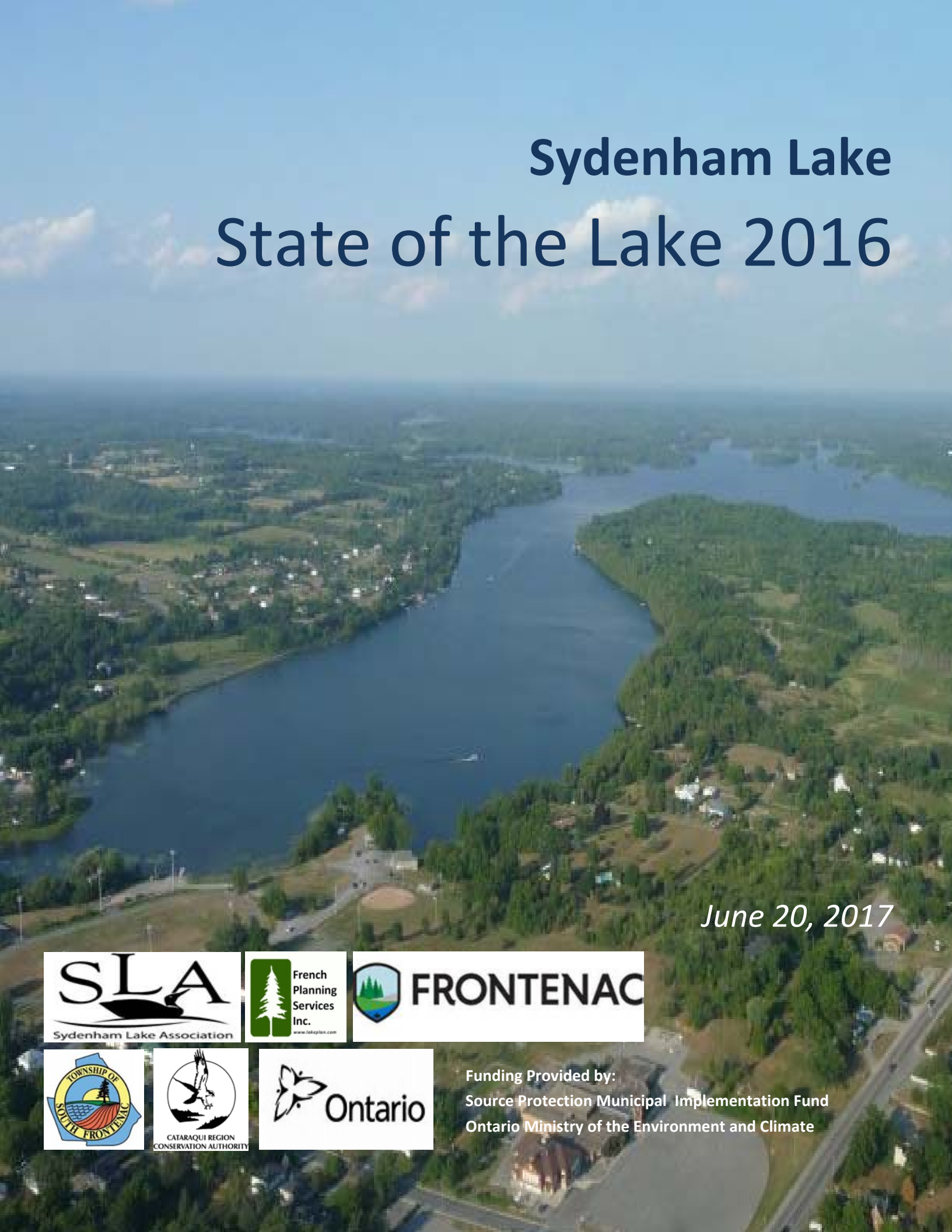


# Sydenham Lake
# State of the Lake 2016

*June 20, 2017*

Sydenham Lake Association

French Planning Services Inc.

FRONTENAC

Township of South Frontenac

Cataraqui Region Conservation Authority

Ontario

**Funding Provided by:**
**Source Protection Municipal Implementation Fund**
**Ontario Ministry of the Environment and Climate**

# Acknowledgements

The Sydenham Lake Plan Project has benefitted from the support and contributions of many groups and individuals including: volunteers from the Sydenham Lake Association; and staff from South Frontenac Township and County of Frontenac; Cataraqui Region Conservation Authority, Ministry of Natural Resources and Forestry, and the Ministry of Environment and Climate Change.

**Sydenham Lake Steering Committee**

**Sydenham Lake Association**
- Bill Peairs, Chair
- Jeff Peck
- Graeme Watson
- Mark Schjerning
- Jack Fox

**Cataraqui Conservation Authority**
- Tom Beaubiah
- Holly Evans

**South Frontenac Township**
- Lindsay Mills

**Frontenac County**
- Joe Gallivan

**Facilitators: French Planning Services Inc.**
- Gord Rodgers
- Randy French
- Brent MacDougall (Watersheds Canada)

**Agency Partners**

- Victor Castro - Ministry of the Environment and Climate Change
- Tom Beaubiah, Holly Evans – Cataraqui Region Conservation Authority
- Monique Charette - Ministry of Natural Resources and Forestry

**Funding Partners**

- Thanks to the County of Frontenac and South Frontenac Township and to the Cataraqui Conservation Authority for their facilitation of funding sources.
- Thanks to the Ministry of the Environment and Climate Change for funding through the Source Protection Municipal Implementation Fund.
- Thanks to Jennie Kapusta, South Frontenac Township for map production.
- Thanks to the Sydenham Lake Association for its contribution to funding of this project.

**Other Contributors**

- Helen Parfitt, Commodore, Sydenham Lake Canoe Club
- Wilma Kenny and Dave Borrowman for contributions to the History Section

**How to get involved or find more information:**

All of the background information that is referenced in this document is available at www.sydenhamlake.ca. If you have additional information that you would like to share, please contact any of the following:

Sydenham Lake Association *www.sydenhamlake.ca*.

# Table of Contents

# 1. Welcome to the State of the Lake

The State of the Lake Report provides a summary of the most current and relevant environmental and social information on Sydenham Lake and its watershed. This report is the first step towards preparing a Lake Stewardship Plan, which is an action oriented document to guide stewardship activities and land use policy for long-term protection, maintenance, and restoration of the lake environment. The information contained in this report has been compiled by French Planning Services Inc. staff from various sources. All original reports are available at the website *www.sydenhamlake.ca*.

The Lake Planning Process is a community-based approach, designed to present multiple opportunities for everyone with an interest in Sydenham Lake to provide their input, collaborate, and discuss issues pertaining to the lake. This approach involves community consultations, surveys and meetings, with participation from individual community members, representatives from community groups, non-government organizations, and various levels of government. All partners are invited to contribute expertise, data and information, and share in decision making and overall ownership and implementation of the plan.

During the Lake Planning Process, two key documents are produced: a Report on the State of Sydenham Lake; and the Sydenham Lake Stewardship Plan. The State of the Lake Report is a technical document summarizing the known information about the various environmental and social characteristics of the lake and its watershed. Its purpose is to provide and confirm key observations about various aspects of the lake in order to provide recommendations based on science and consensus; the recommendations are then considered by the community on and around Sydenham Lake, revised accordingly, and included in the Lake Stewardship Plan. The Sydenham Lake Plan is a stewardship document that guides actions towards the protection and management of the environmental characteristics important to the health of the lake.

The target communities for both documents is defined as: anyone who works, lives, or plays within the Sydenham Lake watershed; South Frontenac Township and the County of Frontenac; local non-government organizations; and other relevant agencies, including the Cataraqui Region Conservation Authority, Ministry of Natural Resources and Forestry, and Ministry of the Environment and Climate Change.

French Planning Services Inc. worked with the Sydenham Lake Association to establish a Lake Plan Steering Committee. The purpose of the Steering Committee is to coordinate and direct the process of preparing a stewardship plan for Sydenham Lake, including how the plan is developed, what it contains, and approval of the final plan and associated recommendations. The membership of the committee consists of those organizations and stakeholders who have been instrumental in getting this process to happen, and who have a responsibility for the planning context of Sydenham Lake (see acknowledgement section).

The Lake Plan will be a long term plan of action developed by the community and its partners to protect the health and special characteristics of the lake. The Lake Plan is a voluntary, non-regulatory document that will:

- Identify the characteristics of the lake valued by the community;
- Set goals and objectives for their protection and for overall enhancement of the lake environment;
- Recommend land use polices that influence development on and around the lake;
- Recommend stewardship and community education actions to better care for the lake; and
- Promote continued community discussion, education, action, and unity.

The State of the Lake Report and the Sydenham Lake Stewardship Plan are not government-produced documents, nor is the implementation of the recommendations contained in it mandatory or legally binding. Instead, its actions and recommendations are voluntary and represent a consensus on the values to protect, issues to address, and actions to be implemented to ensure a healthy lake environment for future generations. Both South Frontenac Township and the County of Frontenac have expressed support for this process, and will be asked to implement the relevant recommendations contained in the plan.

# 2. Values and Issues To Be Considered

## 2.1. Introduction

The Sydenham Lake Community is comprised of a diverse set of people including: permanent and seasonal shoreline property owners, commercial operators, residents of the Village of Sydenham and the many recreationalists who visit the lake for hunting, fishing, boating and nature appreciation activities.

The Sydenham Lake Association (SLA) was incorporated in 2012 and has a membership of about 102 families and represents the interests of shoreline property owners on the lake. The mission of the association is to enhance the enjoyment of Sydenham, Bulls Eye, and Little Long Lakes, now and for future generations.

In 2013 the SLA conducted a survey and 70 members of the association participated. Eighty percent of the participants indicated that Environmental Stewardship and Lake Advocacy should be the priority objectives to be achieved. In 2016, the SLA hosted a Community Workshop (August 27) to hear peoples' perspectives on what they value about Sydenham Lake and to obtain ideas on the issues and potential actions to be considered in the State of the Lake Report.

The following provides a description of the Values, Issues, and Potential Actions that were identified by individuals that responded to the survey and participated in the workshop. The order of these issues and actions does not indicate priorities, and the list does not reflect a consensus among community members on the issues and actions. Instead, it provides a list of the matters that the community would like to have considered in the preparation of the State of the Lake Report and the Lake Plan. The Steering Committee will consider these comments and ideas together with the observations made in this State of the Lake Report when developing the Lake Plan.

## 2.2. Values to be Considered

Values are the natural, social, physical, and economic elements that are important to our enjoyment and connection with Sydenham Lake. These values are linked to the reasons why people live, work, and play in the watershed. The key values that were identified from the workshop discussion and the survey results include:

1. Good Water quality
2. Property Use/Re-building
3. Natural shorelines
4. Water Quantity/Water Levels
5. Appreciation of Wildlife
6. Quiet and tranquility, dark skies
7. Provincially Significant Wetland
8. Biodiversity
9. Sense of Community
10. Recreational Enjoyment
11. Fishing

Water quality is, by consensus, the top priority value, followed closely by the ability to continue to use and re-develop one's property.

## 2.3. Issues and Actions to be Considered

The following issues and actions were identified by individuals that participated in the survey and the workshop. The Lake Plan Steering Committee will consider these when confirming the recommended actions in the Lake Plan. The order of these issues and actions is not intended to reflect priorities.

## ISSUE 1 Water Quality

Water quality is the top priority value and is recognized by the community as the key issue to be addressed. At the workshop, concerns were expressed about the impacts on the lake from old or faulty septic systems, and the potential impacts from older two-stroke motors. People also expressed concern about use of bubblers in winter, and road salt entering the lake in winter.

Actions to consider, as proposed by workshop participants:

- *Continue/increase lake 'science' to understand better water quality and quantity (e.g., monitoring annual conditions)*
- *Monitor leachate from septic systems and runoff from farmland*
- *Monitor chemical use (e.g., fertilizers)*
- *Establish a septic inspection/maintenance program*
- *Increase awareness/education through signage, website*
- *Ensure guidelines consider financial implications to landowners*
- *Involve all interested parties in solutions – Township, CRCA, property owners, farmers, businesses*

## ISSUE 2 Natural Shorelines

Several workshop participants expressed concerns about the condition of the shorelines on some of the properties on the lake. They noted that these properties have been 'clearcut' to the shore, and have grassed lawns that allow runoff to more easily enter the lake. There are also signs of shoreline erosion (e.g., fallen trees on the bank, disturbed habitat along the shore).

Actions to consider, as proposed by workshop participants:

- *Need a clear plan for limiting shoreline alteration*
- *Monitor shoreline erosion*
- *Increase awareness/education through signage, website – of the long-term benefits of natural shorelines. Provide examples of low impact development (e.g., runoff)*
- *Involve everyone in the solutions – Township, CRCA, property owners, farmers, businesses*
- *Consider a tree-cutting bylaw*

## ISSUE 3 30 Metre Setback Zoning

An issue has arisen among some members of the community about a change to the Township zoning bylaw that may increase regulatory control and restrictions over the re-building of structures within 30 m of the shoreline. This matter is going before the Ontario Municipal Board; when resolved, its status will be recorded in the plan.

## SSUE 4 Respectful Use of the Lake

According to several workshop participants, there are larger boats and more boat traffic occurring on the lake and this may lead to issues with wakes, noise and unsafe boating conduct. Since the lake is in the urban rural fringe of Kingston, the lake tends to attract many day-users; these users, and other new boaters may not be familiar with proper conduct or the sensitive environmental areas on the lake. Some lake users are catching bass out of season, fishing too close to private docks, and creating large wakes. One of the workshop participants expressed concern about the number of hunters entering the lake from the east end, and noise associated with duck hunting season. Some of the landowners adjacent to the Cataraqui Trail are not respecting the 10 foot setback from the trail.

Actions to consider, as proposed by workshop participants:

- *Work together to build our 'community'*
- *Communicate with day users through signage*
- *Increase awareness/education through signage, website, newsletters*
- *Consider a fee to come onto the lake*
- *Education on boating safety is essential*
- *Work with CRCA to enforce trail setback rules*
- *Close the access point at the east end of the lake*
- *Establish 'No Hunting' at the Provincially Significant Wetland at the east end of the lake*

## ISSUE 5 Fish and Wildlife Habitat

The diversity of the fish and wildlife populations and their habitat must be maintained. Many people indicated a need to identify and protect fish and wildlife habitat. It was thought that fishing derbies may impact local fish populations, bass are being caught out of season, when the pike season is open.

Actions to consider, as proposed by workshop participants:

- *Protection of the environment (land, fish, animals, and shorelines) in zoning and official plans*
- *Request stronger enforcement from MNRF*

## ISSUE 5 Development

Proximity to Kingston brings a degree of development pressure. There is generally good control by the Township over water front development, but concerns exist about potential backlot or additional development in the watershed.

Actions to consider, as proposed by workshop participants:

- *Continue water sampling program and associated work on lake capacity modelling*
- *Maintain positive working relationship with Township*
- *Request that the lake plan be included as a part of the Township's official plan*
- *Township should enforce the maintenance of abandoned properties and docks*

## ISSUE 6 Water Quantity

Some workshop participants expressed a concern that the drawing of water for the municipal water supply in Sydenham village may have a negative effect on water levels in the lake.

Actions to consider, as proposed by workshop participants:

- *Continue/increase lake 'science' to understand better water quality and quantity*
- *Any commercial drawing of water should be discouraged/disallowed*

## ISSUE 7 Light Pollution

At the workshop, concern was expressed over loss of the dark skies above the lake. Several people thought that there is generally an over-use of lighting, with LED lighting being a particular problem. Cell tower lighting is also noted as a concern.

Actions to consider, as proposed by workshop participants:

- *Increase awareness/education through signage, website*

## ISSUE 8 Invasive/Nuisance Species

Invasive species present now, or potentially arriving are of concern to many in the community. Examples of concern are: zebra mussels; wild parsnip; common reed (phragmites). Although not technically invasive, the nuisance species of Canada geese and cormorants were cited as a problem.

Actions to consider, as proposed by workshop participants:

- *Use Invasive Species Hotline (and spread the word about the hotline)*
- *Increase awareness/education through signage, website*
- *Establish a washing station at boat launches to reduce risk of spreading zebra mussels to other lakes*

## ISSUE 9 Big Picture Issues

There were a few issues that could be considered 'Big Picture', as they encompass a broader area than the lake and its immediate surroundings. There is a need to consider the following in the preparation of a lake stewardship plan:

- General need to protect watershed habitat, especially where streams originate.
- Climate Change – can we make a difference?
- Frontenac Arch Biosphere – how does Sydenham Lake contribute?

# 3. Lake & Watershed Characteristics

The following sources were referenced in this section:

- *Castro, Victor. 1993. Lakeshore Capacity Study & Shoreline Development Policies for Greater Sydenham Lake.*
- *Cataraqui Region Conservation Authority, 2005. Establishing Environmental Flow Requirements for Millhaven Creek.*
- *Cataraqui Region Conservation Authority, 2007. Cataraqui Source Protection Area Interim Watershed Characterization Report.*
- *Cataraqui Source Protection Committee, 2005. Watershed Characterization Report.*
- *Cooper, H.A., 1970. Sydenham Lake Survey.*
- *Littkemann, Peter, 1959. Biological Report on Sydenham Lake.*
- *Ministry of Natural Resources and Forestry, 2014. Broad-Scale Monitoring Bulletin.*
- *Ministry of Natural Resources, 1987. Lake Survey Summary Report.*
- *Smith, W.G., 1974. Sydenham Lake Trapnet and Gillnet Report.*
- *XCG Consultants Ltd., 2009. Community of Sydenham Intake Protection Zone Study.*

## 3.1. Location

Sydenham Lake is located approximately 25 km north of Kingston in south eastern Ontario (44˚25', 76˚35') and is situated within the upper portion of the greater Millhaven Creek Watershed (Map 3.1). The northern part of Sydenham Lake lies within the Frontenac Arch, and is partially underlain by pre-Cambrian bedrock of the Canadian Shield and the remainder is underlain by sedimentary limestone of the St. Lawrence Lowlands.

Sydenham Lake is within the municipal jurisdiction of the Township of South Frontenac (formerly Loughborough Township) of the greater Frontenac County. Sydenham Lake is within the administrative boundaries of the Cataraqui Region Conservation Authority (CRCA). The Village of Sydenham is located at the southwest end of Sydenham Lake near its outlet to Millhaven Creek and is one of the largest settlement areas in the Township of South Frontenac, with an estimated population in 2016 of 567. The west basin of the lake provides the source for the village's water supply; Sydenham is the only location in the township with a water treatment and distribution system.

## 3.2. Watershed Characteristics

### 3.2.1 Millhaven Creek Watershed

Sydenham Lake lies in the upper reaches of the Millhaven Creek watershed and is the largest lake in the watershed, covering 5% of the total watershed area. Gould Lake is upstream of Sydenham Lake and is the second largest lake in the system. Millhaven Creek is a relatively small watershed, with headwaters in the Canadian Shield that generally flow in a southwesterly direction and empties into Lake Ontario (Map 3.1). Millhaven Creek Watershed consists of a drainage area of approximately 165.6 $km^2$ (16,561.5 Ha), and an approximate length of 55 km. Millhaven Creek is a warmwater system that has mixed land uses including agricultural, residential, natural forested areas, and wetland. Land use throughout the watershed is predominately agricultural, especially downstream of Sydenham Lake.

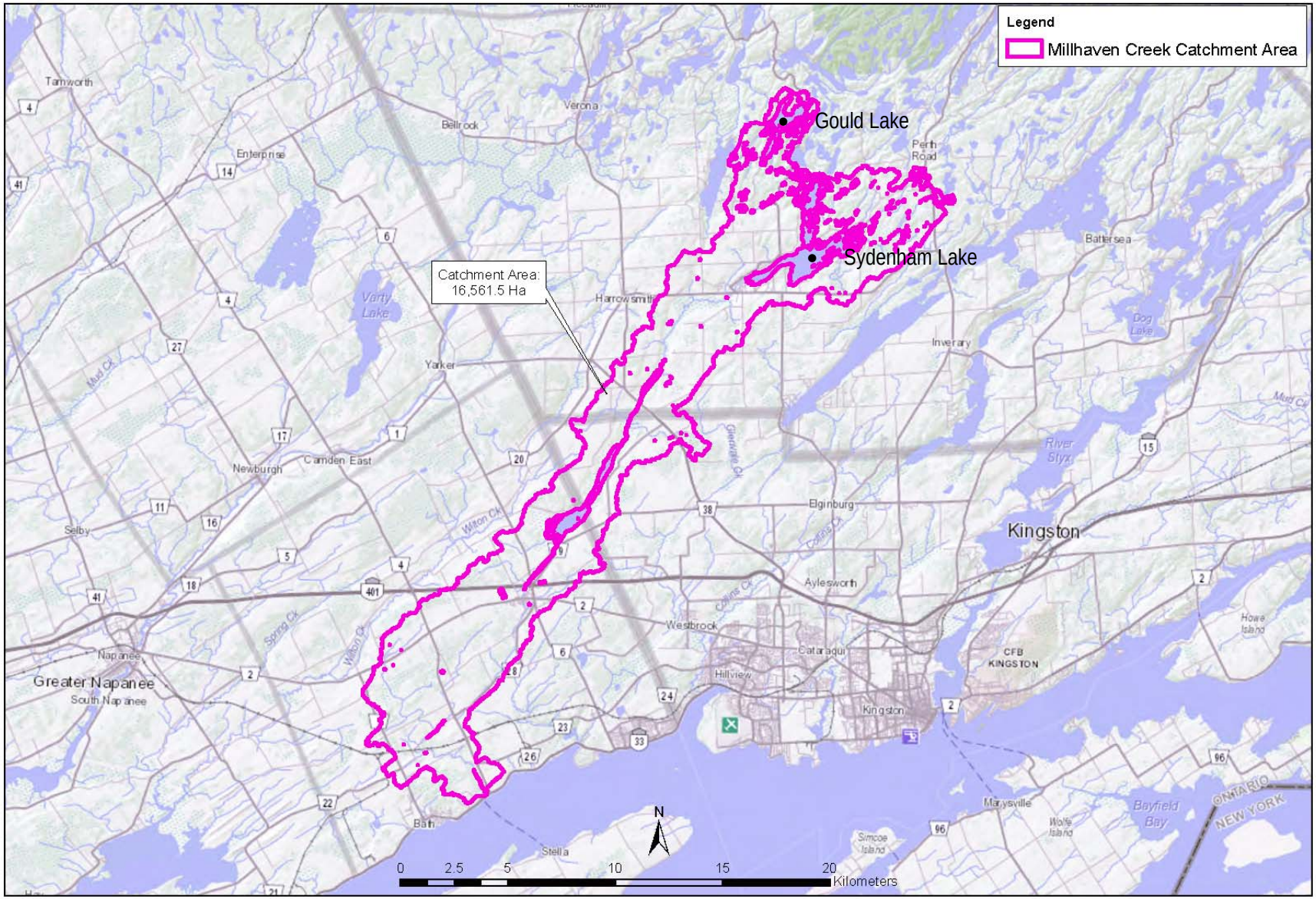
### 3.2.2 Sydenham Lake Subwatershed

The Sydenham Lake subwatershed is a relatively small geographic area of forest, wetland, and farmland encompassing three distinct catchment areas (also called subwatersheds): Gould Lake Catchment (7.2 $km^2$, 720.6 Ha); Little Long Lake Catchment (2.62 $km^2$, 262.4 Ha); and Sydenham Lake Catchment (37.98 $km^2$, 3797.6 Ha) (Map 3.2). The Sydenham Lake catchment can be further divided into 4 smaller catchment areas: Northern; Eastern; Western; and Southern (See inset on Map 3.2). The Sydenham Lake subwatershed outflows into Millhaven Creek from the south-western portion of the lake, at the Sydenham Lake Dam, located in the Village of Sydenham.

Ontario

# Map 3.1 - Millhaven Creek Catchment

Ministry of the Environment and Climate Change




UTM Zone 18 (NAD 1983)
Information Provided by: Ministry of Natural Resources and Forestry, Ministry of the Environment and Climate Change, Ministry of Municipal Affairs and Housing.
Imagery Provided by Land Information Ontario
Catchments Delineated Using OFAT III



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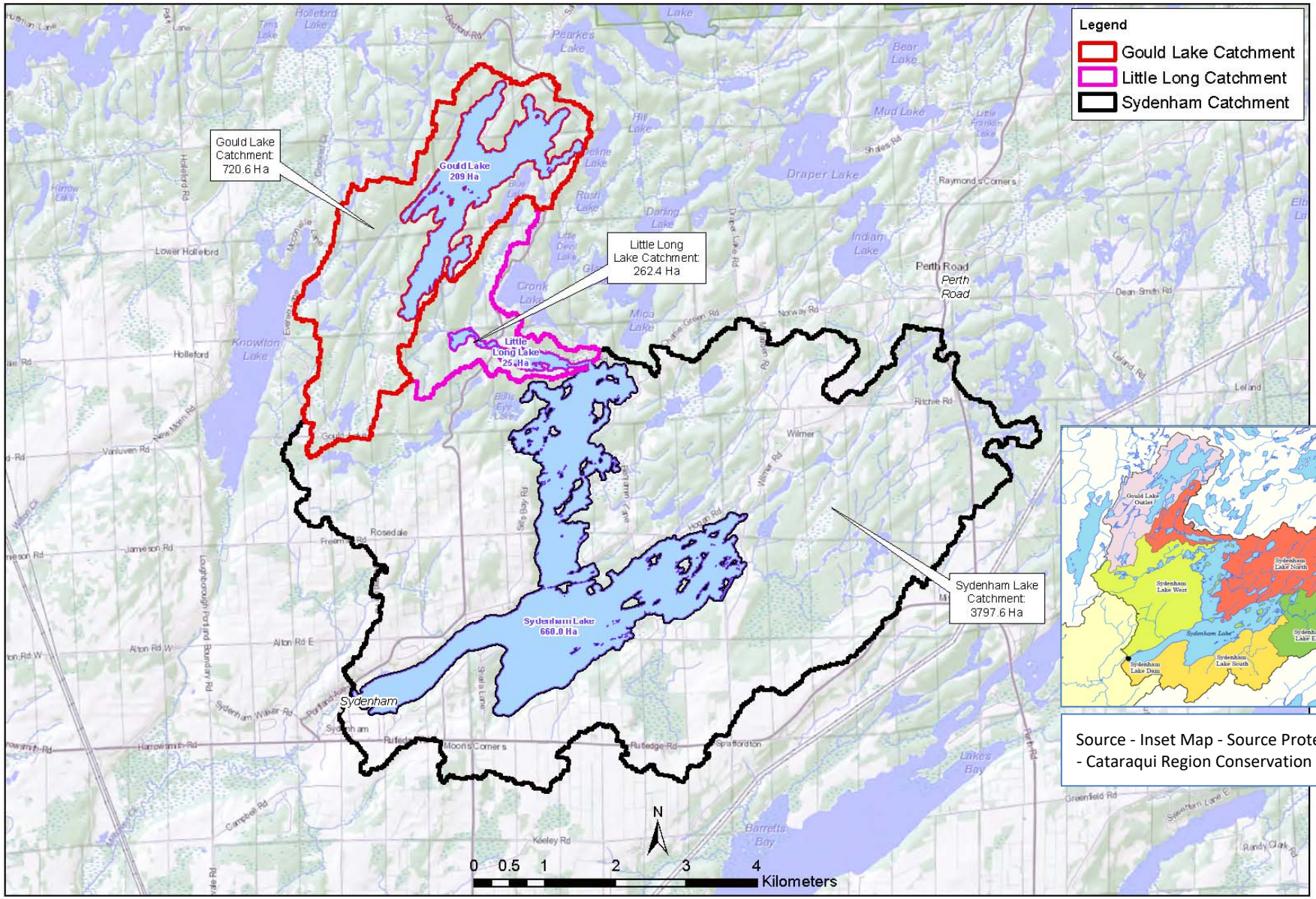
# Map 3.2 - Sydenham Lake Catchment

Ontario

Ministry of the Environment and Climate Change







Source - Inset Map - Source Protection Plan - Cataraqui Region Conservation Authority

UTM Zone 18 (NAD 1983)
Information Provided by: Ministry of Natural Resources and Forestry, Ministry of the Environment and Climate Change, Ministry of Municipal Affairs and Housing.
Imagery Provided by Land Information Ontario
Catchments Delineated Using OFAT III



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Sydenham Lake experiences a relatively low overall flushing rate of 67% of its volume yearly in part due to its small catchment area. The lake receives input from 13 inlets within its catchment area, most of which are only primarily active during spring runoff and heavy rainstorms (Map 3.3). One inlet on the south-west shore was found to exhibit permanent flow as it originates from a spring a short distance inland from the shore. The majority of water input to the lake originates in Gould Lake which passes through Little Long Lake prior to reaching Eel Bay. Several small waterbodies within the Sydenham Lake subwatershed provide limited input to the lake including Harves, Hogan, and Bull's Eye Lake. Although limited data exists, groundwater flow may also exhibit a role in Sydenham Lake's water budget and chemistry.

Sydenham Lake provides water output to the Millhaven Creek Watershed through a single outlet. The Sydenham Lake Dam, operated by the CRCA, is the only permanent outlet and, along with precipitation, is primarily responsible for water levels of Sydenham Lake, Eel Bay and Little Long Lake. Water levels within Sydenham Lake are held relatively constant throughout the seasons and vary only minimally (+/- 30.5 cm), as the dam is operated under a very tight rule curve. The low flushing rate of Sydenham Lake is in part restricted by this single permanent outflow and relatively small amount of inflow creeks and streams.

The predominant land uses surrounding Sydenham Lake include seasonal and permanent residences, recreation, forestry in the northern portion of the region, as well as agriculture and rural residences in the southern portion of the area. Additionally, the Village of Sydenham, which includes commercial, institutional, and residential uses is located on the southwest shore of the lake. There are 333 existing lots of record on the shoreline of Sydenham Lake, Eels Bay and Little Long Lake of which 75% of the lots are built (248 lots) and 25% are vacant (85 lots).

Much of the land surrounding Sydenham Lake has been developed for agricultural purposes. This is an important consideration to the overall water quality of the lake as water draining this land during heavy precipitation or the spring freshet may be enriched with nutrients. The upper portions of the subwatershed are situated on the Canadian Shield, including portions of Sydenham Lake, and have generally supported livestock. More southern agricultural lands located on the Napanee limestone bedrock also support crop farming in addition to livestock. Substantial areas of farmland are located west and south of the lake. Areas to the north and east are predominantly forested land and wetlands.

In addition to agricultural land uses there exists a number of abandoned mines in the northern (Pre-Cambrian) portion of the Sydenham Lake subwatershed. The Sydenham Lake area was an important mining and shipping location for minerals of the Canadian Shield including phosphate and mica.

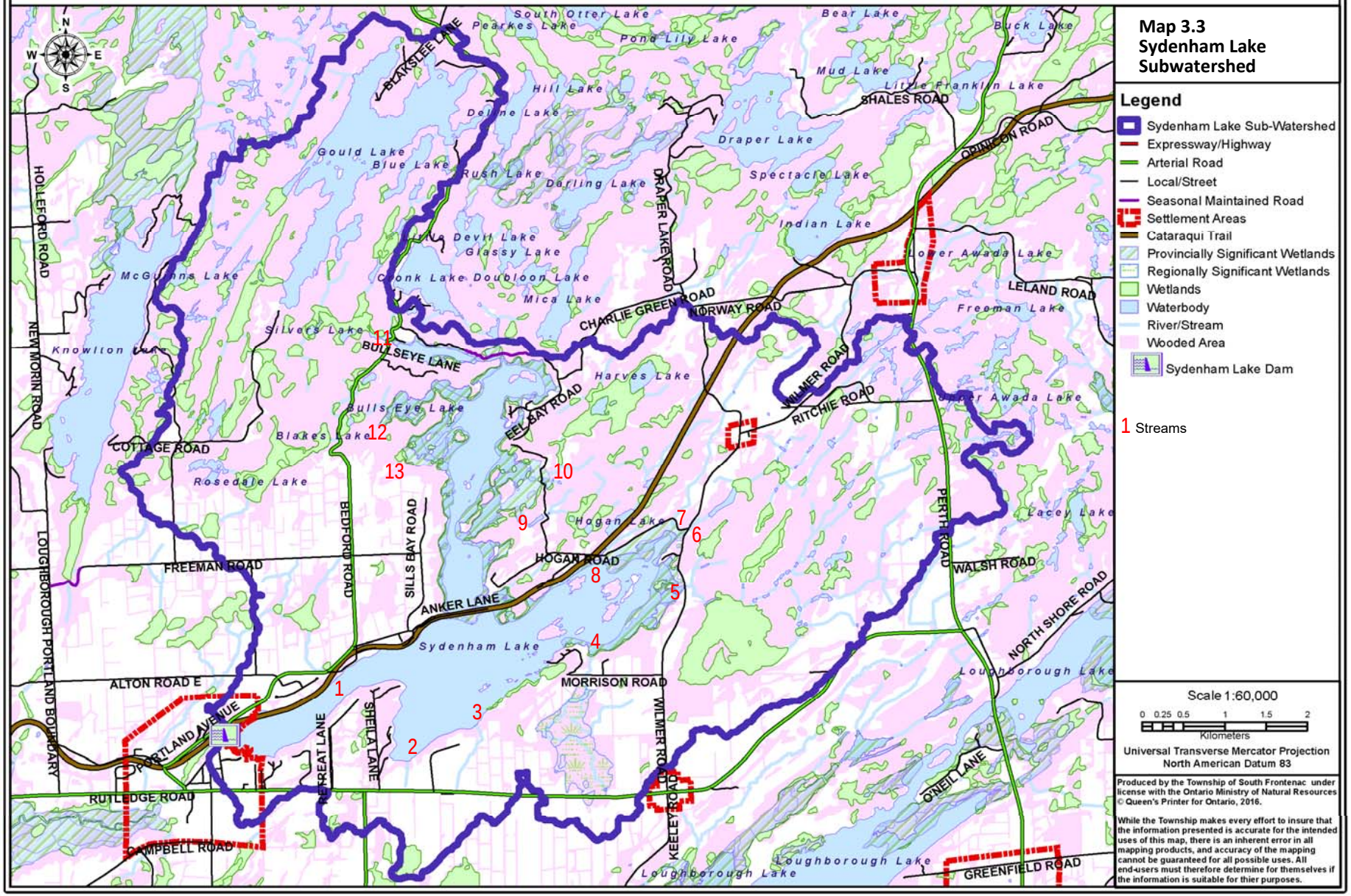
## 3.3. Lake Characteristics

Sydenham Lake is comprised of three separate basins of glacial origin, Sydenham Lake Main Basin, Sydenham Lake East Basin and Eel Bay. Eel Bay is connected to the other basins by a relatively narrow channel. Map 3.4 illustrates the depth contours (called bathymetry) for these three water bodies, prepared by the Sydenham Lake Association.

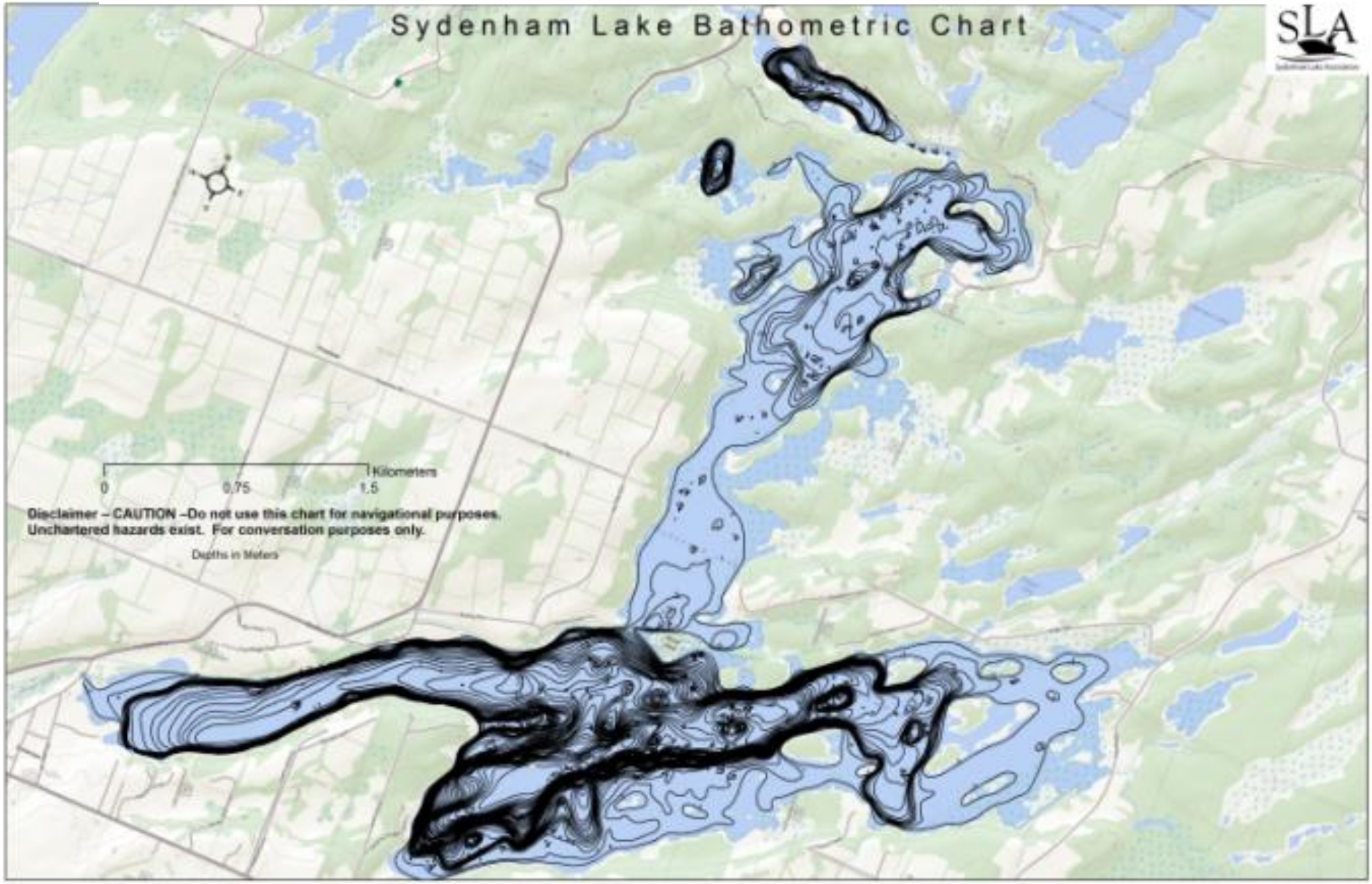
Sydenham Lake is a moderately deep lake with a maximum depth of 36.6 m (120 ft), and a mean depth of 7.2 m (24 ft). The lake has a total shoreline perimeter of 53.9 km (69.2 km including islands), and an approximate surface area of 7.8 $km^2$ (780 Ha). Sydenham Lake possesses a flushing rate of 0.67 times per year experiencing turnover approximately every 1.5 years. A single outlet, the Sydenham Lake Dam operated by the Cataraqui Region Conservation Authority, is permanent and primarily responsible for water levels of the lake which vary minimally throughout the seasons. Physical characteristics of Sydenham Lake are summarized in Table 3.1 (page 9).

Sydenham Lake exhibits good pH buffering capacity as the majority of the lake lies on the Napanee limestone plain which contributes to its alkaline water characteristic. Portions of the lake including the northern part of Eel Bay and all of Little Long Lake and Gould Lake are situated within the Frontenac Arch of the Canadian Shield.

# Sydenham Lake State of the Lake Report



**Map 3.4 - Depth Contours of Sydenham Lake (Graeme Watson)**



Sydenham Lake possesses granite outcrops, a series of wetlands along shorelines, as well as till shorelines and slopes. Rock shoals are quite frequent within Sydenham Lake and often pose hazards to recreational boating.

Sydenham Lake has been classified as a moderately productive, mesotrophic lake. The most productive areas of the lake are Eel Bay and the East Basin which are heavily vegetated, and contain a large (1.8 $km^2$, 180 Ha) Provincially Significant wetland, the Eel Bay/Sydenham Lake Wetland Complex.

**Table 3.1 – Physical Characteristics of Sydenham Lake and Watershed**

| Physical Characteristic | Measured Value |
|---|---|
| Latitude | 44˚25'[2] |
| Longitude | 76˚35'[2] |
| Surface Area ($km^2$) | 7.02[2], 7.8[5], 6.6[6] |
| Shoreline Perimeter (km) | 41.8[2], 53.9[8] |
| Shoreline Perimeter including Islands (km) | 69.2[2] |
| Height Above Sea Level (m) | 152.4[2], 130.7[4] |
| Sydenham Lake Catchment Area ($km^2$) | 37.98[7] |
| Little Long Lake Catchment Area ($km^2$) | 2.62[7] |
| Gould Lake Catchment Area ($km^2$) | 7.2[7] |
| Mean Depth (m) | 7[1], 6.7[2], 7.2[3] |
| Maximum Depth (m) | 35[1], 36.6[2] |
| Littoral Zone Area (%) | 46[3] |
| Total Lake Volume ($m^3$) | 32.1 x $10^6$[2] |
| Water Level Fluctuation (m) | 0.3 |
| Total Inlets | 7-8[2], 13 |
| Total Outlets | 1[2] |
| Flushing Rate (Times per year) | 0.67[5] |
| Response Time (Months)*(time required for complete flush)* | 18 |
| pH | 8.0[2], 8.15[6] |

(XCG, 2009[1];Cooper, 1970[2]; MNR, 1985[3]; Smith, 1974[4]; Castro, 1993[5]; MNRF, 2014[6]; MOECC, 2017[7]; CRCA, 2016[8])

Both the East Basin and Eel Bay are shallow, and because of this, a substantial portion of Sydenham Lake (46%) is considered to be 'littoral', meaning that approximately half of the lake is comprised of shallow nearshore areas, marshes or wetlands. Littoral zones are of high biological significance to lake ecosystems, are sensitive to environmental degradation, and provide essential habitat to numerous fish, amphibian, waterfowl and mammal species.

Sydenham Lake is predominately fed from one major lake upstream, Gould Lake, located in the upper portion of the Millhaven Creek Watershed. Input from Gould Lake passes through Little Long Lake prior to reaching Eel Bay. Minor drainages entering Sydenham Lake also include Harves Lake and Hogan Lake (Map 3.3).

### Sydenham Lake Main Basin

The western and central portion of Sydenham Lake is considered to be the Main Basin and has a maximum depth of 36.6 m (120 ft) and a mean depth of 6.7 m (22 ft). The nearshore habitat of the main basin is mainly comprised of rock rubble, silt and sand. The bottom of the main basin is heavily silted, due to sediments carried into the lake by different sources such as wind, inflowing streams, wave action and accumulating remains of plant and animal life. The bottom substrate near the islands on the east end of the main basin is rocky. Marl (a clay substance) was noticed in some shallow areas of the main body of the lake. Due to its depth, the main basin thermally stratifies, with a thermocline occurring between 5.4 m (17.8 ft) and 8.9 m (29.1 ft) deep. The main basin of the lake experiences oxygen stress at its lower depths prior to spring and fall

turnover. This can also occur during the winter in some lakes, but would need to be confirmed for Sydenham by doing a winter profile through the ice.

### Sydenham Lake East Basin

The eastern basin of Sydenham Lake is quite shallow, has 19 limestone islands and the mainland shoreline is well vegetated. A small portion (0.11 $km^2$, 11 Ha) of the Eel Bay/Sydenham Lake Provincially Significant Wetland Complex is located along the shores of the east basin. The eastern basin of Sydenham Lake is too shallow to thermally stratify.

### Eel Bay

Eel Bay is a relatively shallow basin (mean depth 1.6 m (5.2 ft)) and does not experience stratification. This basin has a very irregular limestone bottom, 25 islands and several shoals of sedimentary material. The near shore habitat of Eel Bay is predominantly silt and mud with some areas of sand and rock rubble. The bottom of Eel Bay is covered in mud, except on the areas surrounding the islands. Significant amounts of aquatic vegetation exist in Eel Bay, and the entire shoreline is classified as a Provincially Significant Wetland. Previous surveys of aquatic vegetation within the bay have revealed this area of the lake produces a dense growth of numerous species.

### Little Long Lake

Little Long Lake is connected to Eel Bay by a small channel. Similar to Sydenham Lake, its water level is controlled by the Sydenham Lake Dam. Past studies indicate Little Long Lake possesses a warmwater thermal regime and shallow waters which do not stratify.

### Bull's Eye Lake, Harves Lake, Hogan Lake

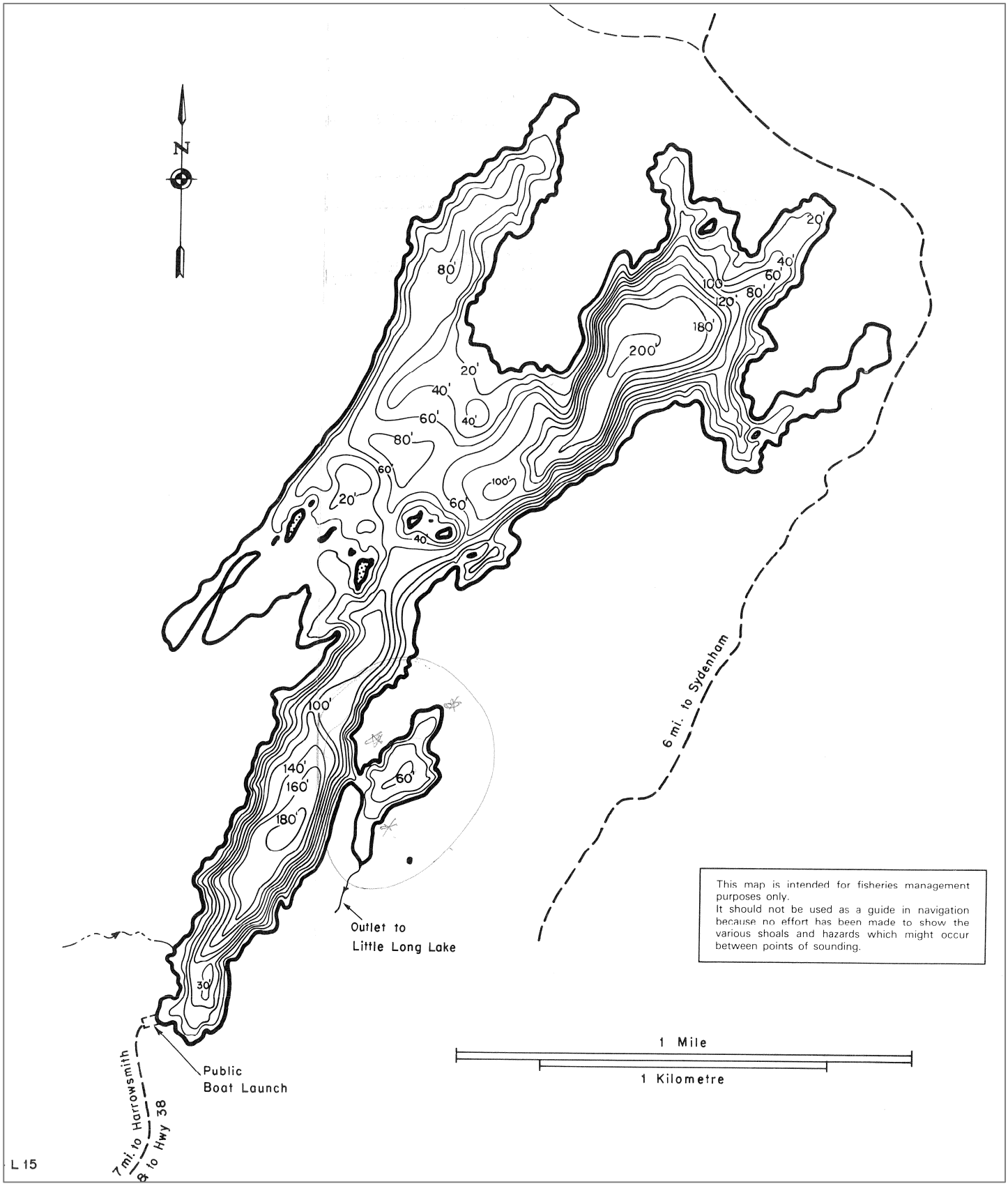
Harves Lake (0.7 $km^2$), Hogan Lake (0.5 $km^2$) and Bull's Eye Lake are all relatively small lakes that provide relatively minimal input to Sydenham Lake throughout the year. Substantial future development is not anticipated on these lakes due to their small size, lack of accessibility and presence of wetlands.

### Gould Lake

Gould Lake is a small deep and cold headwater lake with a maximum depth of 61.6 m (202 ft), a mean depth of 18 m (59 ft) and total surface area of approximately 2.2 $km^2$ (222 Ha) (Map 3.5). Gould Lake has a catchment area of approximately 7.2 $km^2$ (720.6 Ha), and shoreline perimeter of 16.9 km. Gould Lake's littoral zone has been previously estimated as 23% of the total lake surface area. Gould Lake exhibits a very low flushing rate of 0.08 times per year experiencing turnover approximately every 12 years. Small tributary streams flow into Gould Lake from the surrounding catchment area on the Canadian Shield. The lake's catchment area is predominately composed of coniferous and mixed forests. Gould Lake is characterized by granite outcrops that rise sharply above the water from the lake bottom.

Gould Lake has deep, clear and cold water with good concentrations of dissolved oxygen supporting lake trout species. Gould Lake flows through a creek into the upper wetland areas of Little Long Lake with flow eventually reaching Sydenham Lake through Eel Bay. Development on Gould Lake is minimal and is likely to remain low as a large portion of the shoreline forms part of the Gould Lake Conservation Area. The CRCA owns approximately 50% of the lake shoreline and the remainder is not easily accessible. There exists a large swamp area between the outlet of Gould Lake and the inlet to Little Long Lake acting as a natural purifier for water eventually reaching Sydenham Lake.

## Map 3.5 - Depth Contours of Gould Lake (MNR, 1971)



## *Observations – Lake & Watershed Characteristics*

- Sydenham Lake lies within the jurisdiction of the Township of South Frontenac of the greater Frontenac County and the Cataraqui Region Conservation Authority.
- Portions of Sydenham Lake lie within the Frontenac Arch of the Canadian Shield, but mostly within the sedimentary limestone bedrock of the Napanee Plain.
- Sydenham Lake is a mid-depth lake (mean depth of 7.2 m, 24 ft), possesses a shoreline perimeter of 53.9 km, surface area of 7.8 $km^2$ (780 Ha), and 46% of the lake is designated as littoral.
- Sydenham Lake exhibits a relatively low flushing rate of (0.67 times per year) in part due to its low number of inlets (7-8), single permanent outlet (Sydenham Lake Dam), and small catchment area (37.98 $km^2$, 3797.6 Ha).
- Sydenham Lake is within the headwaters of a relatively small watershed (Millhaven Creek), and is predominately fed from one major lake upstream, Gould Lake.

## *Recommendations for Lake Plan Actions*

- Identify and assess general flow of water in inlets during peak (spring) and low flow scenarios (summer/fall).
- Continue water quality monitoring based on the assumption of three distinct basins (Main, East & Eel Bay).
- Monitor run off from farm land.

# 4. History

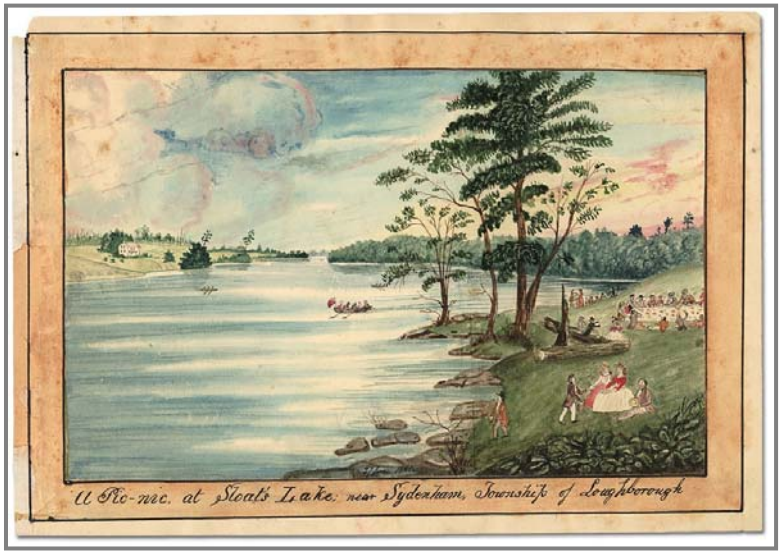
This section was based on the 'Lake History' page of the Sydenham Lake Association Website, prepared by Wilma Kenny and Dave Borrowman, with additional material and editing by Wilma Kenny. Original sources include the following:

- Cooper, C.W., 1856. Frontenac Lennox and Addington, Facsimile Edition 1980. Canadian Heritage Publications. ISBN 0-920648-03-7 FCL 971.35902 Coo.
- Corporation of the County of Frontenac, 1982. County of a Thousand Lakes, The History of the County of Frontenac 1673 – 1973. ISBN 0-6960461-0-3.
- http://www.uppercanadagenealogy.com/townshipsS.html#L
- JH Meacham & Co., 1878. Illustrated Historical Atlas of Frontenac, Lennox and Addington Counties, Ont. Offset Edition 1971, Mika Silk Screening Ltd., Belleville, Ont. ISBN 0-919302-14-9.

Photos Courtesy of: Cam and Wilma Kenny, Sydenham; Dale Silver, Sydenham; David Borrowman, Sydenham.

## 4.1 The Land

Frontenac County (along with many of the other counties 'fronting' on Lake Ontario) consists of two geologic characteristics. The northern part is pre-Cambrian bedrock Canadian Shield topography while the southern region is Limestone bedrock of the St. Lawrence Lowlands laid down by ancient seas. Sydenham Lake has the relatively unique circumstance of being situated on the boundary between the two. This geology fundamentally explains the lake's character as it exists today. The more populated region to the south of the lake is based mainly on agricultural communities while the area to the north is largely a recreational, hunting, fishing, and (in earlier days) mining region. As lakefront property was developed over time it usually took the form of camp or cottage structures particularly on the north and Eel Bay shores owing to the shield nature of the land there.




**Picnic at Sloats Lake - By Thomas Burrowes (1861)**
Archives of Ontario, C1-0-0-0-94

## 4.2 First Nations

Very little concrete information is available about the first nations people in the Sydenham Lake area, but several of the long-time area families have first nations roots. Sydenham/Millhaven Creek is recorded to have been deep enough to carry small steamboat in the early and mid 1880's, so it seems highly probable that the network of portage routes and lakes known as 'the winter roads' that led south into Sydenham Lake and from there to Lake Ontario were used as a travel route by the local people before the Europeans arrived. There are no recorded settlement sites along the lake.

There must, however, have at least been campsites: several stone or flint arrowheads and a small green stone 'hatchet' were plowed up by my ancestors who farmed north of the lake near Sydenham village. My father remembers playing in a dugout canoe that they found along the shoreline near the village (Wilma Kenney).

## 4.3 Settlers

Early settlers near the lake were largely United Empire Loyalists. The Treaty of Paris in 1783, which recognized the independence of the United States, was the final blow for British Loyalists in North America. They emigrated from the newly formed country to parts of what is now Canada with by far the greatest numbers coming to present-day Ontario. In 1791 the British Parliament passed the *Canada Act*, usually known as the *Constitutional Act*, which provided for the division of Quebec into Upper and Lower Canada. The disbanded Loyalist regiments provided the majority of settlers in Upper Canada and were given land grants, first in the 'front townships' along and near the Lake Ontario shore, later further north in the 'back townships'.

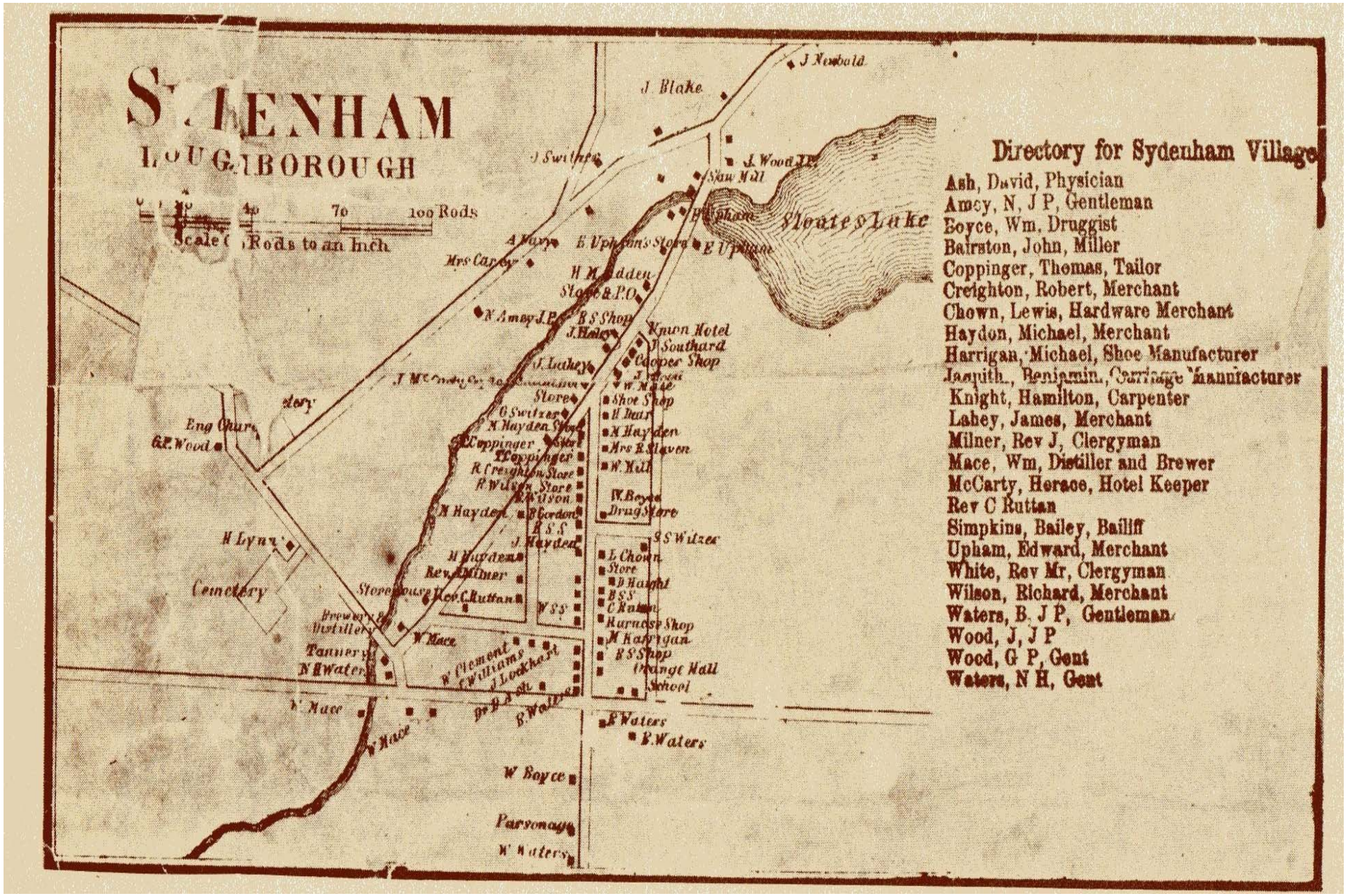
Apparently the first settler here on the lake was Michael Sloat (or Sloot) who was an UAE given a free land grant in 1796, and two more lots in 1806 and1807. As a result, the lake came to be known as 'Sloat's Lake' and the west end near the outlet of the lake into the creek was called 'Sloat's Landing'. Other UAE settlers followed: one note stated 'around 1819 English squires Rutledge, Sloat, Wood, Blake, Purdy, Simkins, Sills and MacMillan owned the only wagon in Loughboro.' Loughboro was an early name often used for the growing village at the outlet.

## 4.4 Sydenham Village

The history of Sydenham Lake is intricately linked with the history of the village of Sydenham. In October 1839 Charles Poulett Thomson came to Kingston from England to be the Governor of Upper Canada. His dream of uniting Upper and Lower Canada into the United Province of Canada was realized on 10 February 1841. He was also Baron of the barony of Sydenham in England and therefore addressed as Lord Sydenham. He thus became the first Governor of the united Canada, with Kingston as the seat of government. He died in late 1841 or early 1842 as the result of complications from a broken leg following a fall from his horse in Kingston while in ill health. Shortly after Lord Sydenham's death, Squire William Holditch who lived on what is now Portland Street in Sydenham suggested changing the name of Sloat's Landing (or Loughboro) to Sydenham in his honour. The lake continued to be called Sloat's Lake for a time after that but gradually became known as Sydenham Lake.

Sometime prior to 1853, perhaps as early as 1830, Loughborough Post Office was created in the settlement of Sloat's Landing. There are some references that indicate the hamlet was called 'West Loughborough' or just 'Loughboro' after this post office. The hamlet of Sydenham was laid out about 1846 but the post office continued to be called Loughborough until 1 June 1883 when its name was officially changed to Sydenham.

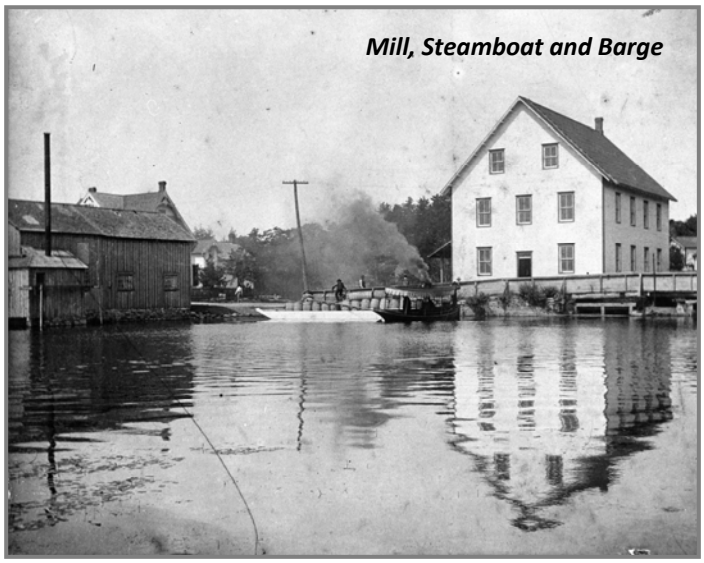

**Sydenham Lake and Community, CIRCA 1950**




**Map and Directory for the Village of Sydenham (1856)**

A map of the village from about 1860 shows 77 structures all told including homes and businesses. By 1856 the Sydenham Road had been constructed from Kingston to Sydenham (16 miles long, 9 of which were macadamized).

At the outlet to Sloat's Lake was a small waterfall that provided hydraulic power to a sequence of mills and eventually electric works. A bridge was built crossing the creek at the lake outlet sometime prior to 1850. In the latter half of the 19th century a dam was also constructed at the outlet to increase the lake level and provide more water power for the several mills that had been built there. The creek was called Mill Creek and runs down through Mud Lake to Odessa, then on to fall into Lake Ontario at Millhaven. Odessa was originally a village named 'Mill Creek'. The creek is currently named 'Millhaven Creek' although locals here often refer to it as 'Sydenham Creek'.



***Mill, Steamboat and Barge***

## 4.5 Boating on the Lake

C. W. Cooper writes in 1856 that a small steamboat or scow was used for transportation on Mill Creek between the villages of Sydenham and Mill Creek. Subsequent references show that a small steamer was used to haul a barge on Sydenham Lake bringing materials from the mines on Eel Lake at the northeastern end of the lake to the village for processing or shipment out to Kingston. It is not clear if this is the same steamboat as was used on Mill Creek or a new one.


***Boat Party at Boyce's Island***

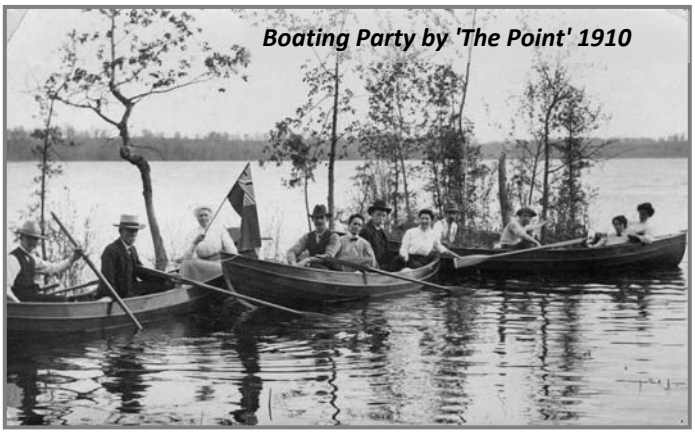
Early drawings and then photographs show that boating for pleasure has long been one of the lake's main attractions which is not surprising given the cottage nature of most of the lakefront development. Sailboats as well as canoes and rowboats have been used from very early days. Several photos from the early 1900s show picnic parties and many boathouses at various locations along the shores of the lake. The Boyce Family who owned the drug store in Sydenham also had a resort on Boyce's Island which would have been accessed by boat.

'The Point' in Sydenham is a recreational area with swimming beaches on either side of the end of a small peninsula. However, the beaches are not natural and did not exist until around the 1950's. Burrowes' 1861 drawing vividly demonstrates that both boating and picnicing have long been popular (see image in sidebar). Along what is now called Clearwater Road South was an area known as 'Moore's Landing' with several boathouses.

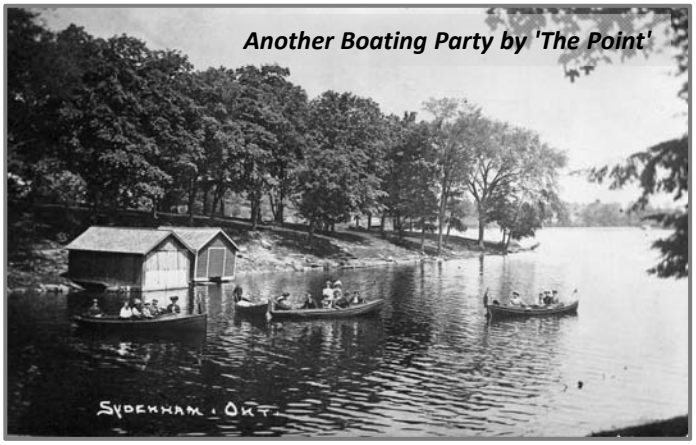
There was a small natural beach there sometimes called 'Moore's or Sydenham Beach'. In addition, across the narrows from there is a small treed point that was also known as 'Picnic Point' which was evidently a popular boating destination. In the 1930's and 40's a family named Gallagher who owned a store in Harrowsmith built a cottage near that little point but had to access it in their boat, leaving their car at the boathouse on the north shore.

Of course many people over the years have held informal sailing, rowing, windsurfing, canoe and motorized boat regattas on the lake. Various community events held at The Point such as on Dominion Day included boating activities and sometimes waterski demonstrations. In more recent times organized boat racing has been held.

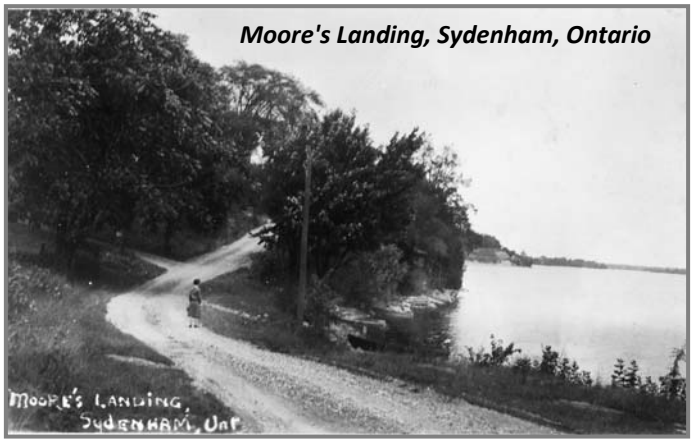
In addition to waterskiing, the usually calm waters of the west end have attracted canoe and kayak races. In the 1980's the Kingston Rowing Club organized some racing events based at The Point. Today this is continuing through the auspices of the Sydenham Lake Canoe Club. Frequent fishing derbies are held with departures and weigh-ins at the boat ramp on The Point.



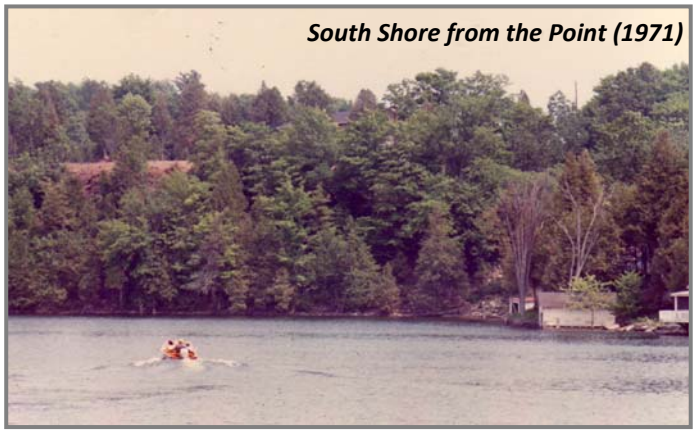
***Boating Party by 'The Point' 1910***




***Another Boating Party by 'The Point'***




***Moore's Landing, Sydenham, Ontario***



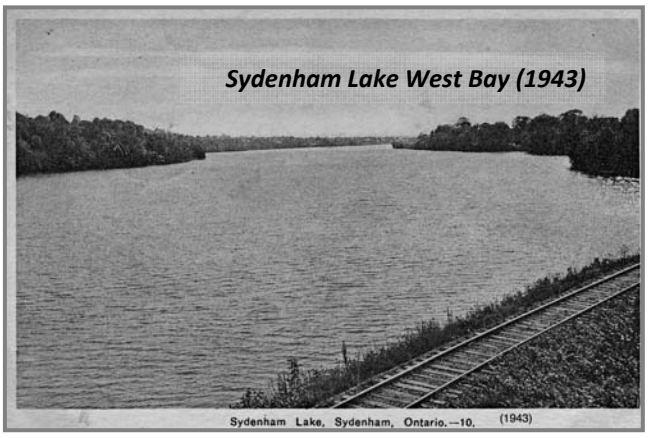
***South Shore from the Point (1971)***

## 4.6 Rail Transport

In August 1884, the 'Napanee, Tamworth & Quebec Railroad' was created with the intent of building rails all the way east to Quebec. However in 1886 it was sold to E. Rathburn and became the 'Kingston, Napanee & Western Railroad'. Rathburn extended the tracks north to Tweed and in 1893 east to Sydenham and by connecting with the K&P Railroad, produce and people could travel by train to Kingston. The Sydenham Station was located on the site of the present day Beer Store (recently closed) and was a busy terminus, transporting passengers and shipping minerals, livestock and lumber.

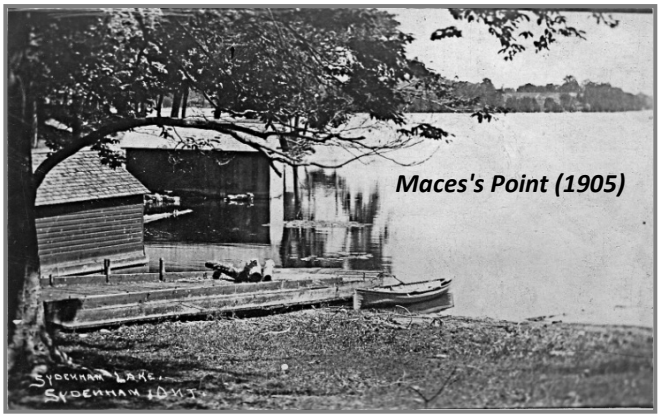
*Sydenham Station Circa 1900*

By 1914 the line was part of the Canadian Northern Railway (eventually becoming part of the CNR) which refurbished much of the track and extended it to Smiths Falls and Ottawa, with the rail bed running along the north shore of the lake. Trains began to run on the CN line just in time to carry troops for World War 1 in 1914. At the time it was the only rail line from Toronto to Ottawa. Long standing residents of Sydenham may recall the familiar train whistle at 5:00 in the morning and at noon. From 1914 until 1938, two passenger trains ran through Sydenham daily, as well as freight trains. After passenger service ended, freight service continued until the mid 1970's. In the 1980's rail traffic along that route was abandoned and the track was removed in 1989.




*Sydenham Lake West Bay (1943)*

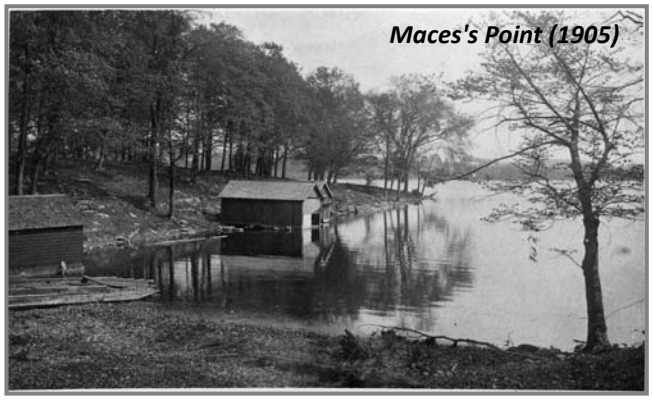
In 2000 the rail bed became the Cataraqui Trail – part of the Trans-Canada Trail system. A small stone bridge which can be seen by looking northeast from the Sydenham Veterinarian building, and a patch of dressed stone wall just below the railway underpass on the Sydenham-Harrowsmith road are all that remain visible of the initial rail system.



*Maces's Point (1905)*

## 4.7 The Point

As previously mentioned the recreational area now known as 'The Point' was once part of a land grant which was farmed beginning in the early 1800's. The 1878 Atlas shows it was owned by William Mace who also had a brewery and distillery in the village. Over the years it has been given various names: Picnic Point, Mace's Point and Lake's Point are a few. Today it is simply called The Point.



*Maces's Point (1905)*

In 1947 the Sydenham Women's Institute along with the Sydenham Board of Trade undertook to purchase it from the Lake family, paying off the cost by 1955 with various community fund raising events. In 1971 the two organizations agreed to transfer the 'Loughborough Memorial and Recreational Centre' to the township for use by its citizens in perpetuity.

## 4.8 The Lake

Up until the original dam was built at the outlet to Millhaven Creek the lake's surface area was much smaller than at present. The 1878 Atlas shows the east end of Sydenham Lake and the east side of the waterway joining it to what was then called Eel Lake to be low lying marshland. The dam raised the lake level enough to flood those areas increasing the surface area by approximately five square kilometres. Thus the island-filled east end of the lake over to Wilmer Road was created and the widening of the waterway and Eel Lake created Eel Bay. The 1914 extension of the railway ran along the north shore, with two iron bridges crossing the mouth of Eel Bay onto and then off Boyce's Island.

In 1830 the population of the entire township was 1003. Structures on lots with shoreline on Sloat's Lake were built next to a road with the lot running back to the lake, rather than being located on the shore. Gradually more and more recreational properties were developed on the waterfront. Local citizens built there but as transportation to the area became easier, more and more seasonal residents came from Kingston and as far away as the northern states.


Sydenham had many hotels in its earlier life. Today many of the cottage properties have been converted into year round homes and most lakefront lots have been subdivided and have permanent homes built on them. There are about three hundred lakefront owners at present.

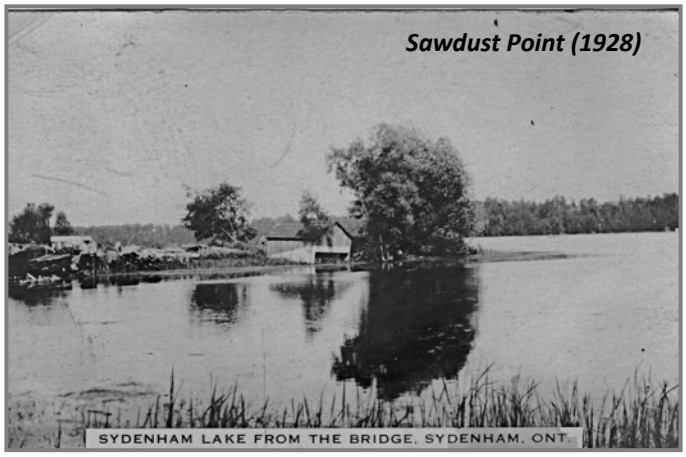
## 4.9 The Mines

The granite of the Shield area just north of Sydenham Lake is rich in minerals: Feldspar, Phosphate, Apatite, Lead, Iron and Mica. Sydenham was an important shipping point for phosphate in the mid-1880's. Foxton Mining of Sydenham sent a large block of phosphate ore to the Chicago World Exposition in 1893. Ironically, at almost the same time, the McKinley tariffs destroyed the Canadian phosphate trade.

However, from 1890 to 1914, Sydenham became a centre for splitting, cutting and grading mica from most of the seventy mines in South/Central Frontenac. Mica crystals can be split into thin, transparent sheets that are tough and flexible. It remains stable when exposed to light, electricity, moisture and extreme temperatures. As such, it was used for woodstove windows, lanterns, kerosene heaters and high voltage electrical equipment. The Lacey/General Electric mine near Eel bay, off Sydenham Lake, produced the best amber mica (phlogopite) in the world: samples are in museums around the world, and the largest crystal ever found came from there. It was 9 feet in diameter, 33 feet long, weighed 90 tons, and produced 60 tons of trimmed mica. At one time, a small steamboat carried barrels of mica down Sydenham Lake from the Lacey/GE mine to Sydenham. From pictures, it appears they used to unload near the present-day site of the Canoe Club.

Mica supply and demand dropped after 1914, though there was a brief resurgence during the second war, when even the mine dumps were re-worked for scrap of mica which could be ground up for lubricants.

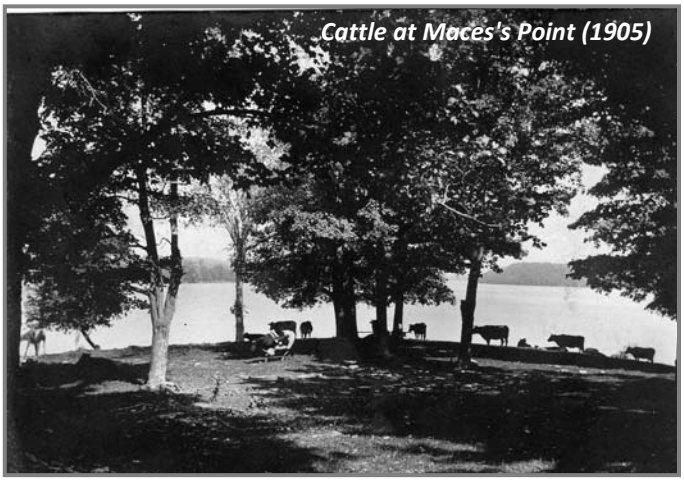

*The Steamer and Barge*



*Sawdust Point (1928)*

## 4.10 Agriculture

Subsistence agriculture was practiced by most of the early settlers the first of whom arrived in the Sydenham Lake area in 1792. When the land was first cleared, the larger trees went to sawmills for lumber and all the brush and smaller trees were burned: the ashes were used to make potash (potassium fertilizer) or lye (soap making and cleaning).


*Cattle at Maces's Point (1905)*

The average farm would have had work horses, sheep, pigs, chickens and cattle for both beef and milk. By the mid-to-late 1800's a network of small local cheese factories were built to process the excess milk, and a veneer mill was begun in Sydenham at the Woodruff/Anglin mill to make round wooden cheese boxes for the factories. As well the farms would have grown hay and grain (wheat, oats, barley, rye and buckwheat), which required grist mills: Sydenham had at least two of these.

Kitchen gardens provided a family's winter supply of vegetables and berries, supplemented by picking wild berries. A few farms had hives of bees, and most made maple syrup in spring.


*The Mill and Bridge*

Most of the farmers also worked part time for cash in logging camps, sawmills, mines or in construction.

# 5. Climate, Climate Change and Lake Impacts

The following sources were referenced in this section:


- *Casselman, John M., 2007. Fish and Fisheries: Sensitivity to Climate Change – Response and Adaptation.*
- *Cataraqui Region Conservation Authority, 1983. Interim Watershed Plan.*
- *Ministry of Natural Resources and Forestry, 2011. Summary of the Impacts of Climate Change on Ontario's Aquatic Ecosystems.*
- *Cataraqui Region Conservation Authority, 2007. Cataraqui Source Protection Area Conceptual Water Budget Report.*
- *Cataraqui Region Conservation Authority, 2008. Watershed Characterization Final Report.*
- *Egginton, Paul, & B. Lavender, 2008. From Impact Toward Adaptation Mississippi Watershed in Changing Climate.*
- *Government of Canada. Historical Climate Data. Canadian Climate Normals 1981-2010. Hartington IHD Station (44˚25', 76˚41'). http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=4287&autofwd=1*
- *Mohseni, O. et al., 2003. Global Warming and Potential Changes in Fish Habitat in U.S. Streams. Climate, Volume 59, Issue 3.*
- *Sydenham Lake Association, 2016. Sydenham Lake News, http://sydenhamlake.ca/news*


## 5.1. Description of Local Climate

The broad climatic region of the area can be described as a cool, humid climate, moderated in part by Lake Ontario. This moderating affect is not likely significantly strong within the Sydenham Lake subwatershed due to the distance from the shores of Lake Ontario. Climatic data for this part of southern Ontario are summarized in Table 5.1.

**Photo 5.1- Sydenham Lake Dam Outflow, April 2002** (CRCA, 2005)

**Table 5.1 – Climatic Data of the Sydenham Lake Subwatershed Region**

| Climatic Variable | Measured Value |
|---|---|
| Mean Annual Rainfall | 822.1 mm [(1)] |
| Mean Annual Snowfall | 156.2 cm [(1)] |
| Mean Annual Precipitation | 953 mm [(2)], 977.7 mm [(1)] |
| Average Annual Temperature | 7° C [(1,2)] |
| Average January Temperature | -8° C [(2)], -8.3 [(1)] |
| Average July Temperature | 21° C [(2)], 20.8 [(1)] |
| Average Date of Last Spring Frost | May 04 [(1)] |
| Average Date of First Fall Frost | October 02 [(1)] |
| Average Length of Frost Free Period | 150 Days [(1)] |
| Sydenham Lake Average Ice On & Off Dates | Ice On- December 19th [(3)]<br>Ice Off- April 9th [(3)] |

(GC, 2017[1]; CRCA, 2007[2], SLA, 2016[3])

Canadian climate normals data (1981-2010) for the nearby (<10 km) Meteorological Service of Canada Hartington IHD Station (44°25', 76°41') are presented in Figure 5.1 and Table 5.2. This climate station lies at approximately the same latitude as Sydenham Lake subwatershed and no major topographical features lie between the station and Sydenham Lake therefore climate data should serve as representative of the Sydenham Lake subwatershed.

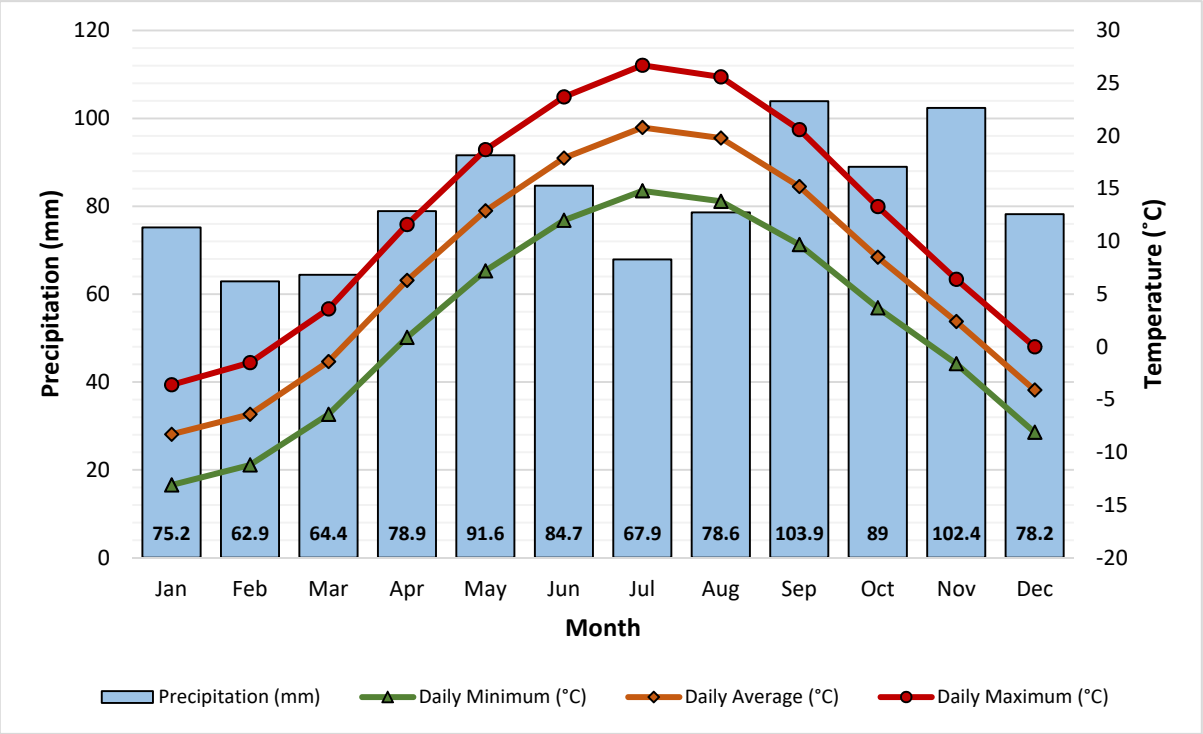



**Figure 5.1 - Temperature and Precipitation Graph for 1981 to 2010 Canadian Climate Normals Hartington IHD Station (44°25', 76°41')** (GC, 2017)

**Table 5.2- Temperature Normals for 1981 to 2010 Canadian Climate Normals Hartington IHD Station (44°25' 76°41')** (GC, 2017)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Daily Average (°C)** | -8.3 | -6.4 | -1.4 | 6.3 | 12.9 | 17.9 | 20.8 | 19.8 | 15.2 | 8.5 | 2.4 | -4.1 |
| **Standard Deviation** | 3.4 | 2.5 | 2 | 1.5 | 1.6 | 1.3 | 1.3 | 1.3 | 1.4 | 1.2 | 1.6 | 3.1 |
| **Daily Maximum (°C)** | -3.6 | -1.5 | 3.6 | 11.6 | 18.7 | 23.7 | 26.7 | 25.6 | 20.6 | 13.3 | 6.4 | 0 |
| **Daily Minimum (°C)** | -13.1 | -11.2 | -6.4 | 0.9 | 7.2 | 12 | 14.8 | 13.8 | 9.7 | 3.7 | -1.6 | -8.1 |

Ice duration will undoubtedly be impacted by future changes in climate. The ice-free period for Sydenham and Little Long Lakes has been gradually increasing, as is noted in Figure 5.2 and 5.3. Longer ice-free conditions may allow for increased water temperatures, increased aquatic vegetation growth and increased risks of algal blooms.

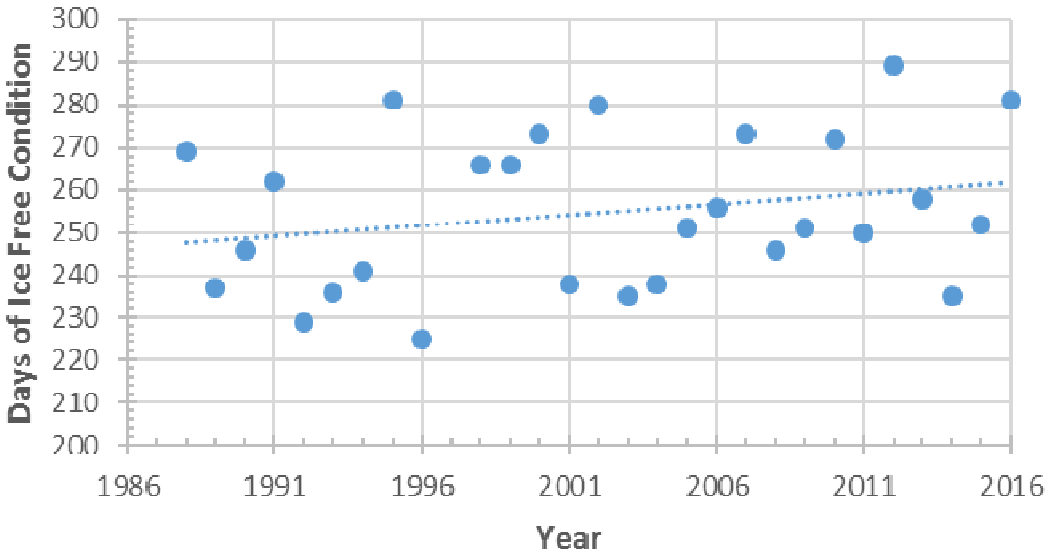



**Figure 5.2 - Sydenham Lake Number of Days Ice Free Condition by Year** (Sydenham Lake News, 2016)

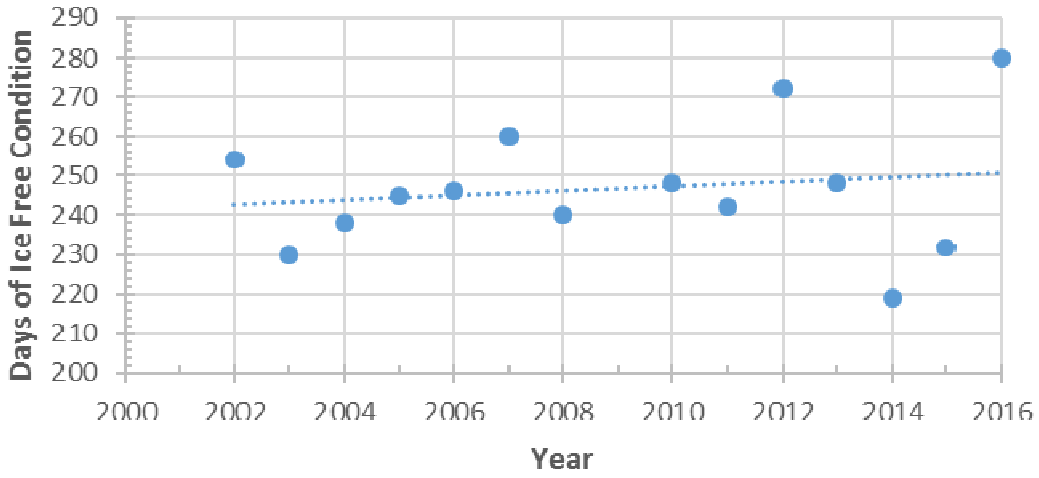



**Figure 5.3 -Little Long Lake Number of Days Ice Free Condition by Year** (Sydenham Lake News, 2015)

## 5.2. Climate Change

Global warming has been occurring and will continue to occur, and understanding the local impacts on the Sydenham Lake area environment, wildlife, and water characteristics is crucial to the development of future actions.

Several municipalities, in conjunction with the provincial government, have begun to develop climate change adaptation strategies for their respective watersheds. Climate change adaptation strategies involve the assessment and evaluation of the risk of climate change impacts on a particular watershed, estimation of future scenarios and vulnerability, development of risk reducing adaptation measures, and implementation of adaptive measures. Sydenham Lake may benefit from reviewing adaptation strategies developed for other watersheds and implementation of adaptive measures that have proven successful in other regions.

Climate change has been predicted to exert numerous impacts including contribution to more frequent severe weather events, higher intensity rainfall, and more frequent and prolonged drought. Additionally, changes in climate are predicted to affect the distribution of flows in surface watercourses including reduced flow and levels in streams, rivers, lakes and groundwater. A reduction in wetland and marsh habitat is also predicted to occur as a result of climate change, which is of particular importance to Sydenham Lake due to the numerous sensitive and biologically significant wetlands within the area.

Since 1948, the average annual temperature in Ontario has increased by as much as 1.4°C as reported by Natural Resources Canada (Egginton, 2008). A warming trend is predicted to persist, with most significant increases in temperature occurring within the winter months. It has been proposed that within Ontario higher air temperatures have the potential of leading to overall reductions in lake volume, warmer surface waters, longer ice free periods, increased growing seasons, and greater risks of hypoxia (Dove et al., 2011), which is a deficiency of oxygen in the water. Additionally, climate change may alter spring freshet timing, affect ground water dynamics, and modify stream flow patterns (Mohseni et al., 2003).

## 5.3. Lake Impacts

Climate change and associated warming temperatures and erratic weather patterns are predicted to exert changes on the environment, wildlife, human populations, and water characteristics.

Species ranges are shifting and trophic dynamics are being altered as a result of climate change. Some of these changes are likely to occur in and around Sydenham Lake. Some changes are evident today, for example, the abundance of black-legged ticks. Increases in water temperature have the potential to influence the demographics of fish species populations which will favour increases in warmwater fish species (e.g. bass, sunfish) abundances (Casselman, 2007). Increases in pathogens are predicted to coincide with water temperature increases affecting human health. Global warming is also expected to contribute to reduced water quality and increased water treatment costs, an additional impact on human health.

Increased temperatures as well as reduced flows from the surrounding subwatershed are predicted by climate change modelling and may cause a reduction in the flushing rate of Sydenham Lake. A reduction in flushing rate may cause an increase in nutrient levels within the lake that in combination with increased air and water temperatures may lead to more weed and algal growth.

Reduced flow as well as an overall lowering of water levels would likely impact boating and fishing activities on Sydenham Lake. Lowering of water levels would expose additional shoals creating navigation and docking issues and will also affect water access to some waterfront properties by creating shallow areas. Some properties are already experiencing this issue when the water is drawn down in the fall. Additionally, shorter winter ice periods would affect winter recreational activities including ice fishing and snowmobiling.

At the lake level, as changes in climate occur, continued and increased monitoring of environmental characteristics such as water quality, fisheries status, and wildlife abundance and diversity will become ever more important to identify threats to the natural environment prior to significant disturbances. Local

stewardship actions such as reducing nutrient inputs, preserving and restoring riparian vegetation, inspecting and upgrading septic systems, and reducing overall impact on the natural environment may help to buffer against impacts associated with climate change. Collectively and collaboratively, the Sydenham Lake community may be able to reduce the negative impacts associated with climate change through responsible land use practices, local stewardship actions, continued and increased monitoring of environmental characteristics and education of the community as a whole.

### *Observations – Climate Change*

- Climate change and associated warming temperatures and erratic weather patterns are predicted to exert changes on the environment, wildlife, human populations, and water characteristics.
- Increased temperatures as well as reduced flows from the surrounding subwatershed are predicted and may cause a reduction in the flushing rate of Sydenham Lake. A reduction in flushing rate may cause an increase in nutrient levels within the lake that in combination with increased air and water temperatures may lead to more weed and algal growth.
- Ice duration will be impacted by future changes in climate. The ice-free period for Sydenham and Little Long Lakes has been gradually increasing.

### *Recommendations for Lake Plan Actions*

- Encourage local stewardship actions (such as reducing nutrient inputs, preserving and restoring riparian vegetation, maintaining and upgrading septic systems) to help buffer against impacts associated with climate change.
- Implementation of farming best management practices within the entire subwatershed to reduce erosion and contaminated runoff entering lakes.
- Implementation of stormwater best management practices within urban and rural areas.
- Ensure maintenance of, and where needed, rehabilitation of, natural wetlands to promote water conservation and storage within the subwatershed.

# 6. Source Water Protection

The following sources were referenced in this section:

- Cataraqui Source Protection Authority, 2014. Cataraqui Source Protection Plan.
- Cataraqui Source Protection Authority, 2014. Cataraqui Source Protection Plan Primer.
- http://cleanwatercataraqui.ca/sourceProtectionPlan.html

## 6.1. Introduction

The Cataraqui Source Protection Plan (SPP) was approved in 2015 and provides direction to keep the Village of Sydenham's drinking water source safe and clean. Since the Village's source of drinking water is Sydenham Lake, implementing the policies of the Source Protection Plan provides additional protection that ensures the lake's water quality is healthy. There are no current risks with using the lake as a source of drinking water and the SPP provides direction to deal with inherent risks related to potential uses and activities that could occur.

The Cataraqui Source Protection Plan was approved by the Minister of the Environment and Climate Change on November 26, 2014 and it has been in effect since April 1, 2015. The Cataraqui Source Protection Plan is a locally developed plan of action required by the *Clean Water Act* to keep sources of drinking water clean and plentiful. Implementation of the Plan is being carried out cooperatively amongst implementing bodies, including municipalities, local health units, provincial ministries, the Cataraqui Region Conservation Authority, businesses and others.

The Cataraqui Source Protection Plan focuses on the protection of municipal drinking water supplies (from wells and surface water) and includes policies for highly vulnerable aquifers that are plentiful throughout the entire Cataraqui Source Protection Area. Development of the Source Protection Plan included public consultation and the preparation and analysis of many technical studies. A Source Protection Committee with 16 community members, plus a Chairperson, worked to guide technical work, consider stakeholder input and develop a locally viable plan to protect drinking water sources.

One of the requirements for a source water plan is to identify areas from which municipal residential water supplies are drawn and the associated areas needing some degree of protection, referred to as Intake Protection Zones (IPZ) for surface water sources. The Sydenham Intake Protection Zone is one of them. The Sydenham Water Treatment Plant draws water from Sydenham Lake and is operated by Utilities Kingston on behalf of the Township. The water is treated and distributed to residents and businesses in Sydenham. Out of 276 homes, there are currently 202 (73%) that are connected to the municipal water system (pers. communication Lindsay Mills). The rest continue to be serviced by private wells. The entire village and surrounding area are serviced by private septic systems or holding tanks.

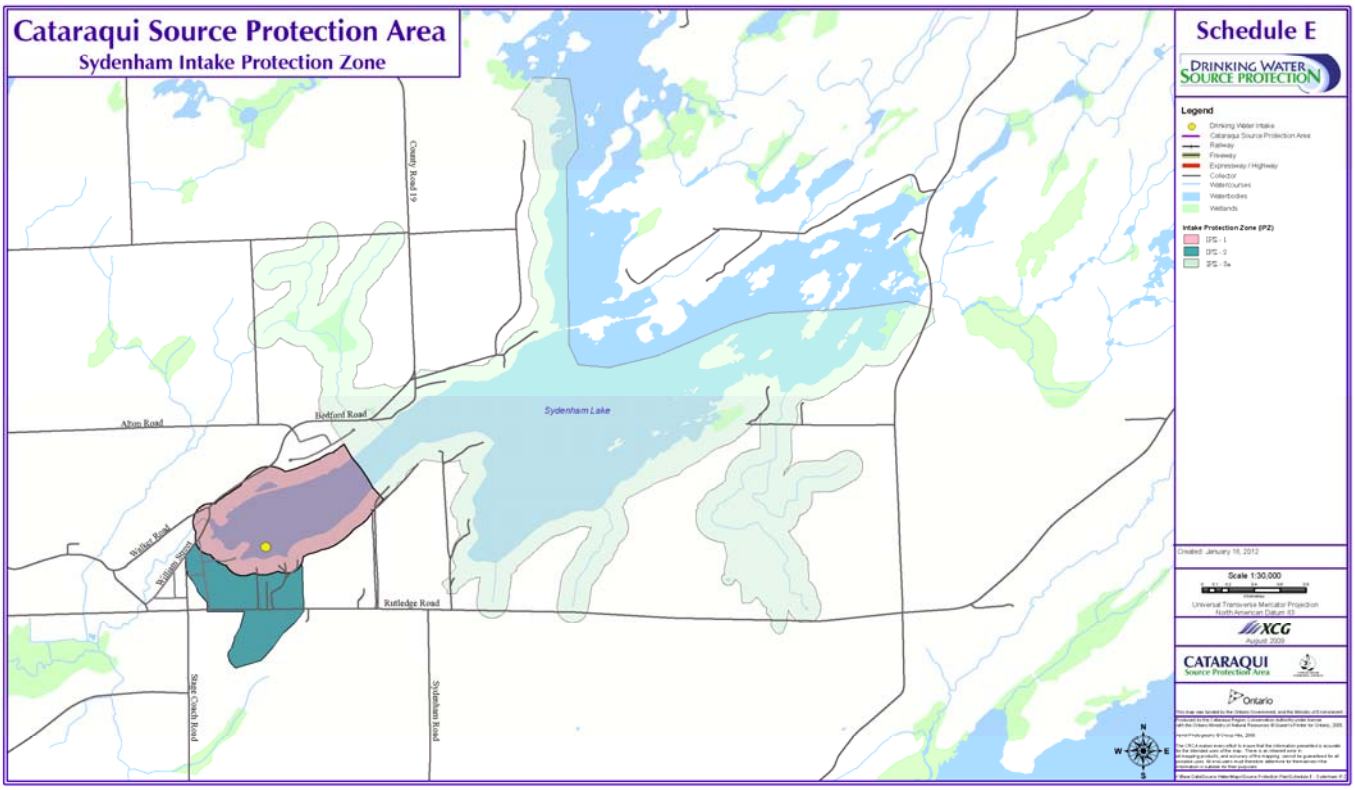
The majority of the area in the Sydenham Intake Protection Zone (IPZ) consists of portions of the lake and a limited zone on the shoreline and beyond (Map 6.1). On land, the IPZ consists mainly of shoreline residential properties. It also includes the Sydenham Water Treatment Plant, a municipal park and boat launch facility, a few farms, and part of the village of Sydenham, which has a variety of residential, commercial and institutional land uses.

There are 3 Intake Protection Zones (IPZs) identified on Sydenham Lake (Map 6.1):

- **IPZ-1** This zone includes the extreme western portion of the main basin of Sydenham Lake and is the primary protection area around the intake. The zone contains a sports field, municipal offices, the Point Park, a water access ramp, a grocery and hardware store, as well as shoreline residential uses. Due to its close proximity to the intake, this zone is considered the most vulnerable, since any contaminant of concern entering this area would have little to no dilution or break-down prior to reaching the intake.

- **IPZ-2** This zone acts as a secondary protective zone for the intake and includes the lands east of Mill Street in the Village of Sydenham containing the high school and sports fields and residential development. In the event of a spill or release of contaminants into this zone, the Water Treatment Plant operator will have only minimal time to respond, for example by shutting down the intake.
- **IPZ-3** includes the rest of the main basin and a portion of the western shoreline of Eel Bay and primarily contains shoreline residential land uses. IPZ3 is a protective zone where early warning system activities, including monitoring, may be pursued. The IPZ-3 is the area within each surface waterbody that may contribute water to the intake.

**Map 6.1 - Source Protection Plan - Intake Protection Zones - Sydenham Lake**




## 6.2. No Significant Existing Drinking Water Threats Identified

The municipal intake for the Village of Sydenham is located in the western bay of Sydenham Lake and land uses in the Intake Protection Zone are primarily residential. This means that most of the activities considered by the Ministry of the Environment and Climate Change to be 'significant' drinking water threats (such waste disposal sites, wastewater treatment facilities) do not exist and are unlikely to become established in the future. As a result, the focus of the Source Protection Plan for these locations is to make sure that these activities that are unlikely to occur never become established, and that other activities that would be a 'significant' threat are properly managed. Finally, activities that are 'moderate' or 'low' threats are managed through the promotion of best management practices and through education and outreach.

The 'significant' drinking water threats that could reasonably be established in this intake protection zone relate to the application, handling and storage of fertilizers and pesticides and agricultural source material (e.g., manure). 'Moderate' and 'low' ranked drinking water threats relate to the application of road salt; the transportation, handling and storage of liquid fuel; septic systems; and holding tanks.

## 6.3. Source Protection Plan Policies

The Cataraqui Source Protection Plan provides numerous policies on activities that could potentially impact the lake's water quality. Some of these policies prohibit and restrict activities, while others apply best management practices.

The following provides a summary of the most relevant policies from the Source Protection Plan. The specific policies are provided in more detail in the Source Protection Plan.

### 6.3.1 Prohibited Uses

Policies 7.2.2-CW and 7.2.3-CW prohibit the following land uses in the entire Intake Protection Zone:

- waste disposal sites;
- the storage of mine tailings;
- farming with petroleum refining waste;
- the filling of land with hazardous waste, municipal waste and solid non-hazardous waste; and
- wastewater treatment facilities.

None of these land uses exist in the Intake Protection Zone and the Official Plan and Comprehensive Zoning By-law (Township of South Frontenac) prohibits these uses from occurring in the future.

### 6.3.2 Restricted Uses - New Development or Expansions to Existing Development

For new development or expansions to existing development, management practices must be incorporated to manage the risk to the community's source of drinking water, associated with the following activities of the applicable zones:

In IPZ-1:

- handling and storage of >25 litres of a dense non-aqueous phase liquid and/or an organic solvent (e.g., metal manufacturing, electroplating and fabrication industries, automotive or equipment repair shops, furniture refinishing shops, dry cleaning establishments);
- handling and storage of more than 2,500 kg or litres of commercial fertilizer (e.g., lawn and garden centres, farm supply stores, yard maintenance contractors, golf courses); and
- the handling and storage of more than 2,500 litres of liquid fuel (e.g., gas stations, marinas).

In IPZ-2:

- the storage of sewage associated with a sewage system or sewage works;
- the handling and storage of more than 250 litres of a dense non-aqueous phase liquid (DNAPL) and/or an organic solvent (e.g., metal manufacturing, electroplating and fabrication industries, automotive or equipment repair shops, furniture refinishing shops, dry cleaning establishments);
- the handling and storage of more than 2,500 kilograms or litres of commercial fertilizer and/or more than 2,500 kilograms or litres of pesticide at a facility where it is sold or used for application at other sites, except where it is manufactured or processed, (e.g., lawn and garden centres, farm supply stores, yard maintenance contractors, golf courses);
- the handling and storage of more than 2,500 litres of liquid fuel (e.g., gas stations, marinas); and
- the handling and storage of greater than 500 tonnes of road salt (e.g., public or private maintenance yards).

None of these activities currently occur in the Intake Protection Zone 1 and 2, and the Official Plan and Comprehensive Zoning By-law (Township of South Frontenac) prohibits the land uses that are associated with these activities. New development or expansions to existing development associated with these activities are generally considered to be commercial uses, and further restrictions may be imposed through a Site Plan and Agreement between the landowner and the Township.

### 6.3.3 Sewage Systems

The entire community in and around the Sydenham Intake Protection Zone is serviced by on-site sewage systems (mostly septic tanks and tile beds). Sewage systems in the IPZ-1 and IPZ-2 pose a moderate threat to the Sydenham intake, while those in IPZ-3 pose a low risk.

The Ontario Building Code requires ongoing maintenance of every on-site sewage system (e.g., septic system) and the remediation of unsafe or failing systems. It is the responsibility of the Township of South Frontenac to enforce the Building Code. Owners/operators are responsible for septic system maintenance. In addition, the *Building Code Act*, 1992 and the Building Code contain provisions that allow the municipality to establish maintenance inspection programs in the municipality.

Policy 7.2.1 NB of the Source Protection Plan encourages the Township of South Frontenac, to establish an on-site sewage system maintenance inspection program for these systems. In addition, the program should provide information to landowners about the proper operation and maintenance of their on-site sewage systems (i.e. septic systems and holding tanks), and about the benefits of a well-maintained system.

The Township requires all new septic systems to be setback 30 m (100 ft) from the shoreline. In addition, any new shoreline development that requires a building permit or other development approval (minor variance, zoning amendment, severance application) requires the property owner to enter into a Site Plan Agreement with the Township which can impose conditions to promote natural buffering along the shoreline and other best management practices.

Between 2004 and 2008 the Township conducted a Septic Re-inspection Program on all lakes in South Frontenac. Visual inspection of septic systems was coordinated by the Township of South Frontenac and the Kingston Frontenac Lennox and Addington Public Health Unit, and in some cases tank lids were lifted and an internal inspection of the septic tank was completed. The inspections provided excellent opportunities to educate property owners about the use and maintenance of their septic systems. The results of the program indicated that the septic systems in the Township were in very good condition. On Sydenham Lake, only 5 septic systems were found to be substandard and required follow-up action (pers. comm. Lindsay Mills). At the end of the 5 year program an assessment was conducted and it was recommended that an on-going mandatory program was not necessary and that the focus of any new action should be on communication and voluntary action.

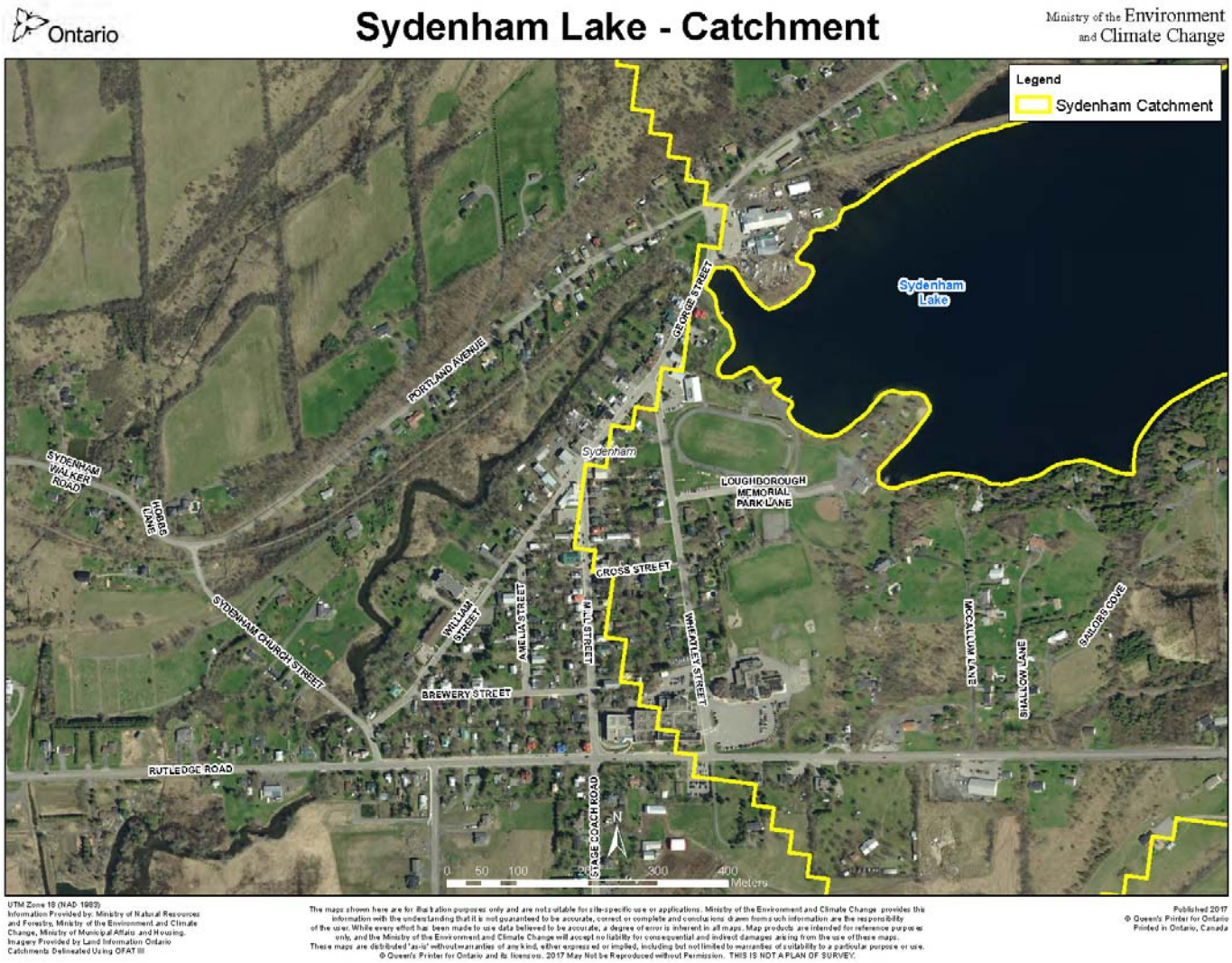
### 6.3.4 Stormwater Management - Land Use Planning and Development

Stormwater includes runoff from rainwater, roofs, snowmelt and the ground surface. This water picks up pollutants such as sand, oil, fertilizer and bacteria as it flows over the ground and carries them to streams and lakes. This runoff can pose a moderate threat to a community's drinking water in the Sydenham Intake Protection Zones. This runoff would be a moderate threat in IPZ-1 and a low threat in IPZ-2 and for the balance of the Intake Protection Zones.

Only a small portion of stormwater from urban areas is treated or adequately managed, meaning that it flows directly from the streets and gutters into the nearest waterbody. There are ways to control this runoff in order to avoid flooding and erosion in watercourses, allow for groundwater recharge, provide sediment control, limit nutrient and bacteria loading to the waterways and reduce the impact of changes on the aquatic environment.

Policy 7.2.8-NB encourages municipalities to develop a strategy to address untreated stormwater run-off in IPZ-1 and IPZ-2 areas. The strategy could include mapping of storm sewers, catch basins and outfalls and the monitoring of storm water quantity/quality. This information can be used to develop a Master Stormwater Management Plan for the Village of Sydenham, and identify priority areas for the installation of stormwater treatment facilities.

Currently, the Township is working on a Salt Management Plan to lessen the impacts of the use of road salt on lakes and waterway. Map 6.2 illustrates the Sydenham Lake Catchment Area which includes all lands in the Village that drain into Sydenham Lake. The Township should include details in the Salt Management Plan regarding the use of road salt in this area in order to reduce the impacts of salt on Sydenham Lake and the water intake.




**Map 6.2 - Stormwater Catchment Area -Village of Sydenham**

Policy 7.3.5-HR encourages municipalities to require proponents of development applications to incorporate stormwater management features in accordance with best practices and that provides enhanced protection (e.g., 80 per cent suspended solids removal), into building and site plans. The purpose is to reduce the volume of contaminants entering storm sewer systems and roadside ditches draining to Sydenham IPZ-1 and/or IPZ-2, or directly to Sydenham Lake, where discharge of untreated stormwater is a moderate or low drinking water threat. Further the Source Protection Plan suggests that these requirements could be reflected in the site plan control by-law and any development guideline documents.

Any new commercial development in the village, or any new development on the shoreline of Sydenham Lake is required to enter into a Site Plan Agreement which can address the requirements to manage stormwater runoff and impose other best management practices to lessen the impact of development.

### 6.3.5 Parks and Recreation

There are three municipal sports fields adjacent to the water treatment plant in Sydenham IPZ-1 on which commercial fertilizer may be applied. Runoff containing fertilizer can pose a moderate threat to Sydenham's drinking water. It is a best practice to maintain a buffer between sports fields and nearby waterbodies so that runoff from the fields is attenuated before it reaches the waterbody.

Policy 7.3.6-NB encourages the Township of South Frontenac to establish fertilizer-free buffer zones between the sports fields in IPZ-1 and Sydenham Lake to address the moderate drinking water threat of application of commercial fertilizer to land.

The sports field, Point Park, boat launch ramp and the lands around the Township office are owed by the Township of South Frontenac. The Township is considering the implementation of a fertilizer free zone in IPZ 1 (pers. comm. Lindsay Mills). The Sydenham Lake Association should work with the Township to adopt a similar approach for the entire lake.

### 6.3.6 Lakeshore Capacity Assessment

The Source Protection Plan suggests that a lakeshore capacity assessment can provide the Township of South Frontenac with an accurate and quantitative linkage between the level of development and the level of phosphorus in the lake. It can be used to predict the impacts of development on water quality. Implementation of the results of an assessment requires collaboration between various stakeholders including the municipality and residents.

Policy 7.3.7-CW encourages the Township of South Frontenac to consider undertaking a lakeshore capacity assessment for Sydenham Lake using the Ministry of the Environment Lakeshore Capacity Model, or another appropriate model, to determine the impact of on-site sewage systems, and agricultural runoff, on the water quality of Sydenham Lake. The purpose is to provide information that will assist in identifying the best local risk management measures to address significant drinking water threats related to agricultural runoff (i.e. the application of agricultural source material and the use of land as livestock grazing or pasturing land, an outdoor confinement area or a farm animal yard) in IPZ 1 and 2. The Township is also encouraged to implement the findings of this research to inform land use planning decisions and to promote best management practices.

In 2016 the Ministry of the Environment and Climate Change's (MOECC) Kingston Regional Office applied the Ontario Lakeshore Capacity Assessment model and found that the model could not be applied to Sydenham Lake. In its simplest form, the model is a planning tool that quantifies the linkages between natural and human sources of phosphorus, the water balance of a lake, and the size and shape of a lake to predict a lake's phosphorus concentration. The predicted phosphorus concentration can then be compared with measured values to assess the accuracy and validity of the model as a predictive tool. However, when the MOECC ran the model on Sydenham Lake, they found that predicted phosphorus concentration was not within the acceptable limits and therefore it cannot be applied.

In such cases where the model does not work, the MOECC recommends that the interim Provincial Water Quality Objective for total phosphorus be followed as a guideline. The guideline states:

- To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 ug/L;
- A high level of protection against aesthetic deterioration will be provided by a total phosphorus concentration for the ice-free period of 10 ug/L of less. This should apply to all lakes naturally below this value.

## *Observations – Source Water Protection*

- The Cataraqui Source Protection Plan was approved in 2015 and provides direction to keep the Village of Sydenham's drinking water sources safe and clean.
- Since the Village's source of drinking water is Sydenham Lake, implementing the policies of the Source Protection Plan provides additional protection that ensures the lake's water quality is healthy.
- No existing 'significant' drinking water threats such as waste disposal sites or wastewater treatment facilities exist or are likely to become established in the future, and those that may become established must be managed.
- The Source Protection Plan provides direction to deal with inherent risks related to potential uses and activities that could occur. The Township of South Frontenac:
    - Prohibits specific lands uses in the Official Plan that pose a significant threat to drinking water.
    - Requires risk management plans for some significant drinking water threats that could reasonably become established
    - Recommends proponents of development applications to incorporate stormwater management features in accordance with best practices and that provides enhanced protection into building and site plans.
- Additional work is required to:
    - Complete a Road Salt Management Plan.
    - Develop a strategy to address untreated stormwater run-off in IPZ-1 and IPZ-2.
    - Re-establish a septic system maintenance inspection program focusing on communication and education.
    - Establish a fertilizer-free buffer zone between the sports fields in IPZ-1 and Sydenham Lake to address the moderate drinking water threat from applying commercial fertilizer.

## *Recommendations for Lake Plan Actions*

- Work with the Township to establish: a septic system maintenance awareness program focusing on education, communication and voluntary action.
- Work with the Township to complete a Road Salt Management Plan to lessen the impacts of road salt on Sydenham Lake.
- Work with the Township to define a Stormwater management strategy potentially via a community improvement plan.
- Provide information to shoreline property owners those in watershed about how to keep the lake water healthy (e.g., restricting use of fertilizers, maintaining natural shorelines, restoring lawns to natural areas).

# 7. Geology and Soils

The following sources were referenced in this section:

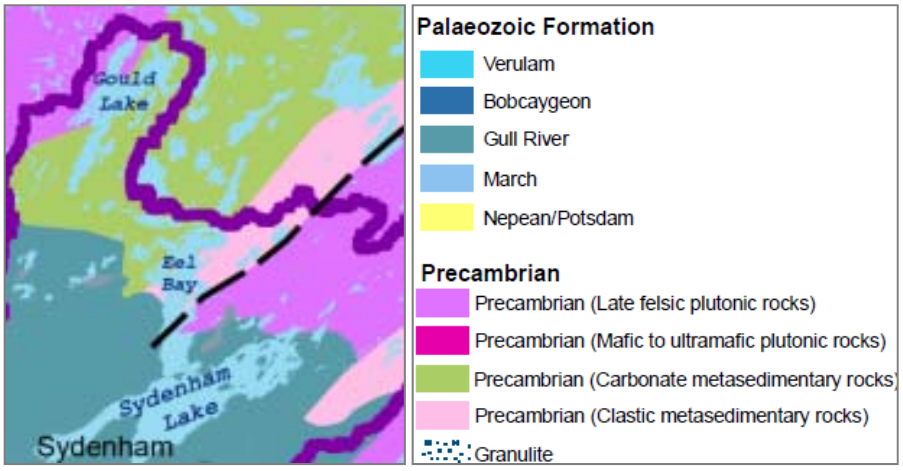
- *Castro, V., 1993. Lake Capacity Study & Shoreline Development Policies for Greater Sydenham Lake.*
- *Cataraqui Region Conservation Authority, 2005. Establishing Environmental Flow Requirements for Millhaven Creek.*
- *Cataraqui Region Conservation Authority, 2008. Watershed Characterization Report.*
- *Chapman, L.J. & Putman, D.F., 1984: Physiography of Southern Ontario; Ontario Geological Survey, Map P.2715.*
- *Littkemann, Peter B (Ontario Department of Lands and Forests), 1959. Biological Report on Sydenham Lake.*
- *Ministry of Northern Development and Mines. April 17, 2017. CLAIMaps IV. https://www.mndm.gov.on.ca/en/mines-and-minerals/applications/claimapsiv*
- *XCG Consultants Ltd., 2009. Technical Memorandum # 1, Vulnerability and Issues, Community of Sydenham Intake Protection Zone Study.*
- *XCG Consultants Ltd., 2009. Technical Memorandum # 4, Community of Sydenham Issue Evaluation and Threats Inventory Study.*

## 7.1. Introduction

The geological setting and rock type underlying and surrounding a lake are very important in determining the chemical character of a lake. Generally, shield lakes located entirely on the Precambrian Shield are sensitive to acid rain, possess less ability to adjust to pH changes, and are often low in calcium limiting the ability for fish and other organisms to flourish. Lakes located entirely on carbonaceous rocks, such as limestone and calcite, generally exhibit sufficient buffering capacity and are able to maintain a relatively stable pH level. Lakes located on carbonaceous rocks are also usually high in calcium content and provide organisms the necessary chemical elements to thrive. However, lakes of this nature also supply conditions suitable for the existence of zebra mussels.

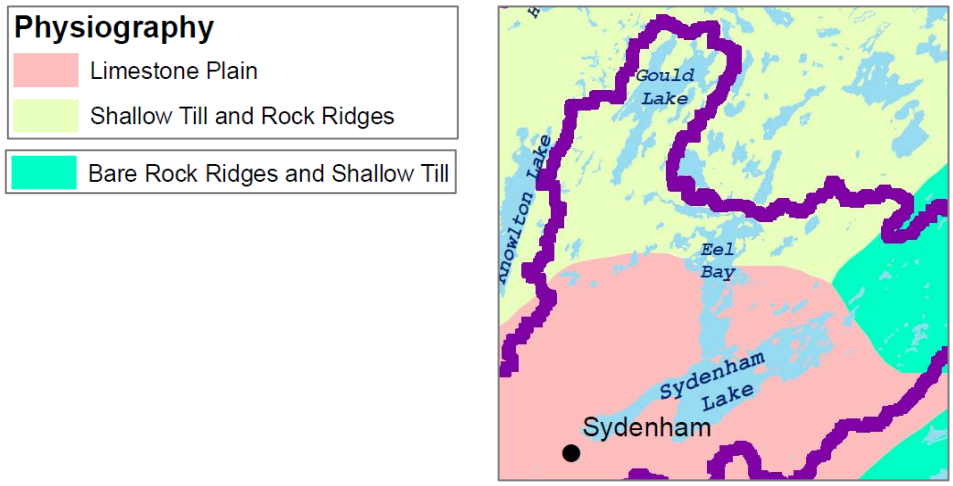
Frontenac County, along with many of the other counties 'fronting' Lake Ontario, consists of two distinct geologic characteristics. The northern portion is Precambrian bedrock of the Canadian Shield topography while the southern region is limestone bedrock of the St. Lawrence Lowlands laid down by ancient seas.

Sydenham Lake is situated on a transition zone between the Precambrian Shield and the limestone bedrock of the Napanee Plain. The northern half of Eel Bay and the area north of that lies within the comparatively acidic Canadian Shield (Pre-Cambrian) and everything to the south is underlain by the more basic sedimentary limestone bedrock (Palaeozoic) of the Napanee Plain (Map 7.1).




**Map 7.1- Ministry of Northern Development and Mines Bedrock Geology of the Sydenham Lake Subwatershed Clipped Map Section** (LIO, 2007)

The characteristics of native soils are influenced by the types of rock that are proximate to the area and the legacy of glacial drift. Calcareous soils would be expected to be present in this entire area, and this is further supported by the alkalinity concentrations and pH levels of Sydenham Lake water. Sydenham Lake's geological setting fundamentally explains the lake's character as it exists today. The Sydenham Lake subwatershed area is characterized by the exposed bedrock, lakes and woodlands of the Canadian Shield (Frontenac Axis) to the north, and the agricultural landscape of the limestone and clay plains to the south (Map 7.2). The more populated region to the south of the lake is based mainly on agricultural communities while the area to the north is less populated, and more predominantly a recreational, hunting, fishing, and (in earlier days) mining region.

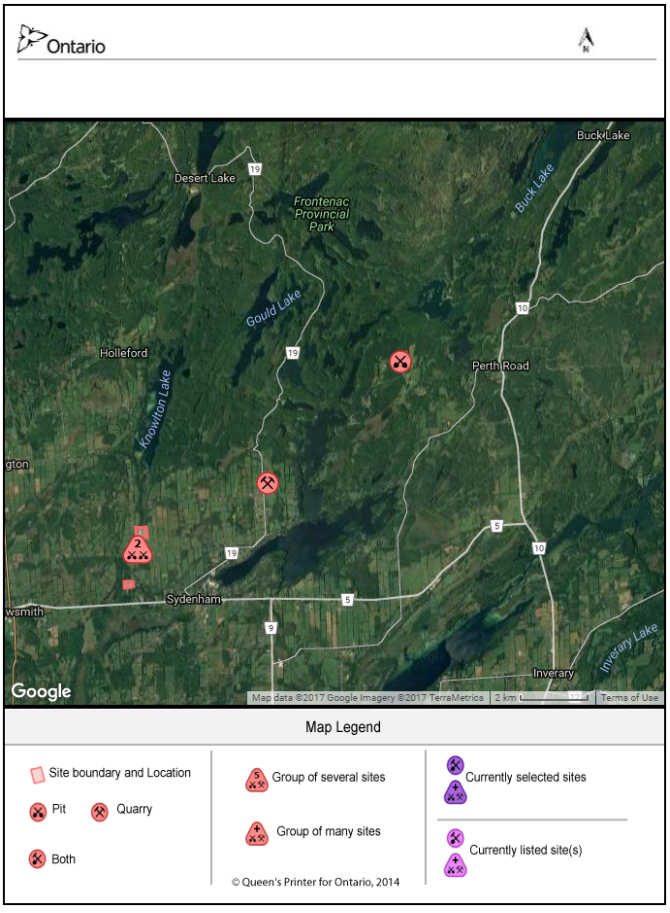



**Map 7.2- Physiography of the Sydenham Lake Subwatershed Clipped Map Section** (Chapman & Putman, 1984)

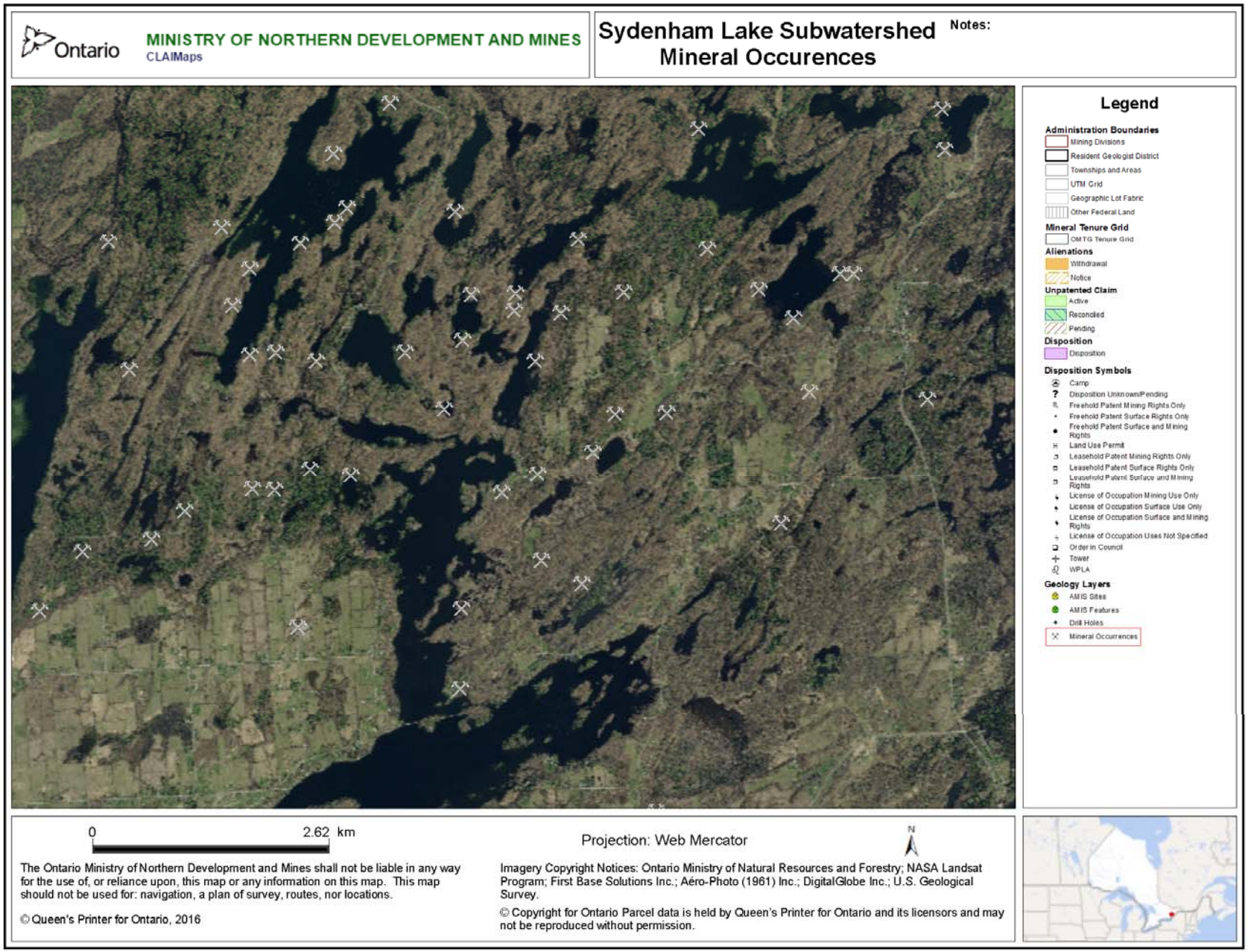
## 7.2. Economic Geology

Map 7.3 illustrates the location of current pits and quarries in the area surrounding Sydenham Lake. The area surrounding Sydenham Lake contains glaciofluvial deposits of sand or gravel, and has been the location of a number of current and historical pits and quarries. While no large scale mining currently exists within the Sydenham Lake subwatershed there was active mining in the past, and a number of abandoned mines exist (Abandoned Mine Information System- 17 Records) in the northern (Pre-Cambrian) area of the watershed. There are also several aggregate pits which coincide with mineral occurrences within the area (Map 7.4).

The granite of the Canadian Shield in the northern portion of the Sydenham Lake subwatershed is rich in minerals including Feldspar, Phosphate, Apatite, Lead, Iron and Mica. The Sydenham Lake area was once an important mining and shipping area for minerals of the Canadian Shield, notably for phosphate and mica (see Section 4.9 of the History Chapter).



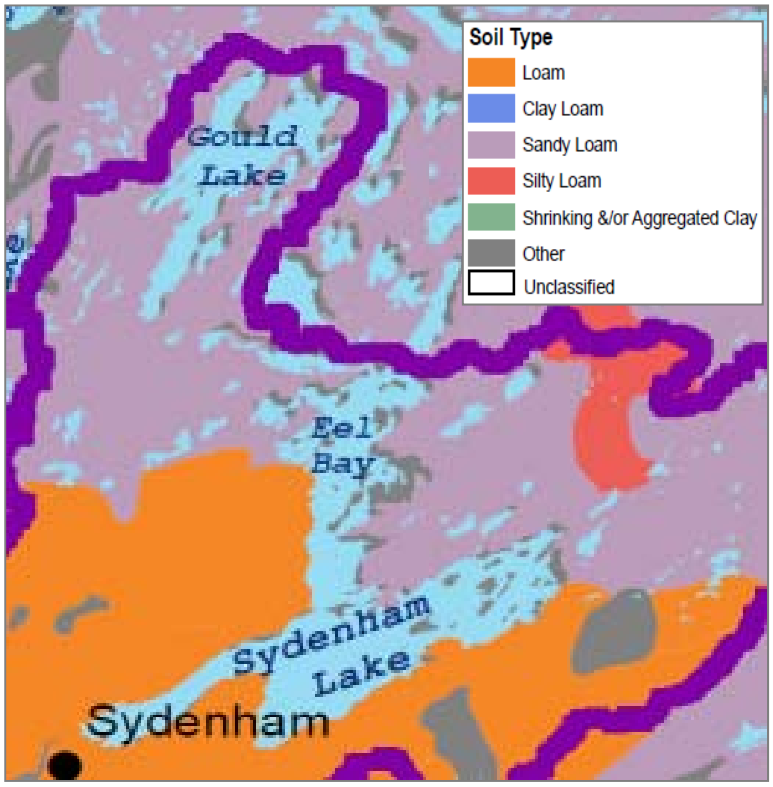

**Map 7.3 - Pits and Quarries Near Sydenham Lake Subwatershed** (Find Pits & Quarries- Ontario, 2017)




**Map 7.4- Mineral Occurences of the Sydenham Lake Subwatershed (MNDM Claimaps- Ontario, 2017)**

## 7.3. Soils

The Sydenham Lake area is located within a larger moraine landform shaped during previous periods of glaciation. Surficial deposits in the Sydenham Lake area are primarily of glacial origin and consist of glacial till and ice contact deposits, deposited mostly during the late Wisconsin ice advance approximately 12,000 years ago. The soils of the Millhaven Creek watershed range from loam complexes in northern areas to clay in the south. Soils surrounding Sydenham Lake are shallow, with bedrock typically less than one meter from the surface; these soils have been described as shallow and coarse textured including granitic sandy soils and sandy loams.




**Map 7.5- General Soil Types of the Sydenham Lake Subwatershed Clipped Map Section** (LIO, 2005)

The northern portion of the Sydenham Lake subwatershed is predominantly composed of sandy loam soils while the southern portion of the subwatershed is composed of loam type soils (Map 7.5). A transition zone between soil types occurs in Eel Bay and north of the East Basin areas which roughly mirrors the transition zone of bedrock types (Map 7.1).

Detailed soil type mapping reveals Monteagle sandy loam soil surrounding Gould and Little Long lakes in the northern portion of the subwatershed. Monteagle soils are derived from granite, are acidic in nature and are associated with plutonic granitic bedrock. Monteagle soils have low fertility, low moisture holding capacity, and extreme stoniness thus resulting in very low potential for agricultural production. The Canadian Shield and rocky outcrops with limited soils characterize the northern portion of the subwatershed.

The southern portion of the Sydenham Lake subwatershed is predominantly composed of soils that are well drained and water percolates readily through the coarse soil materials or runs off the surface. Stones occur throughout the soil profile but are rarely present in sufficient numbers to interfere with agricultural cultivation.

### Phosphorus Attenuation in Soils

The degree to which phosphorus may be attenuated in soils has been the subject of considerable scientific debate over the past several decades, and is of importance because phosphorous levels in the lake are an important determinant of water quality. Recent studies published by Dr. Will Robertson and his colleagues at the University of Waterloo (Robertson et al. 1991, Robertson et al. 1998, Zanini et al. 1998, Robertson 2003, Robertson 2005) have demonstrated that septic system phosphorus may be attenuated in the long-term at some sites on the Canadian Shield. The attenuation of septic system phosphorus is controlled by the processes of adsorption and mineralization. Whereas adsorption only slows down the movement of the septic phosphorus plume, mineralization (or mineral precipitation) of phosphate with aluminum, and to a lesser extent iron, is more permanent under most conditions.

For mineralization to be sustained over the long-term, a number of conditions must exist, including: development of acidic conditions; a well-oxidized environment; the presence of available aluminum and iron in the soil; and adequate contact-time between phosphorus-rich wastewater and unsaturated soils. Research on small septic systems has demonstrated that acidic soils are far more effective at binding phosphorus than calcareous soils.

The characteristics of native soils are influenced by the types of rock that are proximate to the area and the legacy of glacial drift. Sydenham Lake is situated on a transition zone between the Precambrian Shield and the limestone bedrock of the Napanee Plain. Calcareous soils would be expected to be present in this entire area, and this is further supported by the alkalinity concentrations and pH levels of Sydenham Lake water. Knowledge of soil characteristics in the watershed is directly linked to the sensitivity of Sydenham Lake. This data can be used to guide planning decisions as they relate to septic design and setbacks (Castro, V.; pers. comm., 2017).

### Lake Basin Substrates

The Sydenham Lake basin is of glacial origin. Overall, the lake substrates of the main basin are heavily silted, while the bottom near the islands, shores and over shoals is rocky. Marl was noticed in some shallow areas of the main body of the lake.

The bottom of Eel Bay/Sydenham Lake Wetland complex largely consists of the hard igneous rocks of the Canadian Shield. Overburden thickness is generally thin (0-0.5 m) surrounding the wetland complex. Mud covers the bottom of large areas of Eel Bay with the exception of regions surrounding islands. Sandy loam to loam soils are present in the Eel Bay/Sydenham Lake Wetland complex.

### *Observations – Geology and Soils*

- Sydenham Lake is situated on a transition zone between the Precambrian Shield and the limestone bedrock of the Napanee Plain. Calcareous soils would be expected to be present in this entire area, and this is further supported by the alkalinity concentrations and pH levels of Sydenham Lake water.
- While no large-scale mining currently exists within the Sydenham Lake subwatershed there was active mining in the past, and a number of abandoned mines exist.
- The northern portion of the Sydenham Lake subwatershed is predominantly composed of sandy loam soils while the southern portion of the subwatershed is composed of loam type soils. A transition zone between soil types occurs in Eel Bay and north of the East Basin areas which roughly mirrors the transition zone of bedrock types.
- The Sydenham Lake basin is of glacial origin. Overall, the lake substrates of the main basin are heavily silted, while the bottom near the islands, shores and over shoals is rocky. Marl was noticed in some shallow areas of the main body of the lake.
- The bottom of Eel Bay/Sydenham Lake Wetland complex largely consists of the hard igneous rocks of the Canadian Shield. Overburden thickness is generally thin (0-0.5 m) surrounding the wetland complex. Mud covers the bottom of large areas of Eel Bay with the exception of regions surrounding islands.
- The calcareous soils surrounding Sydenham Lake are less effective at retaining (binding) phosphorus than the acidic soils located on the Canadian Shields and further information of soil characteristics can be used to guide planning decisions as they relate septic design and setbacks.

### *Recommendations for Lake Plan Actions*

- Undertake a soil survey in watershed to characterize percentage calcium carbonate, percentage aluminum and percentage iron in native soils to better understand the capability of local soils to bind phosphorus coming from septic systems.

# 8. Water Levels

The following sources of information were used in this section:

- Cataraqui Region Conservation Authority (CRCA) http://crca.ca/
- Sydenham Lake Association, undated. Water Levels on Sydenham Lake. http://sydenhamlake.ca
- Sydenham Lake Association, 2011. Sydenham Lake Dam History Report.
- Cataraqui Region Conservation Authority, undated. Establishing Environmental Flow Requirements for Millhaven Creek.

## 8.1. Water Level Management

The water level of Sydenham Lake is controlled through the management of a dam located at the lake's outlet in the Village of Sydenham. There are no dams upstream of Sydenham Lake, so the water levels of Little Long and Gould Lakes are subject to natural conditions in the watershed, and to the level of the Sydenham Lake dam.

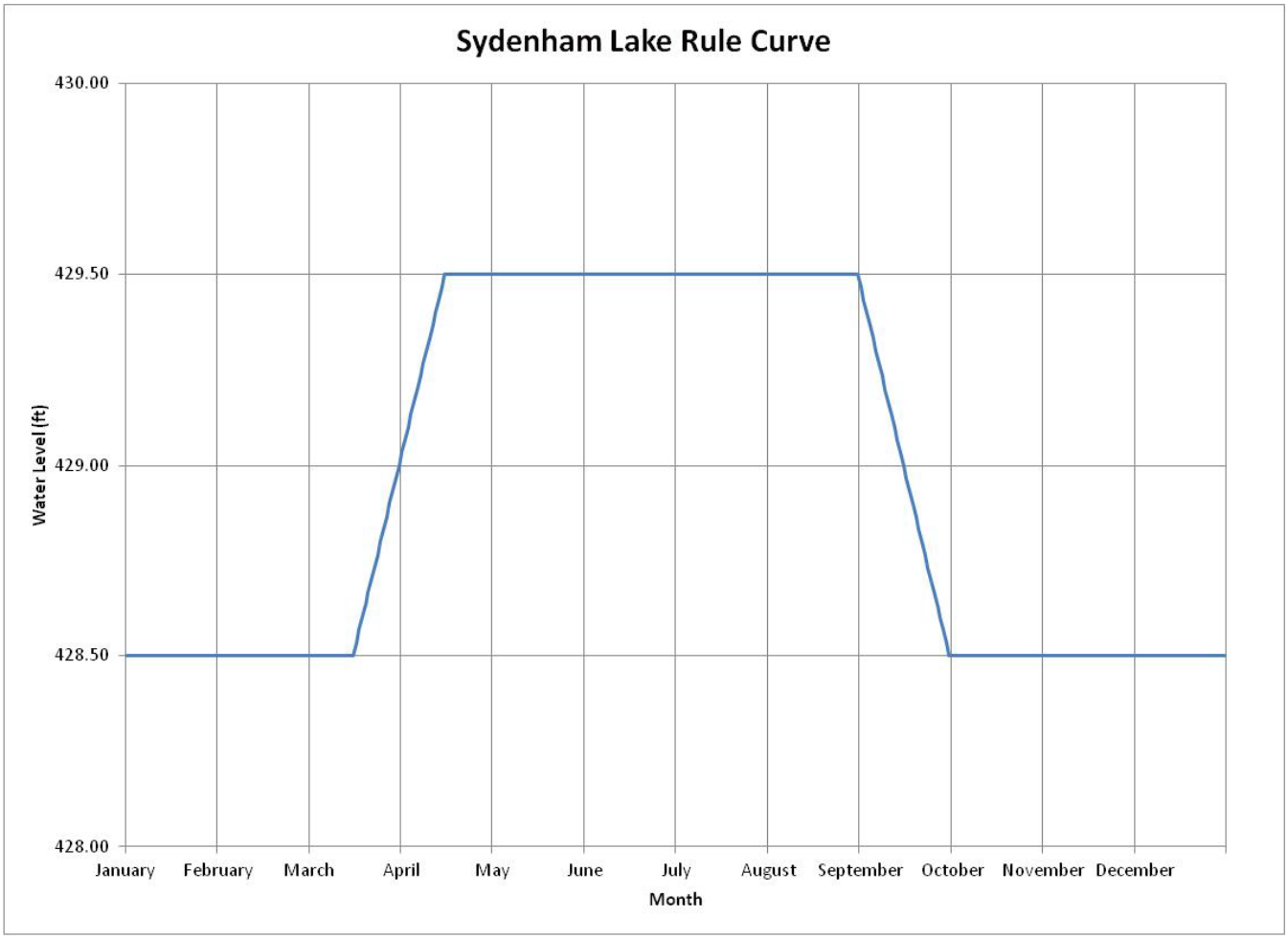
The first dam was built in the latter half of the 19th Century to increase the lake level and provide more water power for the several mills that had been built there. Since its construction, the dam has undergone a number of improvements and rebuilds. The Cataraqui Region Conservation Authority (CRCA) purchased the dam structure in the late 1970's, and rebuilt the dam in 1977. The surrounding park, the mill structure, as well as the water rights to the lake were purchased by the CRCA in the late 1980's. From 2005 to 2009 the CRCA undertook extensive renovations to the dam to reduce leaking and upgrade structural integrity, including replacing the stop logs, excavating and stabilizing the park where the old mill structure was located, and rebuilding the dam spillway. Funding from the Ministry of Natural Resources and Forestry enabled recent improvements including telemetry to remotely monitor lake levels, rain fall, stream flow and evaporation. There is also a new direct read gauge attached to the old gauge on the dam structure. Water levels are also monitored upstream from Sydenham Lake and snow pack information is gathered every two weeks over the winter months.

The CRCA has the responsibility for managing water levels at this dam, with the initial and primary objective being flood control. Management for flood control is balanced by two other objectives: maintaining wetlands; and ensuring continued recreational use of the lake. The CRCA manages the dam in conjunction with the Ministry of Natural Resources and Forestry (MNRF) and Ministry of the Environment and Climate Change (MOECC). These agencies share information and data collection, which helps form the basis of the water cycle control often referred to as the rule curve (Figure 5.1).

The CRCA strives to maintain the water levels in Sydenham Lake to match the data in the rule curve currently established between 130.9 m (429.5 ft) (spring & summer) and 130.6 m (428.5 ft) (fall & winter) above sea level. This 30.5 cm (1.0 ft) differential was established through historical record, legal agreement, consultation with the Sydenham Lake Association and the general public. The current rule curve has been in effect, with minor changes from time to time, since the mid 1980's. Depending on the amount of rain, snowmelt, the length of dry spells, the amount of sunny weather and the temperature, the CRCA tries to maintain water levels along this rule curve.

As Sydenham Lake is now a reservoir for the municipal water supply of the Village of Sydenham, the CRCA has completed a number of source water protection studies, including a Water Budget Study, to define the extent of water available in the watershed. Although the CRCA controls the water level in the lake and indirectly 'owns' the water rights, the MOECC issues a Permit to Take Water to the Township specifying the maximum amount of water that can be removed for the water plant in Sydenham.

**Figure 5.1 - Sydenham Lake Rule Curve - CRCA Sydenham Lake Dam OMS Manual**




Spring lake levels are closely monitored to control excess flow over the dam which could cause flooding downstream, yet keep enough water in the lake to maintain the wetlands and recreational use, while also minimizing flooding potential around the lake. The CRCA also responds to summer storms which can quickly raise levels. As well, they hold the lake level as high as possible as a hedge against drought. During the autumn the lake level is brought down to the winter holding level to provide 'room' for more water during the fall rain storms and spring melt. Lake levels are even monitored during the winter to ensure the integrity and safety of the ice. Too much water will push the ice up, whereas lower levels will allow the ice to collapse; either way creating a safety hazard for recreational users of the ice surface. Through this delicate balancing act, and dealing with excess rain fall, drought, and snow melt, the CRCA attempts to maintain the appropriate water level for the time.

## 8.2. Potential Threats to Water Level

There has not been any recent history of water level issues. There are fluctuations based on varying levels of precipitation but the current rule curve and dam management protocols have been effective in maintaining water levels to satisfy the objectives noted earlier. In future, it is still important to be aware of potential threats, as presented below.

a) Climate Change

As discussed in Chapter 5, the effects of climate change may lead to changes to the water level of the lakes. Intense bursts of precipitation may cause flood conditions, and extended periods of drought may lower water levels to a point where dam management cannot compensate.

### b) Sydenham Village Water Intake

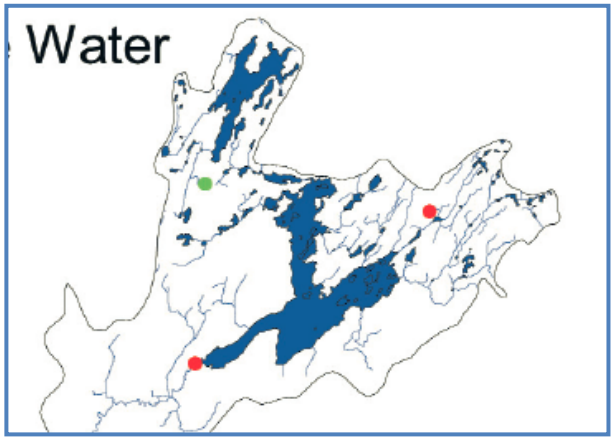
Concern was expressed by a few participants at the 2016 Workshop about the potential draw down of the lake's water level by the municipal intake for the Village of Sydenham.

The maximum daily withdrawal projection of the plant in 2020 is estimated to be 1290 m3/day. This daily withdrawal would result in about 0.2 mm (0.0002 cm) decrease in lake level, which is equivalent to the thickness of a sheet of paper. In a worst case scenario where the maximum withdrawal occurred every day over the course of the year, it would result in a 6.5 cm (2.6 in) drawdown of water level. This is equivalent to the evaporation losses that occur during 1 week in the summer months which can be 1 to 1.5 cm of loss (10 to 15 mm), per day, on a reasonably frequent basis (pers. correspondence - Sean Watt, CRCA).

Due to the very limited draw down of water levels caused by current operations and the low future population growth that is expected in the Village (pers. comm. Lindsay Mills), the taking of water to be used as drinking water for the Village has and will continue to have no significant impact on the water level of Sydenham Lake.

### c) Other Permits to Take Water

In the past, 3 non-consumptive Permits to Take Water have been issued by MOECC in the Sydenham Lake subwatershed, of which only one is still active (2011, CRCA) (Map 8.1). This permit is for a Ducks Unlimited impoundment on a stream to Gould Lake in the upper area of the watershed, and as such would have very little impact on downstream, watershed sites. The other 2 are currently inactive, one for a Ducks Unlimited impoundment on a stream that outlets on the east side of Sydenham Lake and the other was for a market garden to take water from an isolated pond in the Village of Sydenham. None of these water takings have an impact on the water level of Sydenham Lake.




**Map 8.1 - Permits to Take Water**

## *Observations – Water Levels*

- The CRCA owns and operates the dam that controls the water levels on Sydenham Lake, Eel Bay and Little Long Lake.
- The CRCA maintains the water levels in Sydenham Lake to match the data in the rule curve currently established between 130.9 m (429.5 ft) (spring & summer) and 130.6 m (428.5 ft) (fall & winter) above sea level. This one foot (30.5 cm) differential was established through historical record, legal agreement, consultation with the Sydenham Lake Association and the general public.
- Current water level management is effective in balancing the three objectives of: flood control; maintaining healthy wetlands; and ensuring continued recreational use of the lakes.
- The Sydenham Water Treatment Plant draws water from West Bay which results in a 0.2 mm daily decrease in lake level, which is equivalent to the thickness of a sheet of paper.

## *Recommendations for Lake Plan Actions*

- Continue to work with CRCA to monitor water levels and continue to communicate and provide information to all shoreline property owners.

# 9. Water Quality

The following sources were referenced in this section:


- Castro, V. 1993 Lakeshore Capacity Study and Shoreline Development Policies for Greater Sydenham Lake.
- Castro, V. (Ministry of Environment and Climate Change), 2016 personal correspondence.
- Cataraqui Source Protection Committee, November, 2014. Cataraqui Source Protection Plan.
- CRCA, 2008. Watershed Characterization Final Report.
- Kingston, Frontenac, Lennox and Addington Public Health Unit. 2012-2015 Beach Count at Point Park (spreadsheet of coliform counts).
- Ministry of the Environment and Energy, July 1994. Policies, Guidelines - Provincial Water Quality Objectives.
- Ontario Ministry of Health and Long-Term Care, 2014. Beach Management Guidance Document.
- Ontario Ministry of the Environment and Climate Change, Lake Partners Program website, 2016. https://www.ontario.ca/data/ontario-lake-partner
- Norman, Greg, 1976. Environment St. Lawrence Report on Sydenham Lake Watershed.
- SLA website summary – water quality.
- XCG Consultants, November, 2007. Technical Memorandum # 2. Threats Inventory And Issues Evaluation For The Community Of Sydenham Update No. 1.
- XCG Consultants. 2006, 2007 Water Quality Data (spreadsheets).
- XCG Consultants, January, 2010. Final Report Community of Sydenham Intake Protection Zone Study.


## 9.1. Introduction

'Good' water quality ranks as the most important value identified by the community, and maintaining or improving water quality is the most important issue needed to be addressed by the Lake Stewardship Plan.

Although there are natural processes that will affect the quality of our surface water, the most significant impacts usually result from human activities. Shoreline development, faulty or inadequate septic systems, agricultural and residential runoff from the land, will all contribute to a reduction of water quality. Excess levels of nutrients (from fertilizers, septic seepage, and other sources) leads to increased growth of aquatic plants, algae blooms, and changes to the overall ecology of the water. This is why it is important to measure water quality over the years, to put in place best management practices to reduce ongoing impacts and if deterioration is observed, to take remedial action.

The main lakes in the subwatershed, Sydenham, Eel Bay, Little Long Lake, and Gould, have all been tested to some degree over the years, and all have good water quality that meets or exceeds provincial 'standards.' Gould Lake stands out as having higher water quality overall – it is deeper than the others, surrounded by forest cover, and has a low level of shoreline development.

**Ontario Lake Partner Program**

- A partnership between Ministry of the Environment and Climate Change, Federation of Ontario Cottage Associations, and local lake associations
- Lake volunteers take samples; MOECC lab does analysis for Total Phosphorous
- >600 lakes monitored annually in the province
- All data for all lakes since 2002 is on line

www.ontario.ca/data/ontario-lake-partner

## 9.2. Measuring Water Quality

In addition to the studies undertaken over the years, the SLA instituted in 2015 an annual sampling regime under the auspices of the Ministry of the Environment and Climate Change's Lake Partner Program. The Lake Partner Program is a volunteer-based program, where lake

associations take water samples, and the samples are analyzed by the MOECC at no cost to the lake association. Volunteers from the Sydenham Lake Association collect samples from four locations (Sydenham Lake East, Sydenham Lake West, Eel Bay, and Little Long Lake), monthly from April through to October. At the time of sampling, the volunteers take a reading of temperatures and of water clarity using a Secchi disk. The samples are sent to MOECC's lab at the Dorset Environmental Science Centre where they are analyzed for level of Total Phosphorous. The two parameters of water clarity and total phosphorous, when measured regularly with consistent sampling and lab analysis, will provide a trend line of water quality.

## 9.3. Description of Lake Trophic Status and Historical Overview

Trophic status is a useful means of classifying lakes and describing the general lake condition in terms of the biological productivity of a lake. The classification typically includes three levels of trophic status (Table 9.1). Low trophic status, or oligotrophic, indicates excellent water quality, typical of the coldwater lakes on the Canadian Shield, with clear waters and low levels of aquatic vegetation and algae. Mesotrophic status is good water quality, typical of many of the lakes of Eastern and Southern Ontario; waters are less clear, and moderate levels of vegetation and algae growth can be expected. Eutrophic status is a state to be avoided, typical of highly enriched lakes, sometimes caused by man-induced conditions; eutrophic conditions include heavy growth of vegetation, and frequent algae blooms.

The trophic status of a lake depends on a number of factors including depth, size, drainage area, lake turnover rate, and presence and type of vegetation. Not all lakes can be oligotrophic. Some lakes are naturally more nutrient rich and their status should be protected.

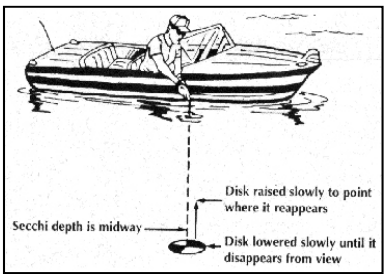
**Table 9.1 – Lake Trophic Classification**

| Lake Trophic Status | Description | Total Phosphorus (µg/L) | Chlorophyll *a* (µg/L) | Secchi Disk Depth (m) |
|---|---|---|---|---|
| **EXCELLENT (Oligotrophic)** | Lakes with low nutrient levels, minimal algae present. Water is often clear and cold with sufficient oxygen levels in the entire water column throughout the year; often supporting cool to cold water fisheries. | **≥10 µg/L** | **< 2 µg/L-low algal density** | **> 5 m** |
| **GOOD (Mesotrophic)** | Lakes with moderate nutrient levels, algae present. Water is often less clear with greater probability of lower oxygen levels at lower water levels. | **11 to 19 µg/L** | **2 to 4 µg/L-moderate algal density** | **3.0 - 4.9 m** |
| **POOR (Eutrophic)** | Lakes with high nutrient levels, abundant algae, regular algae blooms. Water has poor clarity, especially in summer months when algae blooms and plant growth peaks. Oxygen levels are greatly reduced in lower water columns throughout the year. | **≥20 µg/L** | **> 4 µg/L-high algal density** | **< 2.9 m** |

Three measurements of water quality that can be used to establish the overall condition/trophic status of a lake are:

**Phosphorous** is the limiting nutrient for the growth of aquatic plants and algae. Phosphorous is present in a healthy lake, as it is needed to allow the growth of the algae and plants that sustain life

in the lake, but too much phosphorous is a condition to be avoided. High phosphorous levels usually contribute to more and larger algae blooms, and heavier growth of aquatic plants.




**Water clarity**, as measured by use of a Secchi disk. The Secchi disk is a black and white metal disk that is lowered into the water until it can no longer be seen, at which point the measurement is taken. This is a measurement of the clarity of the water, and is determined by the amount of material that is suspended in the water (algae, phytoplankton, suspended soil sediments, and other materials). These materials are naturally found in our lakes, but if their levels are high, light will not be able to penetrate to deeper levels of the lake, reducing the photosynthesis rates of aquatic vegetation, which reduces oxygen levels, affecting the health and survival of fish and other aquatic life.

**Chlorophyll *a*** is the green pigment contained in algae and aquatic plants that is used in the process of photosynthesis. The Chlorophyll *a* concentration is used to measure the abundance of algae and potential plant growth in the water, and is directly related to the amount of nutrients available. If the concentration of Chlorophyll *a* is high, then it can be assumed that the nutrient levels in the water are high as well, promoting growth of the algae. High concentrations of algae and vegetation can also cause oxygen depletion in the lake. As the algae and vegetation die off, the decomposition uses up available oxygen; if there are more organisms the amount of oxygen needed for decomposition increases.

Trophic classification offers a practical guideline for approximating the productivity level of a lake. These levels have been used by MOECC in the past as benchmarks beyond which water quality should not deteriorate. For example, if a lake measured phosphorous at mesotrophic levels (between 11 and 20 µg/L), the water quality objective was to maintain levels below 20.

In 1976, St. Lawrence College published a report based on a detailed examination of the water quality of Sydenham Lake, Eel Bay, and Gould Lake. The work in 1976 used results from tests for bacteriology, chemical water quality (dissolved oxygen, chlorophyll, Secchi disk, chloride, pH) and biological (zooplankton and benthic) sampling to determine the condition of the lakes. The results indicated that the water quality on the three lakes should be considered good, and well within Ontario's recreational lakes standards.

The 1976 results classified the following trophic status for the three water bodies:

## Historical Water Quality Results

| | |
|---|---|
| **Sydenham Lake** | GOOD - Generally Mesotrophic |
| **Eel Bay** | GOOD - Mesotrophic |
| **Gould Lake** | EXCELLENT - Oligotrophic |

## 9.4. Today's Water Quality Conditions

The Ministry of Environment and Climate Change has established a set of guidelines for desirable or safe levels of a long list of water quality measurements. These guidelines, referred to as the Provincial Water Quality Objectives (PWQOs), will be referenced in the following discussion of water quality results, as they provide scientifically-based levels for most parameters that measure water quality.

### 9.4.1 Water Clarity (Secchi disk depth)

Water clarity is determined by measuring how far down sunlight can penetrate into the water by lowering a Secchi disk into the water and measuring the deepest point that it is visible. The Secchi disk depth indirectly indicates the amount of algae/phytoplankton, suspended soil sediments, and other materials in the water column. The larger the number, the clearer the water, as the number represents the depth to which the Secchi disk is visible. While water clarity can help to determine water quality status, water clarity should not be considered a reliable measure of water quality in the absence of other data.

The presence of zebra mussels, which entered Sydenham Lake in approximately 2001, is a contributing factor to increased water clarity, as this invasive species eats the plankton that floats in the water, thereby clarifying the water column.

Prior to the regular sampling in 2015, there are only a limited number of results available for water clarity. Table 9.2 and Figure 9.1 summarize the available results:

**Table 9.2 – Water Clarity: Average Secchi Disk Depths (m)**

| | Gould Lake | Little Long Lake | Eel Bay | Sydenham West | Sydenham East |
|---|---|---|---|---|---|
| **1971-1984** (5 sample years) | 6.1 (5.9-6.5) | | | | |
| **1977-1990** (12 sample years) | | | 4.0 (2.9-5.0) | | |
| **1996** | | 4.0 | 3.4 (3.0-3.5) | | |
| **1999** | | 5.1 (4.6-5.6) | | | |
| **2000** | | 4.1 | | | |
| **2009** | | 2.3 | | | |
| **2012** | 4.9 (4.8-4.9) | | | | |
| **2015** | | 4.1 (3.0-4.8) | 3.8 (3.0-4.8) | 5.1 (3.8-6.0) | 4.75 (3.5-5.5) |
| **2016** | | 4.6 (4.5-5.0) | 4.2 (3.3-5.0) | 5.1 (3.8-6.0) | 4.75 (3.5-5.5) |

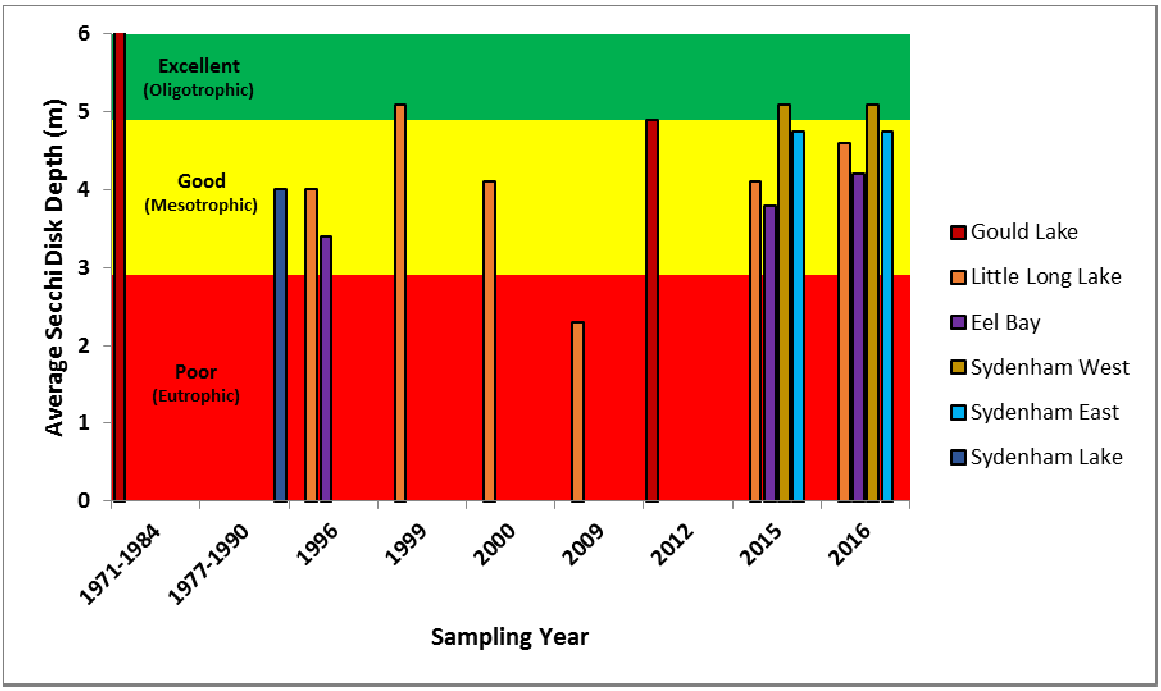



**Figure 9.1 - Average Secchi Disc Depth (m) by Sampling Year and Location**

Most results indicate a good water clarity for all years and all water bodies sampled. Only in 2015 and 2016 is there a consistent sampling regime of four samples taken over the ice-free period for Sydenham and Little Long Lakes (in June, July, August, and October).

## Water Clarity Results

| | |
|---|---|
| **Sydenham Lake** | GOOD - Mesotrophic |
| **Eel Bay** | GOOD - Mesotrophic |
| **Little Long Lake** | VERY GOOD - Mesotrophic to Oligotrophic |
| **Gould Lake** | VERY GOOD - Mesotrophic to Oligotrophic |

### 9.4.2 Phosphorous

Phosphorous levels are a very important measure of water quality in our lakes and rivers. Phosphorous is the nutrient that is most influential in controlling the growth of algae and aquatic plants. Higher levels of phosphorous lead to higher levels of algae and plant growth. Phosphorous levels above 20µg/L indicate a highly productive (eutrophic) state; when levels approach or exceed 20µg/L, there is a greater likelihood of excess algae blooms and growth of aquatic plants. As noted in Section 6.3.6, these levels are established as the Provincial Water Quality Objectives for phosphorous. Phosphorous is a natural-occurring element in our surface waters, and is necessary for plant growth in a healthy ecosystem. However, phosphorous levels can be elevated through the activities of shoreline development, land clearing, and agriculture.

Phosphorous moves into the water from different sources – natural, human-induced, and internal. In 2016, Ministry of the Environment and Climate Change applied the Lakeshore Capacity Model to Sydenham Lake. While the MOECC found the model was not suitable to predict phosphorous levels in the lake, the calculations did offer estimates of the current phosphorous sources. Phosphorous enters the lake from the surrounding subwatershed from five general sources, as listed below. The approximate contribution that each source makes to phosphorus loading of Sydenham Lake are illustrated on Table 9.3 and Figure 9.2.

**Table 9.3. Estimated Phosphorous Sources for Sydenham Lake**

| Sources of Phosphorous | Total Phosphorus Budget | |
|---|---|---|
| Atmospheric Load | 110.23 kg/yr | 7% |
| Runoff Load | 672.39 kg/yr | 45% |
| Anthropogenic Load | 507.44 kg/yr | 34% |
| Upstream Load (Gould, Long Lake) | 65.13 kg/yr | 4% |
| Internal Load | 129.40 kg/yr | 10% |
| **TOTAL:** | 1484.60 kg/yr | 100% |

*Source: MOECC, application of Lakeshore Capacity Model*

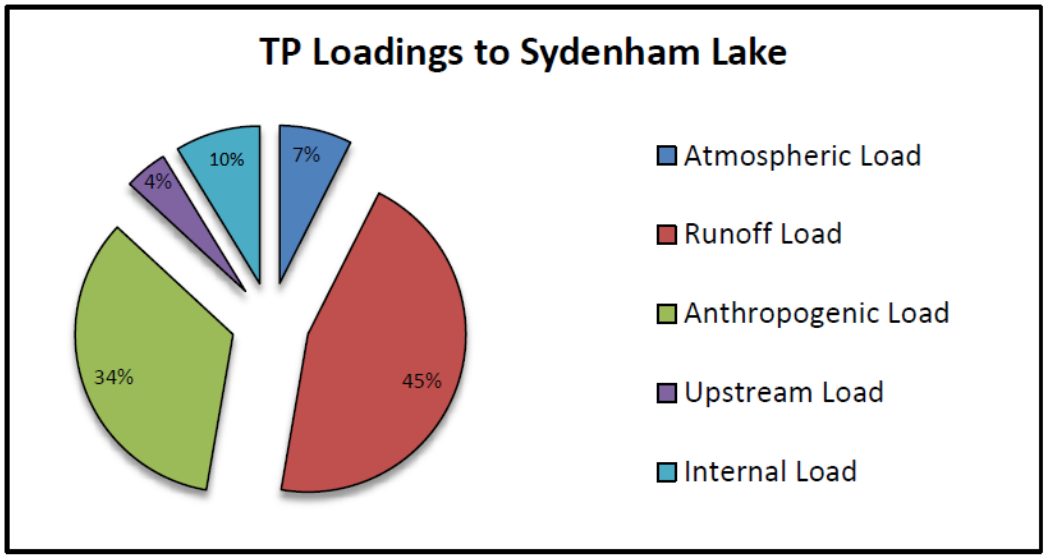



**Figure 9.2. Estimated Phosphorous Sources for Sydenham Lake**

These include:

1. **Atmospheric** - These are estimates of the amount of phosphorous that enters the lake from the atmosphere carried by the wind, rain and snow. While not a large proportion, the atmosphere still brings approximately 7% of the phosphorous into the lake.
2. **Runoff** - The phosphorous attributed to 'runoff' is associated with precipitation that washes over the land, carrying surface material (soils, detritus, animal feces, agricultural fertilizers) into the lake. At 45%, this is the largest source of phosphorous entering Sydenham Lake.
3. **Anthropogenic (man-made)** - This is the estimate of phosphorous that enters the lake from all shoreline development (residential, cottages, resorts, camps). This includes septic system leakage and outflows, as well as material that is washed into the lake from buildings and building sites, and accounts for the second highest proportion of the five sources, 34%.
4. **Upstream Load (Gould Lake, Little Long Lake)** - Water entering Sydenham Lake from the upstream lakes also contributes to the phosphorous 'loading' of the lake, to the level of approximately 4% of the total.
5. **Internal Load** - A certain amount of phosphorous will be released into the water column from the lake sediments. For Sydenham Lake, this source is estimated to contribute 9%.

There are limited data available prior to 2012 to allow for a reliable estimate of phosphorous levels over the years, or to show trends for the levels of phosphorous over time. Early results for Sydenham Lake (1982-1990) were compiled by V. Castro in his 1993 report, 'Lakeshore Capacity Study and Shoreline Development Policies for Sydenham Lake.' In late 2006, through August 2007, weekly sampling was done for the western basin of Sydenham Lake by XCG Consultants as part of the background work to the Source Water Protection Plan. Sampling of Gould Lake took place under the auspices of the Ministry of the Environment and Climate Change in 2005 and 2012. From 2012 to 2014, Sydenham Lake Association volunteers took samples on behalf of MOECC, who used the results as input to the Lakeshore Capacity Model work they were undertaking in 2014-15. In 2015, the SLA established a regular annual sampling of Sydenham Lake (east and west basins), Eel Bay, and Little Long Lake through the Lake Partner Program. This sampling took place on a monthly basis, four times over the year (May, July, September and October). While there are only two years of data to date from this program, the sampling and analysis has been done in a consistent and reliable manner. More importantly, continuing this monitoring regime in future will provide a solid data base, and will allow a 'trend through time' to be established for the water quality of the lakes.

The data that are available for Gould, Little Long, and Sydenham Lakes (including Eel Bay) have been summarized in Table 9.4 and Figure 9.3, 9.4.

**Table 9.4 – Total Phosphorous (Average annual µg/L)**

| | Gould Lake | Little Long Lake | Eel Bay | Sydenham West | Sydenham East |
|---|---|---|---|---|---|
| **1982-1990**[1](5 sample years) | | | 16.9 (10-23) | | |
| **2005**[1] | 8.8(5.8-11.2) | | | | |
| **2007**[2] | | | | 14.6(1 sample) | |
| **2012**[3] | 7.6(7.0-8.4) | 8.0(8.0-8.0) | 9.0(8.0-10.0) | 8.0(1 sample) | 8.0(1 sample) |
| **2013**[3] | | 8.0((8.0-8.0) | 10.0(8.0-14.0) | 9.0((8.0-10.0) | 8.0(1sample) |
| **2014**[3] | | 5.5(5.0-6.0) | 9.8((7.0-12.0) | 7.0(7.0-7.0) | 9.0(7.0-11.0) |
| **2015**[3] | | 8.9(8.0-11.4) | 12.9 (8.0-14.8) | 11.8(10.6-13.6) | 12.5(10.6-14.6) |
| **2016**[3] | | 8.7(8.0-11.2) | 11.7 (8.0-14.0) | 11.0(7.8-13.8) | 11.1 (7.8-13.6) |

*1. Source: Castro, V, MOECC data.2.XCG Consultants, 2006 and 2007. 3. Sampling done under the Lake Partner Program, MOECC*

*Numbers in brackets indicate high and low readings for each year in each waterbody*

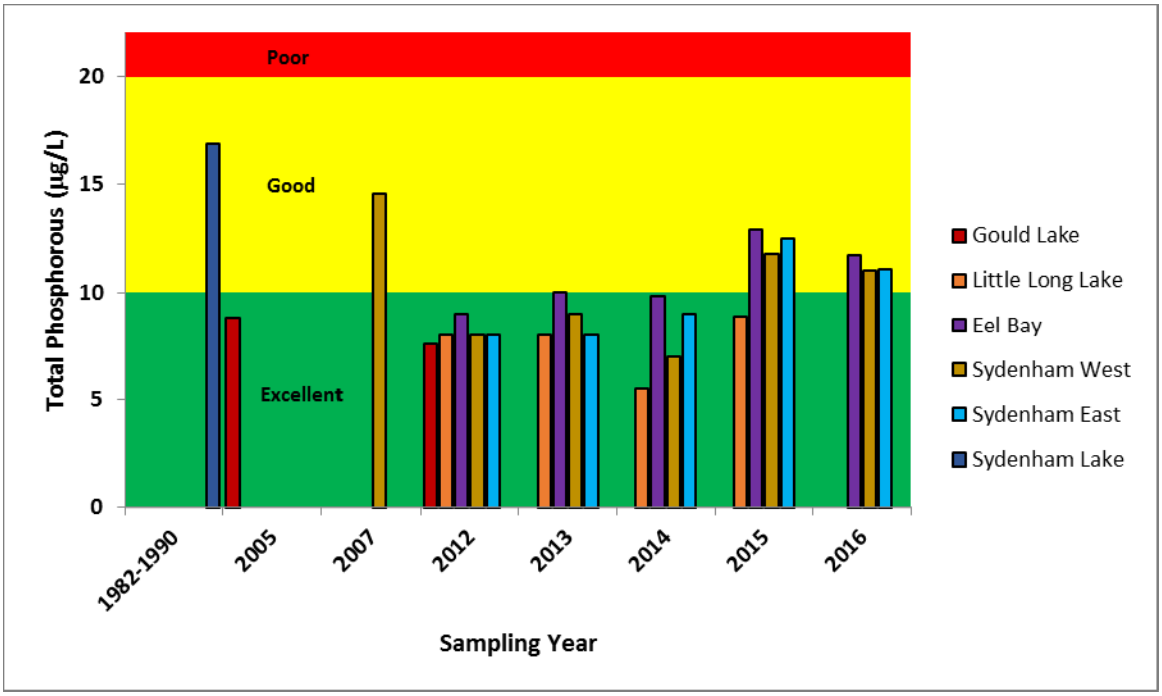



**Figure 9.3 - Total Phosphorus (ug/L) Concentration by Sampling Year and Location**

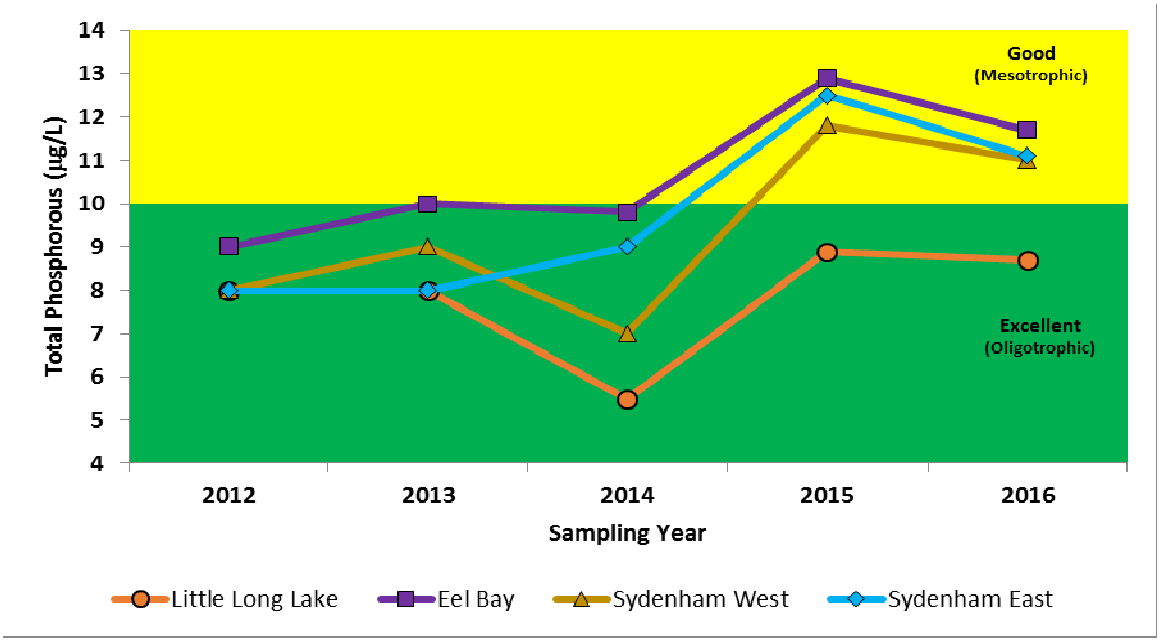



**Figure 9.4 - Total Phosphorus (µg/L) Concentration by Sampling Year (2012-2016) and Location**

Phosphorous results that are available for Sydenham Lake in the period 1982-1990 average out to 16.9µg/L, in the high level of 'mesotrophic.' While these results are included in this report, they should be looked at with an important proviso. In 2001, sampling protocols were changed, and data collected after that time cannot be directly compared to pre-2001 data.

Gould Lake results over the past few decades are sparse. The results that are on record are for 2005 and 2012, and average below 10µg/L. These readings indicate 'excellent' water quality, placing the lake in the oligotrophic status.

Total phosphorous results are available for the 5 years, 2012-2016, for Long Lake, Sydenham Lake (East Basin and West Basin), and Eel Bay. Five years of data establish a preliminary water quality trend line for these lakes. Overall, the results for all lakes tend to show phosphorous levels that are not excessive for these lakes. Little Long Lake phosphorous averages are all below 10 µg/L, indicating excellent water quality. Over the five years, there is no significant rise or fall in the results. Sydenham Lake West Basin, Sydenham Lake East Basin, and Eel Bay, show results and trends that are similar to one another. Average phosphorous levels hover just below or just above 10µg/L, placing these waterbodies all in a good to excellent level of water quality. In the case of Little Long Lake, the annual averages do not change appreciably over the 5-year period. In the case of Sydenham Lake and Eel Bay, results for 2015 and 2016 are higher than those for the years 2012-2014. Although the phosphorous levels were not excessive in any of the past five years, this increase in recent years should be noted.

With additional data being collected through the Lake Partners Program, the recent results can be compared to future years' results, to determine if there is a trend toward decreasing water quality.

The data available for Total Phosphorous indicate the following trophic status:

Phosphorous Results

| | |
|---|---|
| **Sydenham Lake West** | GOOD - Mesotrophic |
| **Sydenham Lake East** | GOOD - Mesotrophic |
| **Eel Bay** | GOOD - Mesotrophic |
| **Little Long Lake** | EXCELLENT - Oligotrophic |
| **Gould Lake** | EXCELLENT - Oligotrophic |

### 9.4.3 Chlorophyll a

Chlorophyll *a* is the green pigment contained in algae and aquatic plants that is used in the process of photosynthesis. Water clarity is influenced by the amount of algae or phytoplankton present in the water. In addition to using a Secchi disk to measure water clarity, 'Chlorophyll *a*' can be used to measure the abundance of algae and potential plant growth in the water, and is directly related to the amount of nutrients (particularly phosphorous) that are available. If the concentration of Chlorophyll *a* is high, then it can be assumed that the nutrient levels in the water are high as well, promoting growth of the algae. Measuring levels of Chlorophyll *a* is not routine today, as more precise water quality results are available through measuring Total Phosphorous levels. The data available for Chlorophyll *a* levels reflect this, and are from the 1970s and 1980s (Table 9.5 and Figure 9.5).

**Table 9.5 – Chlorophyll *a* (µg/L)**

| | Gould Lake | Little Long Lake | Eel Bay | Sydenham West | Sydenham East |
|---|---|---|---|---|---|
| 1977 | | | | 5.1 | |
| 1978 | 1.7 | | | 3.2 | |
| 1979 | | | | 4.5 | |
| 1980 | | | | 4.8 | |
| 1981 | 2.9 | | | | |
| 1982 | | | | 3.6 | |
| 1983 | 2.0 | | | 2.9 | |
| 1984 | 3.2 | | | 4.2 | |
| 1986 | | | | | |
| 1987 | | | | 2.5 | |
| 1988 | | | | 4.7 | |
| 1989 | | | | 3.5 | |
| 1990 | | | | 3.4 | |
| **MEAN** | 2.3 | | | 4.2 | |

*Source: to be added*

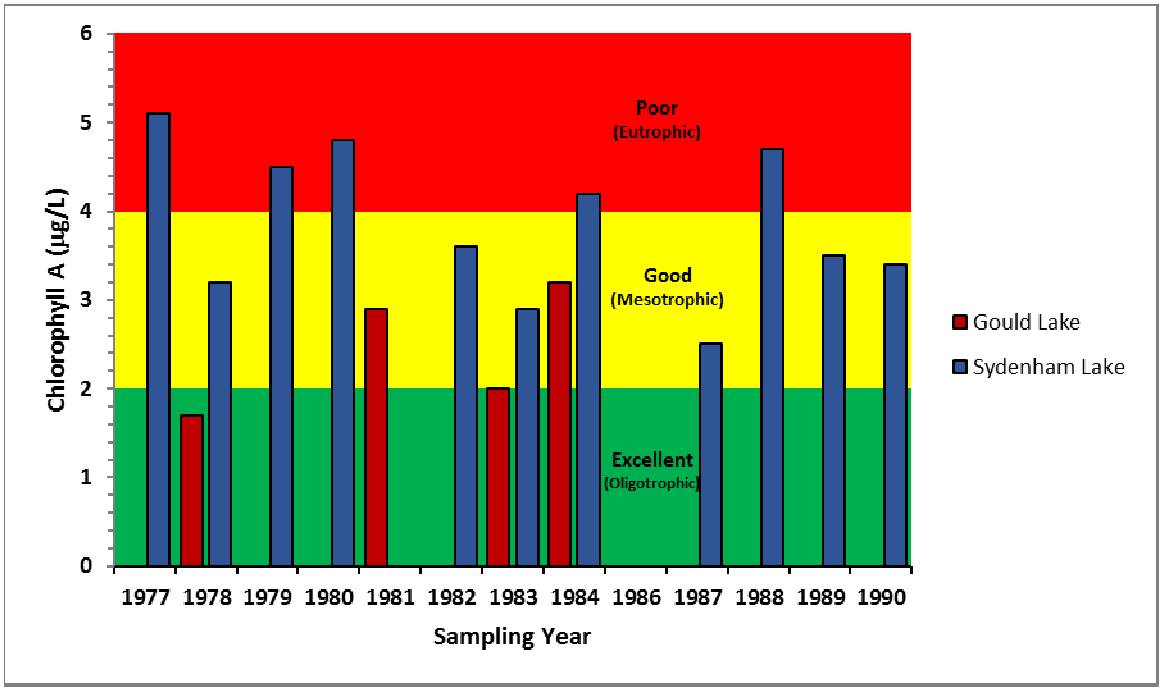



**Figure 9.5 - Chlorophyll *a* (ug/L) Concentration by Sampling Year and Location**

The data for the period 1977 to 1990 suggest a level of Chlorophyll *a* that would place Gould Lake and Sydenham Lake in a higher trophic status than the more recent results for phosphorous and Secchi depth suggest:

| Chlorophyll *a Results* | | |
|---|---|---|
| | **Sydenham Lake** | GOOD - Low Eutrophic |
| | **Gould Lake** | GOOD - Low Mesotrophic |

### 9.4.5 Algae and Blue-Green Algae

Algae, and associated algae blooms, are natural elements of the aquatic ecosystem in a lake, but may be considered a nuisance when in high concentrations, or when blooms become excessive, rendering water unpleasant for swimming and boating. In addition to the direct effects of algae, high concentrations of algae and aquatic vegetation can cause oxygen depletion in the lake. As the algae and vegetation die off, the decomposition of this vegetative matter uses up available oxygen. Reduced oxygen will have a negative effect on fish and other aquatic organisms.

**Blue Green Algae (Cyanobacteria)**

Blue-green algae often thrive in areas where the water is shallow, slow moving and warm, but can be present in deeper and cooler water. Some forms of blue-green algae can produce toxins that can be harmful to human health. Symptoms can include itchy, irritated eyes and skin. If swallowed symptoms can include headaches, fever, diarrhea, abdominal pain, nausea and vomiting.

If you see a bloom and suspect it's blue-green algae, avoid using the water and call the Ministry of the Environment Spills Action Centre at 1-800-268-6060

One particular type of algae, blue-green algae, can be more than a nuisance. Certain types of the algal species referred to as 'blue-green' may emit a toxin that makes water unusable for any purpose. Conditions that encourage blooms include: sufficiently high levels of phosphorous in water or sediments; calm weather;

strong sunlight; high air and water temperatures; and relatively shallow water. There may also be a link to increased ice-free periods.

While Sydenham Lake does experience algae blooms each year, there are no hard data to suggest that these are increasing in number or intensity. Some individuals believe there has been an increase, based on their observations. Blue-green algae does not appear to be an issue in Sydenham Lake. No blue-green algae blooms have been reported to date.

## Algae and Blue-Green Algae Results

| | |
|---|---|
| **All Lakes** | No data available - No blue-green Algae blooms have been reported to date. |

### 9.4.4 Dissolved Oxygen

The concentration of dissolved oxygen (DO) in the water column is a critical factor for the survival of fish and other aquatic fauna. The temperature/oxygen regime determines the type of fish species that can be supported in the lake environment. As the temperature of the water rises, the amount of dissolved oxygen in the water decreases, which affects the survivability of fish deeper in the lake. This is particularly important for cold water fish species such as lake trout, which spend summer months in the depths of the lakes. Sydenham Lake, however, supports a warm and cool water fishery (coolwater species include yellow perch and pike; and warmwater species include bass, sunfish, etc.). These fish species are more tolerant of low oxygen levels than coldwater fish species. Guideline levels have been established by the Ontario MOECC for warmwater fish, as a part of the Provincial Water Quality Objectives (Table 9.6). Coolwater fish would require a higher level of dissolved oxygen at lower depths, at least 5 mg/L.

**Table 9.6 - Provincial Water Quality Objective for Warmwater Fish**

| Temperature °C | Dissolved Oxygen mg/L |
|---|---|
| 0 | 7 |
| 5 | 6 |
| 10 | 5 |
| 15 | 5 |
| 20 | 4 |
| 25 | 4 |

*Source - PWQO, MOE, 1994*

There is only limited data available for Sydenham Lake. Work completed by XCG Consultants in 2007 included some measurements of oxygen levels at some of their sample sites. All results for open lake sites were well above the 5 mg/L threshold for cool-water fish. MNRF also completed sampling profiles of the oxygen levels in August, 2010. The results indicated that dissolved oxygen concentrations were greater than 6 mg/L from the surface of the lake to a depth of 6 metres, and were greater than 4.5 mg/L to a depth of 29 m.

Low oxygen levels exist prior to fall turnover as shown by measured dissolved oxygen profiles. This can also occur during the winter in some lakes, but would need to be confirmed for Sydenham by doing a winter profile through the ice.

## Dissolved Oxygen Results

| | |
|---|---|
| **Sydenham Lake** | Dissolved oxygen concentrations are sufficient to support warmwater and coolwater fish. |

### 9.4.6 Bacteriology

High levels of certain bacteria can cause illness in swimmers, so monitoring beaches and swimming areas for bacteria is relevant from a human health perspective. The Provincial Water Quality Objective (PWQO) uses *E. coli* bacteria as the parameter to measure, as this bacterium is present in human or animal fecal matter. Water is considered to be safe for swimming if the level of *E. coli* bacteria is less than 100 counts/100 ml of water, based on the geometric mean of 5 samples.

Kingston Frontenac Lennox and Addington Public Health (KFLAPH) is responsible for sampling and testing beaches in their area of jurisdiction. KHLAPH follows protocols based on the 'Beach Management Guidance Document' of the Ministry of Health and Long-Term Care. HFLAPH has regularly sampled and tested for *E. coli* at The Point, as this is a public swimming area. Their sampling consists of five samples taken once weekly from the Victoria Day weekend through to Labour Day. Results from the years 2012-2015 indicate that the water at The Point is safe for swimming. All weekly mean results for those 4 years were below the threshold for swimming except on one occasion. August 13, 2014 had an elevated level of 219/100 ml but this result was attributed to heavy rainfall.

In addition to the data collected by the Health Unit at the public beach, sampling for *E. coli* was also done by XCG Consultants in 2007 for other sites on Sydenham Lake. The open lake sites showed good results, with only two samples out of 41 exceeding the PWQO.

## Bacteriology Results

**Sydenham Lake** There are no bacteriology concerns.

### 9.4.7 pH and Calcium

The PWQO's require maintenance of the water's pH in a range of 6.5-8.5 to ensure a healthy aquatic ecosystem (neutral pH is 7.0 and lower levels indicate higher acidity). Calcium is an element that naturally occurs in the environment and helps to 'buffer' pH levels in the water, or to reduce the level of acidity of the water. Lakes with low calcium levels, typical of Canadian Shield lakes, will have difficulty buffering the impacts of increased acidity such as from acid rain. Calcium is also important in many aquatic ecosystems, as it is required, to varying degrees, by all living organisms. The limestone rock underlying Sydenham Lake contains calcium that provides good buffering, and the pH levels of the lake reflect this.

The 2007 data collected by XCG at the 6 open lake sites show an average pH level of 8.4 and an average calcium concentration of 40.0 mg/L. The SLA's sampling of 2015 and 2016 included testing for calcium, with the following results illustrated on Table 9.7.

**Table 9.7 - SLA Sampling - Calcium Concentrations 2015 - 2016**

| | 2015 | 2016 |
|---|---|---|
| Eel Bay | 32.3 mg/L | 33.8 mg/L |
| Sydenham East | 31.6 mg/L | 34.3 mg/L |
| Sydenham West | 31.7 mg/L | 34.2 mg/L |

*Source - SLA Water Quality Sampling*

Lakes need a minimum level of calcium to support growth of zebra mussels; 20 mg/L is the threshold below which zebra mussels will not survive. Sydenham Lake has calcium levels consistently higher than this threshold, and zebra mussels have been found in the lake since approximately 2001.

## pH and Calcium Results

**Sydenham Lake** Calcium levels are sufficient to support aquatic life and are at levels that allow buffering from acid rain.

### 9.4.8 Impact of Zebra Mussels on Water Quality

The zebra mussel is a small invasive species of mussel that has spread dramatically since its introduction to the Great Lakes in the late 1980s, via the ballast of a ship hailing from the Black Sea. The extensive spread of this invasive species has been aided by the ability of the zebra mussel to adhere to boat hulls/engines (and most

other surfaces), and to survive out of water for several days. The movement of boats from lake to lake brings the zebra mussels to new lake environments.

The mussels will spread throughout a water body once established, and at present there is no known way to eradicate them or slow their progress. Zebra mussels are filter feeders, feeding on large quantities of phytoplankton, thereby creating a clearer water column, allowing sunlight to penetrate deeper into the lake. In doing so, the increased sunlight allows for increased growth of aquatic plants.

The impact of their presence would have been pronounced over the first few years after their arrival in Sydenham Lake in 2001, with increased water clarity and associated increased growth of submerged vegetation. Over the past 15 years, the aquatic ecosystem has adjusted with the level of zebra mussels remaining somewhat static in recent years, as compared to the rapid growth in the first few years they were present.

Although it is too late to stop zebra mussels entering Sydenham Lake, it is possible and prudent to do what can be done to prevent boaters from transferring them to other lakes. Other invasive species must be prevented from entering Sydenham Lake.

Zebra mussels are not present in Gould Lake, and steps should be taken to ensure they do not enter this lake.

## Zebra Mussels Results

| | |
|---|---|
| **Sydenham Lake** | Zebra Mussels are found on Sydenham Lake and boaters must be prevented from transferring them to other lakes. |
| **Gould Lake** | Zebra mussels are not in Gould Lake and actions should be taken to ensure they do not enter the lake. |

### 9.4.10 Other Substances

When XCG Consultants undertook their water quality monitoring, they were testing for the suitability of a drinking water source for the Village of Sydenham. As such, they were required to analyze samples for a very extensive array of chemical parameters. The results of their analysis indicated that none of the levels measured would pose a threat to the drinking water supply.

One of the series of tests was for organo-chlorine pesticides *(Aldrin, Dieldrin, Chlordane, DDT, Heptachlor and Heptachlor Epoxide, Lindane, Methoxychlor) and PCBs* ; in all samples taken, concentrations were below limits of detection.

XCG also tested for sodium, and found levels of sodium above the benchmark in the tributaries and storm drain near the village, with highest levels from the boat ramp storm drain. In their final report, XCG suggests that the potential source of sodium is from road salt application in the village.

## Other Substance Results

| | |
|---|---|
| **Sydenham Lake** | Levels of sodium were higher in the tributaries, the storm drain and the boat ramp in the village. Other substances were not detected. |

### 9.4.11 Multiple Stressors

Lakes throughout Ontario are being impacted by multiple stressors and especially by climate change, invading species, and the effects of incremental development. Recent cases of blue-green algae blooms on lakes in eastern Ontario may be occurring because of this combination of factors.

The ice-free period for Sydenham and Little Long Lakes has been gradually increasing, as is noted in Figure 9.6 and 9.7.

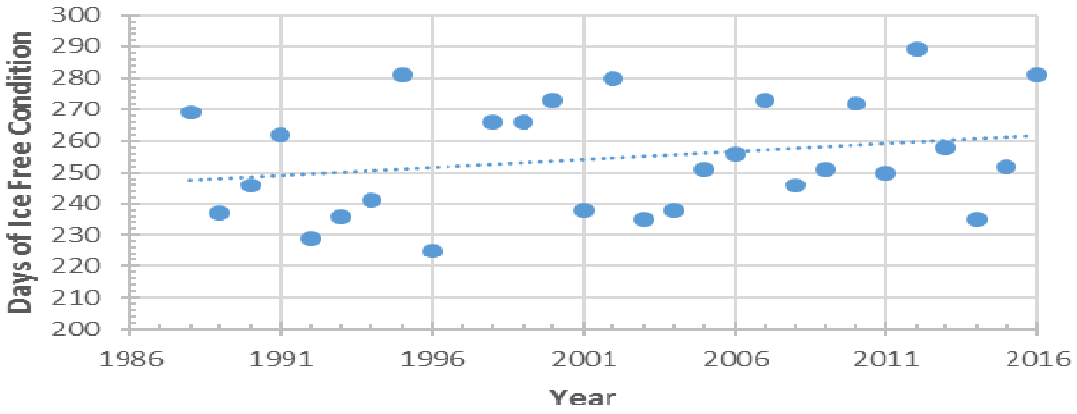



**Figure 9.6 - Sydenham Lake Number of Days Ice Free Condition by Year** (Sydenham Lake News, 2016)

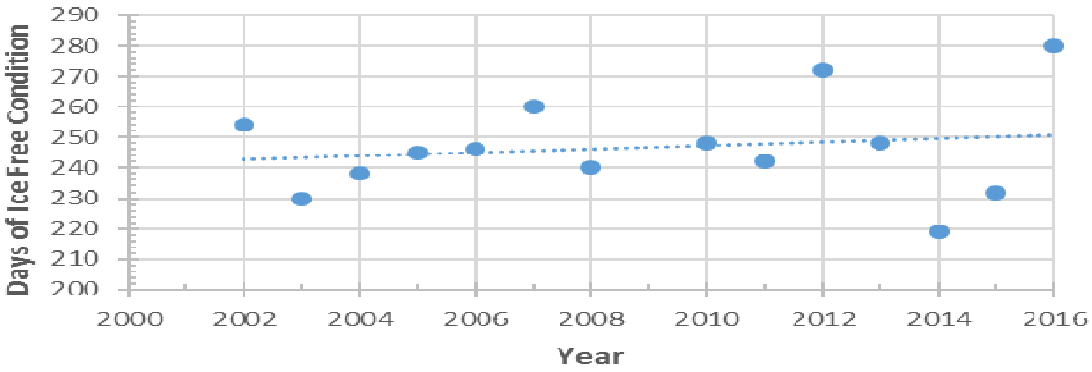



**Figure 9.7- Little Long Lake Number of Days Ice Free Condition by Year** (Sydenham Lake News, 2015)

A shift towards longer ice-free seasons can impact physical properties of the lake especially aspects of temperature and mixing that will be favourable to blue-green algae (cyanobacteria). These potential effects from many simultaneous stressors make it difficult to manage lakes for specific uses. Monitoring and reducing phosphorus inputs, which has been the traditional method to counteract algal blooms, may not be sufficient under these conditions. It may be necessary to apply more stringent objectives for phosphorous levels, pay more attention to the impacts of new development, preserve riparian areas, conduct ambitious invasive species programs to maintain ecosystem integrity, and conduct the research needed to better understand the way nutrients are entering the lake (including sediments).

The lakes of the Sydenham Lake subwatershed have been free of blue-green algae blooms to date, but the experience of others might be a cautionary tale for Sydenham.

## Multiple Stressors

**Sydenham Lake** Multiple stressors are causing changes on many lakes in Ontario and the reduction of human made impacts may help to counteract these changes.

## 9.5. Highlights of Water Quality

Based on the information available, Sydenham Lake, Eel Bay, Little Long Lake, and Gould Lake all meet or exceed the Ontario government's Provincial Water Quality Objectives for recreational use. Results also indicate that the water quality of these lakes is sufficient to support healthy aquatic life. Recent data suggest that the total phosphorous levels may be increasing in Sydenham Lake and Eel Bay, but there are not enough years of data to confirm this. This possible trend can be confirmed with a few more years of consistent monitoring, a process that the SLA has initiated in 2015.

The overall condition and level of productivity of the lakes based on three different water quality measures are noted in Table 9.8. Chlorophyll *a* results reflect conditions pre-1990, and should not be considered an important component of the aquatic health of the lake today'. For a description of trophic status, see Table 9.1 (page 43).

**Table 9.8 – Trophic Levels by Water Quality Measurements**

| | Sydenham Lake | Eel Bay | Little Long Lake | Gould Lake |
|---|---|---|---|---|
| **Water Clarity* (Secchi disk)** | **GOOD** MESOTROPHIC | **GOOD** MESOTROPHIC | **EXCELLENT** OLIGOTROPHIC | **EXCELLENT** OLIGOTROPHIC |
| **Total Phosphorous** | **GOOD** MESOTROPHIC | **GOOD** MESOTROPHIC | **EXCELLENT** OLIGOTROPHIC | **EXCELLENT** OLIGOTROPHIC |
| **Chlorophyll *a***** | **SLIGHTLY POOR** LOW EUTROPHIC | N/A | N/A | **VERY GOOD** LOW MESOTROPHIC |

** Very limited data **No data later than 1990*

## *Recommendations for Lake Plan – Water Quality*

1. Continue annual sampling of Sydenham, Eel Bay, and Little Long Lake and analyse for water clarity (Secchi disk depth) and total phosphorous – under the Lake Partners Program.
2. Establish a sampling program on Gould Lake.
3. Establish a sampling program for sodium and chloride levels in Sydenham Lake at the stormwater outfalls near the village and establish 'best management practices' to mitigate the impact of salt application. An effective sampling program would also include bacteria, Total Suspended Solids, oil and grease, and water flows.
4. Continue measuring timing of ice-on/ice-off on Sydenham and Little Long Lakes. Initiate on Gould Lake.
5. Establish a boat-washing station at the boat launch near the Point to reduce the spread of invasive species into and out of Sydenham Lake.
6. Establish an intensive education program re. invasive species on Gould Lake.
7. Monitor inflow and outflow temperatures and phytoplankton on Sydenham Lake.
8. Work with the community and the township to establish a septic inspection program within the watershed.
9. Implement a storm water management program in Sydenham Village.
10. Consider applying the (voluntary) 'Love Your Lake' program to identify natural condition of shoreline areas, and suggestions for re-naturalization.
11. Consider need for applying 'best management practices' on surrounding farmlands, and means to implement the BMPs.
12. Consider revising policies in the Official Plan regarding the redevelopment of shore lots. For example, applications for a building permit should follow the principle of net improvement in terms of total phosphorous loading from the lot – by means such as planting shoreline vegetation, re-directing lot drainage.

# 10. Natural Environment

The following sources were referenced in this section:

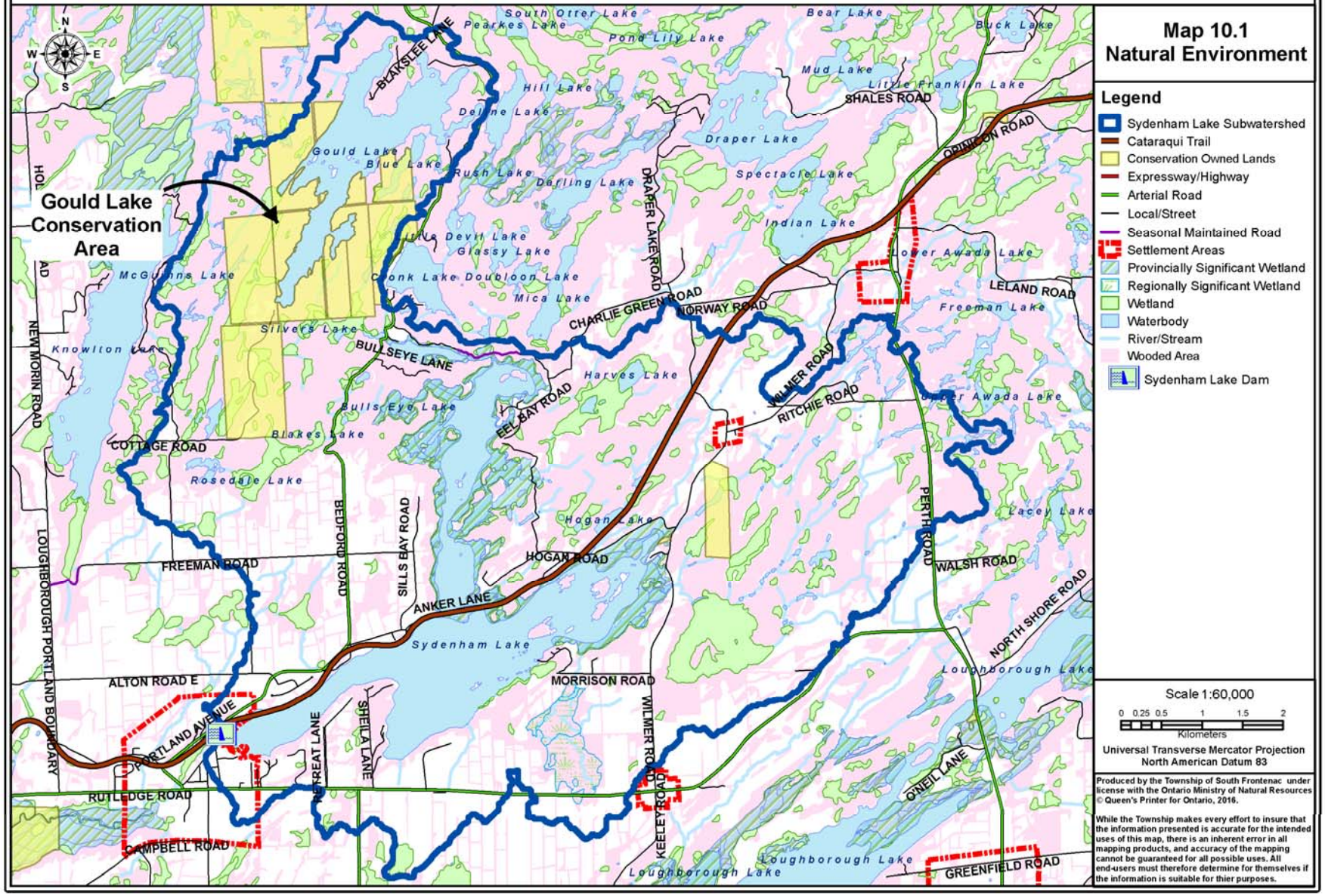

- *Card, Mary, 2017. SLA-Lake Study-Species and Flora & Fauna Lists.*
- *Castro, Victor. 1993. Lakeshore Capacity Study & Shoreline Development Policies for Greater Sydenham Lake.*
- *Cataraqui Region Conservation Authority, 2005. Establishing Environmental Flow Requirements for Millhaven Creek.*
- *Cataraqui Region Conservation Authority, 2007. Cataraqui Source Protection Area Interim Watershed Characterization Report.*
- *Cataraqui Source Protection Committee, 2005. Watershed Characterization Report.*
- *Cooper, H.A., 1970. Sydenham Lake Survey.*
- *CRCA, 2016. Gould Lake Conservation Area. http://crca.ca/conservation-lands/conservation-areas/gould-lake-conservation-area/*
- *County of Frontenac, 2012. County of Frontenac Natural Heritage Study Final Report. Submitted by Dillon Consulting Limited.*
- *Leonard and MacDonald, 1990. Fish Habitat Survey for Sydenham Lake.*
- *Littkemann, Peter, 1959. Biological Report on Sydenham Lake.*
- *Ministry of Natural Resources, 1987. Lake Survey Summary Report.*
- *Minnes, Sarah, 2013. Frontenac Arch Biosphere: A Regional Sustainability Initiative.*
- *MOECC, 2011. Appendix 1: Lakeshore Capacity Model- Info on Version 3.0.*
- *Ontario Invading Species Awareness Program, 2016. http://www.invadingspecies.com/*
- *Ontario, 2016. Ontario Forest Regions. https://www.ontario.ca/page/forest-regions*
- *Ontario Nature, 2017. Ontario Reptile and Amphibian Atlas Program. https://www.ontarionature.org/protect/species/herpetofaunal_atlas.php*
- *Sydenham Lake Association, 2013, Survey.*


## 10.1. Introduction

A portion of Sydenham Lake and its subwatershed lies within the Frontenac Arch, and is underlain by pre-Cambrian bedrock of the Canadian Shield; the remainder is underlain by sedimentary limestone of the St. Lawrence Lowlands. The position of the subwatershed on this geological boundary establishes the conditions for high biodiversity through the convergence of distinct ecosystem types. The combination of these ecosystem types in conjunction with various natural features surrounding the lake (such as wetlands, marshes, and large areas of littoral zone), produce conditions for high biodiversity of plants and animals. The geological boundary also explains the lake's character and changes in land cover within the natural environment of the surrounding catchment area. The more populated region to the south and west of lake have been cleared and developed for agricultural purposes while areas to the north on the Canadian Shield remain relatively dense coniferous and mixed forest systems.

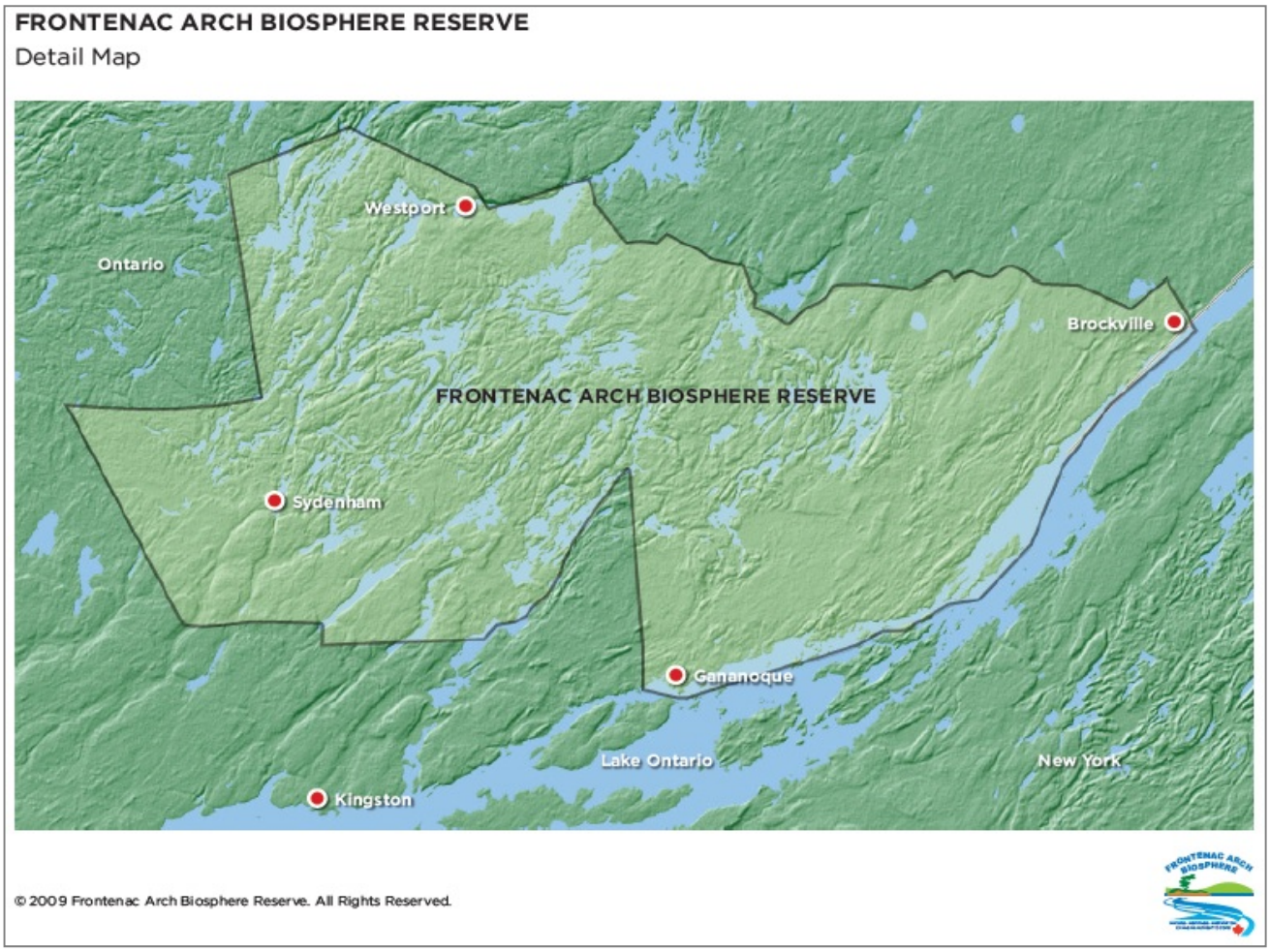
The Sydenham Lake Association Survey (2013) revealed natural environment-related values or issues were of top priority to survey respondents including 79% of respondents ranking Environmental Stewardship/Lake Advocacy as a top priority, the Development of a Lake Capacity Study and Water Quality as a significant concern to over half of all respondents. The natural environment of the lake and subwatershed contributes strongly to the key values identified by the Sydenham Lake community.

# Sydenham Lake State of the Lake Report



## 10.2. Frontenac Arch Biosphere Reserve

Sydenham Lake and surrounding subwatershed lie completely within the boundaries of the Frontenac Arch Biosphere Reserve (FABR) (Map 10.2). The intersection of the Frontenac Arch and the St. Lawrence River Valley forms one of the greatest transition zones of the continent. The Frontenac Arch is a distinctive granite ridge connecting the Adirondack Mountains in the United States to the Canadian Shield. The FABR is an area encompassing over 2,700 square kilometers of significant natural and ecological features. The FABR received designation as an UNESCO World Biosphere Reserve in 2002 as an acknowledgment of the unique environmental, historical and cultural values of the region. The Frontenac Arch Biosphere Reserve contains five forest regions and has been described as one of the most bio-diverse regions in Canada due to the unique and rare habitat it provides for numerous plant, fish, bird and animal species classified as 'Species at Risk' (FABN, 2011). The topography of the FABR consists of steep, rocky slopes and ridges, typical of the Canadian Shield in alternation with dense mixed and coniferous forest systems, numerous inland lakes and watercourses, as well as wetland valleys. Additionally, the Frontenac Arch serves as a funnel for movement and dispersal of wildlife including wide ranging mammals.




**Map 10.2 - Map Displaying Boundaries of the Frontenac Arch Biosphere Reserve** (FABR, 2009)

The UNESCO Biosphere Reserves were initially established in response to environmental concerns. Environmental concerns specific to the Frontenac Arch Biosphere Reserve include loss of habitat and significant wetlands; competition for Species at Risk due to exotic and invasive species; climate change related impacts; and industrial point source and non-point source pollution in the St. Lawrence River.

The Frontenac Arch Biosphere Reserve operates as a not-for-profit and non-regulatory network, called the Frontenac Arch Biosphere Network (FABN). This network includes partnership between more than 80 regional organizations, including representatives from key sectors such as tourism, business, conservation, agriculture, historic preservation, scientific research and education. Although the FABN does not have authority over land or water use within the reserve, it does complement local and regional initiatives. The FABN focusses on reconnecting a fragmented landscape into a regional network of governance in order to ensure sustainability efforts take a more inter-connected approach as a top priority (FABN, 2011).

## 10.3. Forest Cover

Sydenham Lake and surrounding subwatershed are located within the southeastern portion of the Great Lakes-St. Lawrence Forest Region. The northern portions of the Sydenham Lake subwatershed maintain a high level of forest cover and relatively undisturbed natural environment. Agricultural lands to the south and northwest of the lake still maintain small and medium pockets of non-cleared mixed forest systems as well as numerous hedgerows, which aid in connectivity of the natural environment. Table 10.1 presents the percentage of cleared land within the catchment areas of Gould Lake, Little Long Lake and Eel Bay/Sydenham Lake (MOECC, 2011). The forest types of the Sydenham Lake area are reflective of the underlying rocks and soils as well as the agricultural and forestry activities of the past two-hundred years.

**Table 10.1 - Percentage of Cleared Land within Gould Lake, Little Long Lake, and Eel Bay & Sydenham Lake Catchment Areas.**

| Catchment Area | Catchment Area Size (ha) | Percentage of Cleared Land |
|---|---|---|
| **Gould Lake** | 710.96 | 9.97 % |
| **Little Long Lake** | 258.90 | 7.60 % |
| **Eel Bay & Sydenham Lake** | 3909.90 | 42.83 % |

***(MOECC, 2011)***

The Great Lakes-St. Lawrence forest region is primarily composed of hardwood forests, featuring tree species including maple, oak, yellow birch, white and red pine. The Great Lakes-St. Lawrence forest region commonly contains areas in which coniferous trees such as white pine, red pine, hemlock and cedar intermix with deciduous broad-leaved species including yellow birch, sugar maple, red maple, basswood, white elm and red oak. A large majority of the forest in the region is unevenly aged, meaning that a wide variety of age classes can be found within the same group of trees. The Great Lakes-St. Lawrence forest is the second largest forest region in Ontario covering approximately 20 million hectares of Ontario. This forest region is bordered to the south by the Deciduous Forest Region, and is an area of transition between the coniferous and broad-leaved deciduous regions (Ontario, 2016).

Forested areas along the shores of Sydenham Lake have been described as composed of a mixture of cedar and maple species along with some scattered pine and spruce. The shoreline of the lake often contains a large component of white cedar, which in many cases is not indicative of the overall forest stand composition. Forestry was once an important part of settlement of the Sydenham Lake region, but is no longer a significant industry. Management of woodlots by individual landowners is a common practice, although no major forestry operations exist in the area.

## 10.4. Significant Natural Areas and Features

Natural features are interdependent and function as a system to maintain biological and geological diversity, ecosystem services, and species populations. Natural features include areas such as; significant wetlands, fish

habitat, endangered and threatened species habitat, wildlife habitat, conservation reserves and Areas of Natural and Scientific Interest (ANSI).

Sydenham Lake and the surrounding catchment area have diverse natural features integral to the healthy functioning of the Sydenham Lake system as a whole. Shoreline vegetation and wetland areas provide value to both wildlife and humans through: stabilizing shorelines from erosion and loss of property; providing fish and wildlife habitat; minimizing the impacts of flooding; reducing carbon dioxide from the atmosphere and water; filtering contaminants; and creating privacy.

## Gould Lake Conservation Area

The Gould Lake Conservation Area is composed of 589 hectares of CRCA owned land surrounding approximately 50% of the southern, eastern and western shorelines of Gould Lake (Map 10.1). This conservation area is located on the southern boundary of the Canadian Shield and is also the headwaters of both the Sydenham Lake subwatershed and larger Millhaven Creek watershed. This area on the southern boundary of the Canadian Shield features a number of beautiful high ridges overlooking Gould Lake. Gould Lake is a deep, clear, coldwater lake with good concentrations of dissolved oxygen supporting lake trout species in addition to smallmouth bass, largemouth bass, and yellow perch among others.

**Photo 10.1 - Aerial View of the Southern Portion of the Gould Lake Conservation Area (CRCA, 2016)**

The lands that compose the Gould Lake Conservation Area were acquired by the CRCA from 1967 to 1973. Much of land was purchased from Loughborough Township as well as from private landowners. Gould Lake and surrounding conservation area lands are important natural areas for water management purposes, provide high quality wildlife habitat and offer numerous opportunities for nature appreciation and recreation year-round.

Gould Lake Conservation Area is a day use area and a daily or annual entry fee is charged, which aids in maintaining upkeep of the area. The main Rideau Trail and numerous other hiking or cross-country skiing loops are located within the conservation area. Additionally, a beach located near the access point is equipped with picnic tables and washroom facilities. Canoes and other car-top boats may be launched at the beach area; however, boat ramp facilities are not available at this location on the lake. The Limestone District Education Board operates outdoor education programs on the property adjacent to the beach and utilizes a barn on the property as its headquarters.

Prior to designation as a conservation area several historic mica mines were in operation near Gould Lake. A historical mine, the McClatchey Mine, is located between Blue Lake and Gould Lake. After changing ownership this mine was eventually abandoned due to water seeping in from the lake. Additionally, numerous old pits and a large boiler may be viewed on the Mica Trail located on Conservation Authority property. The Gould Lake Conservation Area serves important purposes both historically and environmentally for both humans and wildlife alike (CRCA, 2016).

### County of Frontenac Natural Heritage Study

The County of Frontenac identified the need to undertake a Natural Heritage Study (NHS) in order to achieve a sustainable future through implementation of the Integrated Community Sustainability Plan (ICSP). A Natural Heritage Study is a comprehensive evaluation of all natural heritage features such as wetlands, forest cover and wildlife habitat including the connectivity of such features. The evaluation and mapping of natural features occurred at the regional scale across the county although linkages to areas outside of the county were also considered important.

Numerous goals of the Natural Heritage Study undertaken in 2012 were identified by the County of Frontenac including but not limited to:

- To increase the understanding of natural heritage features and systems;
- To develop land use planning information and policies that identify, protect and enhance natural heritage features and systems in a manner that meets or exceeds provincial requirements;
- To encourage and facilitate private stewardship, partnerships and public education;
- To protect animal and plant community relationships; and
- To recognize linkages between natural heritage features and systems.

The development of the Natural Heritage Study was undertaken by a private consulting firm and involved cooperation between representatives from the Townships, Ministry of Municipal Affairs and Housing, Ministry of Natural Resources, Frontenac Stewardship Council, Conservation Authorities as well as public input. Natural linkage areas within Frontenac County were identified utilizing GIS habitat suitability modelling in order to identify areas of high quality habitat that possess the potential to reconnect or maintain connections between natural heritage features. The modelled natural linkages were observed to be indicative of real world conditions through field surveys. The NHS study further identified and recommended policies to maintain, enhance or restore the natural heritage systems of Frontenac County (Frontenac County, 2012).

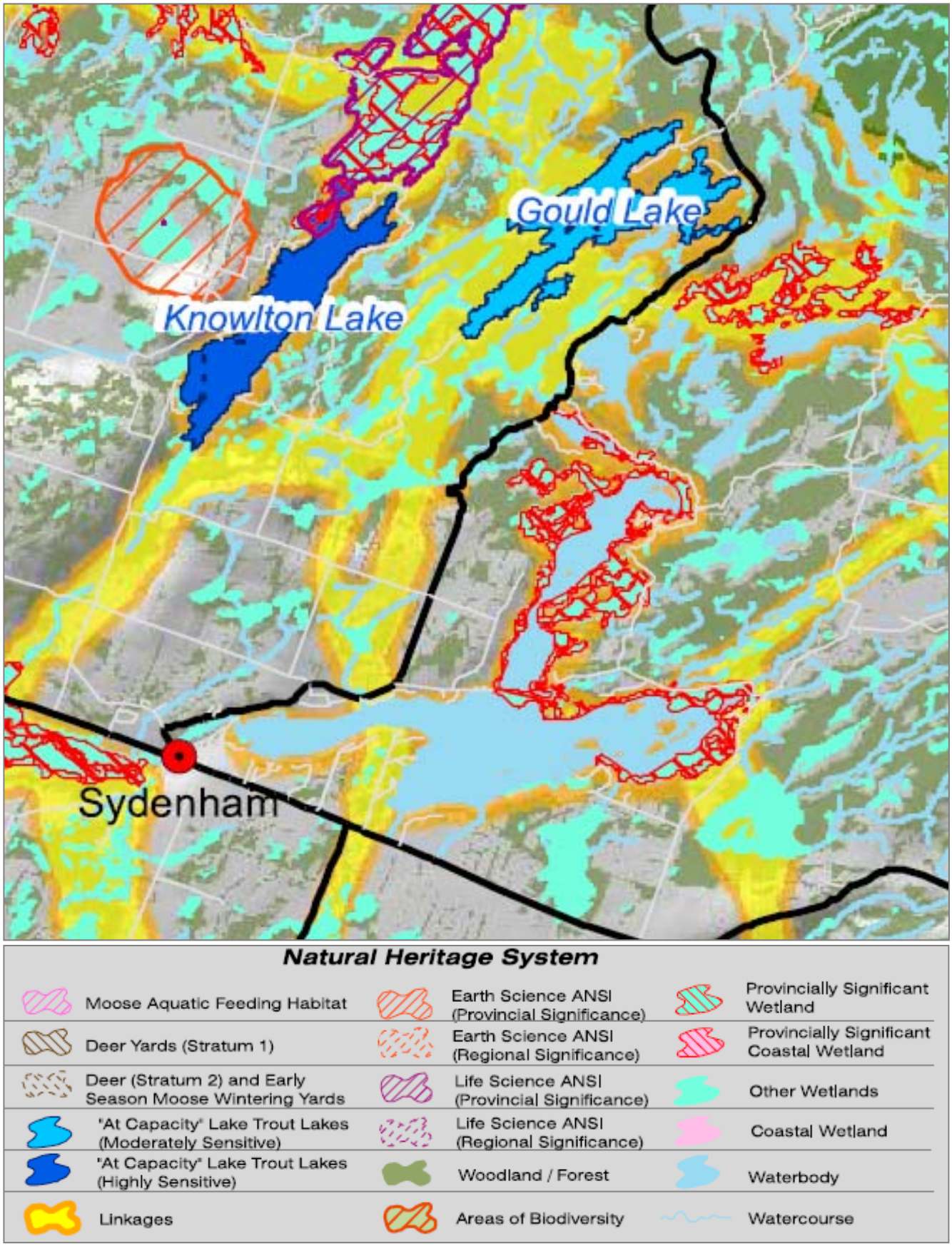
Mapping produced by the County of Frontenac Natural Heritage Study Final Report provides several observations regarding natural heritage features and linkages within the Sydenham Lake area (Map 10.3). Gould Lake has been identified as a moderately sensitive 'at capacity' lake trout lake through the NHS study. Additionally, natural linkages have been identified along the shorelines of Sydenham, Little Long and Gould lakes. These natural linkages, along the shorelines of the Sydenham Lake subwatershed, provide local level wildlife corridor functions to a variety of species including mammals, waterfowl, reptiles and amphibians. The NHS study also identifies the Provincially Significant Wetlands of the East Basin, Eel Bay and portions of Little Long Lake as significant natural features. Numerous linkages between natural heritage features have been identified leading to and from the major waterbodies of the Sydenham Lake subwatershed. The majority of linkages identified through NHS mapping are oriented in a north-south plane, although connectivity in east-west orientation exists as well. The Natural Heritage Study undertaken by the County of Frontenac establishes a precedence for protecting natural heritage features and systems within the Sydenham Lake area.

## 10.5. Wetlands

Wetlands provide various environmental services for the surrounding area and ecosystems including; maintaining ground water quantity, filtering contaminants, maintaining lake water levels, reducing erosion and sedimentation rates, and providing important habitat and food for fish and wildlife. Wetland soils have high moisture content, which reduces soil respiration, limiting the amount of carbon dioxide released back into the environment. Wetlands also provide habitat for numerous species of wildlife, including more than one-third of Canada's Species at Risk. Wetlands are utilized for breeding, spawning, rearing young, shelter, and protection by a variety of species. Wetlands also provide important wildlife passageways between various habitat types.

The Ontario Ministry of Natural Resources and Forestry (MNRF) maintains the Ontario Wetland Evaluation System (OWES), a system designed to evaluate and rank the relative value of wetlands for land use planning

**Map 10.3 - Natural Heritage System of Sydenham Lake Area Clipped Map Section** (County of Frontenac, 2012)



purposes. Through OWES a wetland can be classified as Provincially Significant (PSW), meaning that it possesses features and functions which warrant special protection policies under development/land use planning processes. Municipalities may also designate and zone wetlands that are not evaluated under OWES as locally significant so that they too are protected from certain development activities.

**Photo 10.2- Aerial View of Bay within Eel Bay Provincially Significant Wetland Complex**

Sydenham Lake and surrounding subwatershed is home to numerous wetland areas and types. A substantial proportion of the Sydenham Lake subwatershed area contains ponds, swamps and marshes. The most productive areas of the lake are Eel Bay and the East Basin, which are heavily vegetated, and contain a large Provincially Significant wetland. The Eel Bay/Sydenham Lake Wetland Complex was initially evaluated in 1978, and is composed of two separate units (Eel Bay 1.7 $km^2$, Sydenham Lake 0.11 $km^2$). The Eel Bay wetland complex produces a dense growth of numerous plant species providing essential habitat to numerous animals. Although the deep nature of the main basin makes this area less productive than Eel Bay and the East Basin, areas of shoreline wetlands remain scattered throughout the basin. In addition to provincially significant wetlands, a regionally significant wetland is located south of Morrison Road within the Sydenham Lake catchment area (Map 10.1).

Numerous other unevaluated wetlands lie scattered throughout the catchment area and provide important environmental services. Table 10.2 presents the percentage of wetland cover within the catchment areas of Gould Lake, Little Long Lake and Eel Bay/Sydenham Lake (MOECC, 2011). Wetlands both unevaluated, regionally significant, and provincially significant within the Sydenham Lake subwatershed likely improve the overall water quality of the lake. There exists a large swamp area between the outlet of Gould Lake and the inlet to Little Long Lake acting as a natural purifier for water eventually reaching Sydenham Lake. Wetlands within the Sydenham Lake subwatershed both evaluated and unevaluated provide important environmental services including water purification, critical wildlife habitat, and provide opportunities for nature appreciation and recreation.

**Table 10.2- Percentage of Wetland Cover within Gould Lake, Little Long Lake, and Eel Bay & Sydenham Lake Catchment Areas.**

| Catchment Area | Catchment Area Size (ha) | Percentage of Wetland Cover |
|---|---|---|
| **Gould Lake** | 710.96 | 12.25% |
| **Little Long Lake** | 258.90 | 15.71 % |
| **Eel Bay & Sydenham Lake** | 3909.90 | 12.20 % |

*(MOECC, 2011)*

## Aquatic Vegetation

Aquatic vegetation performs an important role within the ecology of the lake environment by providing vital food sources and habitat for both aquatic and terrestrial wildlife. Conversely, aquatic vegetation can also become detrimental to the environment in excessive amounts, and a nuisance to recreational activities.

Aquatic vegetation will grow where there is adequate sunlight, nutrients, and water quality. There are several different types of aquatic vegetation, which can be broken down into two categories; algae and vascular plants. Algae may be either single celled or multi-celled species, while vascular plants are those with a true plant structure, having a stem, leaves and roots. Vascular plants may be divided into further subsections including emergent vegetation, submergent vegetation and floating vegetation. Emergent vegetation is rooted in the lake bottom, but has stems and leaves which can rise above the water surface. Submergent vegetation resides entirely under the water surface, although they may have some floating leaves, or flower stems that rise above the surface. Floating vegetation is rooted in the lake bottom, but has leaves and flowers that float on the water surface, and typically grow in areas protected from wave action.

Aquatic vegetation provides many important services to the lake environment, including; oxygenating the lake water, taking up available nutrients from the water, filtering sun radiation through photosynthesis, and providing food sources. All types of aquatic vegetation provide habitat to fish, amphibians, waterfowl, reptiles and invertebrates, which is critical for the early life stages of many organisms. The presence of aquatic plants also aids in shoreline and lake bottom stabilization. Stabilization is accomplished through buffering the effects of wave action in the near shore area, and from the network of roots provided by the plants that hold and stabilize the lake's sediment and shoreline soils.

A significant portion of the Sydenham Lake waterbody is inundated with aquatic vegetation especially areas such as shallow sheltered bays and inlet creeks. The most productive areas of the lake are Eel Bay and the East Basin that are heavily vegetated with aquatic vegetation. Previous aquatic vegetation surveys have identified common algae, emergent, submergent and floating plant species listed below (Table 10.3).

**Table 10.3 - Types of Aquatic Vegetation and Species Found on Sydenham Lake**

| Vegetation Type | Species Common Name |
|---|---|
| **Algae** | Chara (Muskgrass) |
| **Emergent** | Cattail, Bur-reed, Pickerel Weed, Arrowhead, Bulrush |
| **Submergent** | Bladderworts, Eel Grass, Coontail, Canada Water Weed, Naiads, Water Milfoil, Water Crowfoots, Lesser Duckweed, Star-Duckweed, Curly Leaf Pondweed, Bassweed, Sago Pondweed, Stonewart, Wild Celery |
| **Floating** | Yellow Waterlily, White Waterlily, Duckweed, Floating Pondweed |

*(Leonard & MacDonald, 1990)*

## 10.6. Shoreline and Littoral Zone

Shorelines and littoral zones are referred to as the 'ribbon of life,' and are areas of high biological activity and diversity that are extremely sensitive to degradation of the natural environment. Littoral zones provide essential spawning and nursery habitat for warmwater fish species in addition to providing habitat for amphibians, mammals and waterfowl. The lakeshore also provides a local level wildlife corridor function. Sporadic areas of sandy shoreline are often utilized by nesting turtles, including painted turtles and snapping turtles.

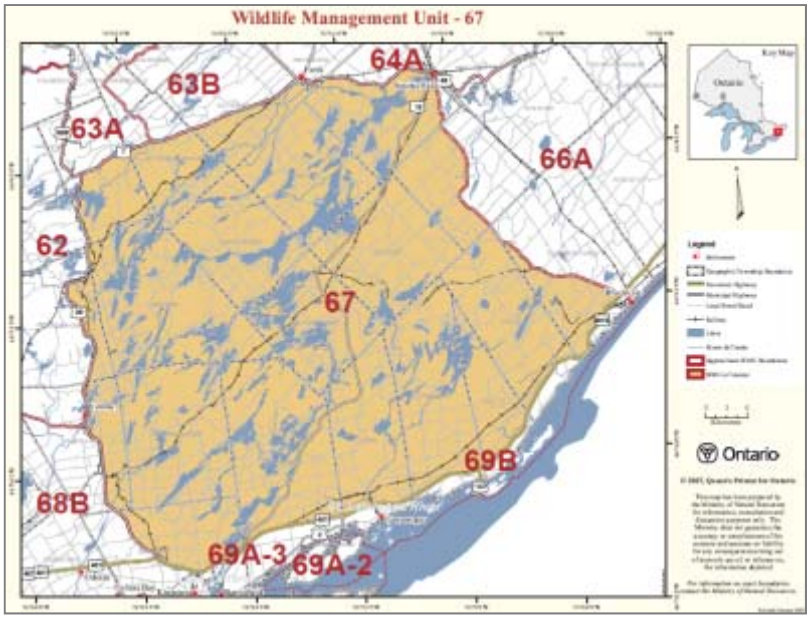
Shoreline alterations including tree and natural vegetation removal will reduce overall available habitat and inhibit wildlife migration to the lakeshore. Simple actions such as maintaining natural shorelines and renaturalization of manicured shorelines may benefit wildlife and increase the overall available habitat surrounding the lake. Maintaining soils and associated vegetation with good phosphate retention capability along the shorelines of Sydenham Lake is essential to maintaining good water quality.

As a result of the shallow depths of both the East Basin and Eel Bay, 46% of Sydenham Lake has been designated as littoral, indicating approximately half of the lake is comprised of shallow nearshore areas, marshes or wetlands. The shorelines of Sydenham Lake are a mixture of developed residential and commercial lots as well as substantial areas of naturally vegetated land. Although substantial areas of shoreline have natural vegetation to the water's edge, some areas of the lake shoreline have been cleared of natural vegetation and have been replaced by manicured lawn. Areas of the Sydenham Lake shoreline removed of trees and shrubs or with manicured lawn to the water's edge may benefit from renaturalization utilizing native plant species. Both private and public lands may benefit from active planting of the shoreline or from simply designating a buffer strip that will not be mowed, allowing the shoreline to return to its natural state through successional growth. Public parks or lands with manicured lawns to the water's edge present an excellent opportunity for renaturalization both as a demonstration site to private landowners and as education tool for the public.

## 10.7. Wildlife

The presence of wildlife and wildlife habitat is important for the sustainability of the lake environment. A diverse natural environment is often what draws people from urban areas to rural lakes such as Sydenham Lake. It is important to protect these natural places both for the ecological services they provide, as well as for the intrinsic value they hold for society.

Sydenham Lake and surrounding subwatershed are located entirely within the Wildlife Management Unit-67. Wildlife Management Units are delineated based upon geographic rather than administrative boundaries in order to allow for homogenous management of wildlife. The primary concern for wildlife management within the Sydenham Lake area and surrounding subwatershed is habitat destruction. Wildlife habitat may be lost or degraded due to a variety of factors including timber harvesting, mining activities, lakeshore development, and shoreline alterations.




**Map 10.4 - Map of Wildlife Management Unit- 67** **(MNR, 2007)**

## Mammals

The Sydenham Lake subwatershed is home to numerous species of large and small mammals. Sydenham Lake lies within one of the most bio-diverse regions in Canada due to the unique and rare habitats it provides for numerous plant, fish, bird and animal species (FABN, 2011). Previous biological inventories and local residents within the area have identified a variety of small and large mammal species listed below (Table 10.4).

**Table 10.4 - Mammals of the Sydenham Lake Subwatershed**

| Common Family | Common Name |
|---|---|
| **Shrews and Moles** | Common Shrew[2], Mole Sp.[2] |
| **Bats** | |
| **Rabbits and Hares** | Cottontail Rabbit[2], Snowshoe Hair[1] |
| **Squirrels** | Chipmunk[1,2], Gray Squirrel[2], Red Squirrel[1], Black Squirrel[1] |
| **Beavers** | Beaver[1,2] |
| **Mice, Rats, and Voles** | Muskrat[1,2], Mouse Sp.[2] |
| **Porcupines** | Porcupine[2] |
| **Dogs** | Eastern Coyote[2], Red Fox[1,2] |
| **Bears** | Black Bear[2] |
| **Raccoons** | Raccon[1,2] |
| **Weasels** | Fisher[2], Otter[1,2], Mink[2], Skunk |
| **Deer** | White-Tailed Deer[1,2] |

*(CRCA 2005[1]; Card, 2016[2])*

## Birds

The diverse environment surrounding Sydenham Lake provides habitat to numerous bird species. Some bird species occupy the lake for the entire year, while others are seasonal occupants, either during their breeding season or during migration. Wetlands provide exceptional habitat for waterfowl, during migration staging, molting, and breeding. Wetlands and open water also provide good habitat for other water or near shore birds, providing nesting locations and food sources to species including the Osprey and Common Loon. The Sydenham Lake vicinity and surrounding catchment area are home to numerous bird species. Previous biological inventories and local residents within the area have identified numerous bird species listed below (Table 10.5).

**Table 10.5 - Partial list of Birds of the Sydenham Lake Subwatershed**

| Common Family | Common Name |
|---|---|
| **Loons, Herons & Bitterns** | Common Loon[2], Great Blue Heron[2], American Bittern[2], Black Crowned Night Heron[2] |
| **Swans, Geese, Cormorants & Ducks** | Wood Duck[1], American Black Duck[2], Mallard[2], Blue-Winged Teal[1], Canada Goose[2], Common Merganser[2], Cormorant sp.[2] |
| **Hawks, Falcons, & Eagles** | Osprey[2], Sparrow Hawk[2], Marsh Hawk[1], Red Tailed Hawk[1], American Kestrel[1], Bald Eagle[2] |
| **Owls** | Owl Sp.[2] |
| **Woodpeckers** | Downy Woodpecker[1], Hairy Woodpecker[1], Pileated Woodpecker[2] |
| **Flycatchers** | Least Flycatcher, Great-Crested Flycatcher[1], Eastern Kingbird[1] |
| **Swallows** | Tree Swallow[1], Barn Swallow[1,2] |
| **Jays, Gulls & Crows** | Blue Jay[1,2], American Crow[1,2], Common Raven[2], Gull sp.[2], Tern sp.[2], Black Tern[1], Herring Gull[1] |
| **Wrens** | Marsh Wren[2], Long Billed Marsh Wren[2] |
| **Thrushes, Bluebirds & Titmice** | American Robin[2], Black- capped Chickadee[2], Eastern Bluebird, |
| **Sparrows, Cardinals & Buntings** | Dark-Eyed Junco, Le Conte's Sparrow[1], Northern Cardinal[2], Vesper Sparrow[2] |
| **Meadowlarks & Blackbirds** | Bobolink[3], Red-Winged Blackbird[1], Eastern Meadowlark[3], Common Grackle[2], Northern Oriole[2], Common Grackle[2] |
| **Hummingbirds** | Ruby-throated Hummingbird[2], |
| **Pheasants, Grouse & Vultures** | Wild Turkey[2], Turkey Vulture[1] |

*CRCA, 2005[1]; Card, 2016[2]; NHIC, 2016[3]*

## Reptiles and Amphibians

The diverse habitat surrounding the shores of Sydenham Lake, from wetland areas to upland forest provide suitable habitat for a number of reptile and amphibian species. Due to their sensitivity to suitable habitat, several amphibian species are considered keystone species and are reflective of the overall ecosystem health. Previous biological inventories and local residents within the area have identified numerous reptile and amphibian species listed below (Table 10.6).

**Table 10.6 - Reptile and Amphibian Species Identified within the Sydenham Lake Subwatershed**

| Common Family | Common Name |
|---|---|
| **Toads** | American Toad[4], |
| **Tree Frogs** | Gray Treefrog[2], Western Chorus Frog[4] |
| **True Frogs** | Wood Frog[2], Northern Leopard Frog[2], Green Frog[2], Mink Frog[2], American Bull Frog[2], Pickerel Frog[2], Spring Peeper[4] |
| **Salamanders** | Eastern Newt[4], Eastern Red-backed Salamander[4], Spotted Salamander[4], Jefferson Complex (Undetermined) Salamander[4], Four-toed Salamander[4] |
| **Snapping Turtles** | Common Snapping Turtle[1,2] |
| **Pond and Marsh Turtles** | Midland Painted Turtle[1,2], Blanding's Turtle[3], Eastern Musk Turtle[4], Northern Map Turtle[4] |
| **Snakes** | Eastern Garter Snake[2], Northern Water Snake[1,2], Gray Rat Snake[2,3], Milksnake[4], Dekay's Brownsnake[4], Eastern Ribbonsnake[4], |

*CRCA 2005[1]; Card, 2016[2]; NHIC, 2016[3]; Ontario Nature, 2017[4]*

Within the past two decades, there has been a noted decline in global frog populations. The decline of amphibian populations and the loss of biological diversity has been linked to climatic and landscape changes, such as acid rain, greenhouse gases, habitat loss, stream channelization, and effluents leaching into wetlands. Amphibians are particularly at risk because they require both healthy aquatic and terrestrial habitats to fulfill life-cycle requirements.

Turtle and snake species populations have also experienced decline because of habitat loss due to development encroachment, road traffic, and direct persecution. Many turtles lay their eggs in in-ground nests, which are heavily predated by both terrestrial and aquatic mammals. Along gravel roadsides and trails, adult turtles are often killed by on-coming traffic prior to or after the laying of eggs. The gravel substrates of the Cataraqui Trail which runs through Sydenham Lake at the connection between Eel Bay and the Main Basin provides vast areas of suitable habitat for nesting of various turtle species including the Snapping, Painted and Blanding's turtles. Turtles nesting along the Cataraqui trail are afforded protection from automobiles however still face the pressure of species that prey on their freshly laid eggs.

Turtles burrow into shoreline sediments, bottoms of ponds, and other warm places where temperatures remain above freezing (typically at 4°C) during winter hibernation. If drawdown exposes these warm places to freezing and drying air temperatures, burrowed animals could become frozen in the lake's sediment.

Snakes on the other hand are often injured or killed purposefully because of fear and misidentification. Sydenham Lake area is home to a rare and threatened snake species, the Gray Rat Snake. The Gray Ratsnake is also known as the Black Ratsnake or the Eastern Ratsnake. This snake species is non-venomous, and is Ontario's largest snake, able to reach lengths up to 2 meters. The snake is known to occur only in a portion of eastern Ontario

**Photo 10.3 – Gray Ratsnake**

(www.ontarionature.org)

and in a small population on the north shore of Lake Erie. Threats to the Frontenac Axis population of Gray Ratsnakes include the loss and fragmentation of suitable habitat as well as direct persecution by uninformed individuals. Several other threats pose risks to the Gray Ratsnake population including motor vehicles and the destruction of suitable hibernation sites (Ontario, 2016)

## 10.8. Species at Risk

Species at Risk (SAR) are flora and fauna that have been identified as being at risk of disappearing from Canada, by Provincial and/or Federal legislation, through either loss of suitable habitat or population decline. The Canadian Government established the *Species at Risk Act* (2002) (SARA) to provide protection to wildlife at a national level. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was established in 1977, to provide a scientifically sound classification of wildlife species at risk of extinction (Government of Canada, 2009). With the establishment of SARA, COSEWIC was designated as the independent body of experts responsible for identifying and assessing wildlife species considered at risk, for the federal government to consider for protection under SARA. The Ontario Provincial Government also has legislation in place to protect at risk species; the *Endangered Species Act* (2007) (ESA) identifies species at risk, protects the species and their habitats, and promotes stewardship activities aimed at the protection and recovery of the listed species (Government of Ontario, 2007).

The legislation and committees involved in the protection of Species at Risk, classify the species into categories; extinct, extirpated, endangered, threatened, and special concern. Listed species may have a different status in different areas of the country, depending on population size and habitat. For the purposes of this report, species that have been listed under federal or provincial legislation have been included, as well as those listed under committee assessments.

**Table 10.7- Ontario Species at Risk Categories of at Risk Status**

| Ontario Species at Risk Categories of at Risk Status | |
|---|---|
| **Extirpated** | Lives somewhere in the world, and at one time lived in the wild in Ontario, but no longer lives in the wild in Ontario. |
| **Endangered** | Lives in the wild in Ontario but is facing imminent extinction or extirpation. |
| **Threatened** | Lives in the wild in Ontario, is not endangered, but is likely to become endangered if steps are not taken to address factors threatening it. |
| **Special Concern** | Lives in the wild in Ontario, is not endangered or threatened, but may become threatened or endangered due to a combination of biological characteristics and identified threats. |

*(Ontario, 2017)*

Table 10.8 lists the species that have been identified within the Sydenham Lake watershed through previous biological inventories, the National Heritage Information Center, and first hand observations. Additional Species at Risk may be present in the area and some species listed may not be currently present although listed in various databases.

**Table 10.8 - Species at Risk Identified within the Sydenham Lake Watershed**

| Common and Scientific Name | Status | | |
|---|---|---|---|
| | SARA[1] | COSEWIC[2] | ESA[3] |
| **Vascular Plants & Lichens** | | | |
| **Butternut** *Juglans cinerea* | Endangered | Endangered | Endangered |
| **Broad Beech Fern** *Phegopteris Hexagonopter* | Special Concern | Special Concern | Special Concern |
| **Invertebrates** | | | |
| **Monarch Butterfly** *Danaus plexippus* | Special Concern | Special Concern | Special Concern |
| **Reptiles & Amphibians** | | | |
| **Blanding's Turtle** *Emydoidea blandingii* | Threatened | Threatened | Threatened |
| **Snapping Turtle** *Chelydra serpentina* | Special Concern | Special Concern | Special Concern |
| **Eastern Musk Turtle** *Sternothernus odoratus* | Threatened | Special Concern | Threatened |
| **Northern Map Turtle** *Graptemys geographica* | Special Concern | Special Concern | Special Concern |
| **Gray Ratsnake** *Pantherophis spiloides* (Front. Axis Pop.) | Threatened | Threatened | Threatened |
| **Birds** | | | |
| **Bald Eagle** *Haliaeetus leucocephalus* | No Status | Not at Risk | Special Concern |
| **Barn Swallow** *Hirundo rustica* | No Status | Threatened | Threatened |
| **Bobolink** *Dolichonyx oryzivorus* | No Status | Threatened | Threatened |
| **Cerulean Warbler** *Dendroica cerulea* | Special Concern | Endangered | Threatened |
| **Eastern Meadowlark** *Sturnella magna* | No Status | Threatened | Threatened |
| **Loggerhead Shrike** *Lanius ludovicianus* | Endangered | Non-Active | Endangered |
| **Louisiana Waterthrush** *Seiurus motacilla* | Special Concern | Threatened | Special Concern |

[1] *SARA (Species at Risk Act)-Extinct, Extirpated, Endangered, Threatened, Special Concern, Not at Risk (assessed and deemed not at risk of extinction), or no status (not rated).*

[2] *COSEWIC (Committee on the Status of Endangered Wildlife in Canada): Extinct, Extirpated, Endangered, Threatened, Special Concern, not at risk (assessed not at risk), or data deficient (available information is insufficient to resolve eligibility for assessment or permit an assessment of the wildlife species' risk of extinction).*

[3] *ESA, 2007 (Endangered Species Act, 2007): Ontario Ministry of Natural Resources (Species at Risk in Ontario (SARO) List: Extirpated, Endangered, Threatened, Special Concern, or not classified.)*

## 10.9. Invasive and Nuisance Species

Flora and fauna species that have been introduced to an area, but originate from other parts of the world, can be detrimental to the health of an ecosystem. Some non-native species can become well established in the new environment, and disrupt the native species, at which point they are classified as invasive species. Invasive species can out-compete native species for resources, such as food and habitat, and introduce new diseases and parasites. Invasive species will often take over, or invade an area upon introduction, often because they have no known enemies in their new environments. Some species, such as Eurasian Milfoil, can form colonies so thick they disrupt recreational activities, such as boating and swimming, by choking navigation channels and popular swimming areas. Invasive organisms reduce the biodiversity of an area by crowding out native species through predation, parasitism, disease, and competition.

Listed below (Table 10.9) are invasive species that either already are present, or possess the potential of spreading to the Sydenham Lake area. Continued monitoring and education regarding environmentally responsible boat transportation practises and invasive species identification are essential to ensure these species will not reach the Sydenham Lake area and affect the natural environment.

**Table 10.9 - Invasive Species Possessing Ability to Colonize Sydenham Lake Area**

| Species Type | Common Name |
|---|---|
| **Terrestrial Plants** | Common Buckthorn, Common Lilac, Purple Loosestrife, Scots Pine, Wild Parsnip, Dog Strangling Vine |
| **Aquatic Plants** | Eurasian Milfoil, European Frogbit, Flowering Rush, Common Reed of Eurasia |
| **Invertebrates** | Zebra Mussel, Spiny Waterflea, Emerald Ash Borer, Rusty Crayfish |
| **Fungus** | Butternut Canker |

## Zebra Mussels – present in the watershed

Zebra mussels are currently found within the Sydenham Lake waterbody and are believed to have colonized the lake since the early 2000's. Zebra mussels may exert a great impact on the lake ecosystem. Since they are filter feeders, they will remove sediment and suspended particles from the water column, in the process increasing water clarity. Increased water clarity will mean that sunlight will penetrate deeper into the water, increasing vegetation growth in the lake. Zebra mussels have undoubtedly affected the water quality, clarity, and chemistry of Sydenham Lake and may have already reached a stable population within the lake.

**Photo 10.4 – Zebra Mussel (*Dreissena polymorpha*)**

*(Central Lake Ontario Conservation, 2016)*

## Common Reed of Eurasia – Phragmites – present in the watershed

Invasive species may exert a greater impact on lake and watershed ecology in the future, with disruptions that may be evident to residents and end up having an associated economic cost. An invasive aquatic plant species that has the potential of spreading to Sydenham Lake is the Common Reed of Eurasia (*Phragmites australis*). The Common Reed of Eurasia is an aggressive plant that spreads quickly and outcompetes native species for water and nutrients. This plant species prefers areas of standing water and releases toxins from its roots into the soil to hinder the growth of and kill surrounding plants (Ontario Invading Species Awareness Program, 2016). The Common Reed of Eurasia is an example of a prominent invasive species that spreads quickly on its own, or through transplantation by lake residents attempting to screen their property from public view. This invasive plant species is very difficult to control and, when established along shorelines, may screen peoples view of the lake.

**Photo 10.5 - Common Reed of Eurasia**

*(Ontario Invading Species Awareness Program, 2016)*

## Wild Parsnip – present in the watershed

Wild Parsnip is an invasive terrestrial plant species native to Europe and Asia. Wild parsnip, also referred to as poisonous parsnip, is a member of the carrot and parsley family. This species typically forms a low rosette of leaves during its first year of growth as its root structures develop. During its second year of growth, this species typically flowers on a tall stalk and then dies. Wild parsnip often forms dense thickets and spreads very quickly in disturbed areas including meadows, open fields, roadsides and railway embankments. This species ability to colonize disturbed areas especially roadsides has allowed it to quickly spread throughout southeastern Ontario. Adding to the problem is that this species is very difficult to control or eradicate as its seeds are easily dispersed by wind, water, and mowing equipment. Extreme caution should be taken when encountering this invasive species as like other species of the carrot family, it produces sap containing chemicals that can cause human skin to react to sunlight, often producing severe burns, rashes or blisters. Wild Parsnip exerts numerous impacts on the natural environment including the ability to form dense stands and outcompete native plants reducing overall biodiversity (OISAP, 2016).

**Photo 10.6 - Wild Parsnip**

*(Ontario Invading Species Awareness Program, 2016)*

## Dog Strangling Vine – present in the watershed

The name Dog Strangling Vine, refers to two invasive terrestrial plants (Black Swallowwort and Pale Swallowwort) native to Eurasia. Dog Strangling Vine thrives in open sunny areas, but can also grow well in lightly shaded areas. This species grows very aggressively up to two metres in height by wrapping itself around trees and other plants. Dense patches of this species possess the ability to outcompete and strangle plants and small trees. This vine species has invaded hillsides, stream banks, and roadsides spreading rapidly since its seeds are easily spread by wind. Dog strangling vine may form dense stands that outcompete native plants and young trees reducing biodiversity. This species also threatens the Monarch Butterfly, a Species at Risk, as butterflies lay their eggs on the plant, but the larvae are unable to complete their life cycle and do not survive (OISAP, 2016).

**Photo 10.7 - Dog Strangling Vine**

*(Ontario Invading Species Awareness Program, 2016)*

## Emerald Ash Borer – presence uncertain

Of significant concern is the Emerald Ash Borer, a non-native insect that has made its way southeastern Ontario. The emerald ash borer is a green beetle native to Asia and Eastern Russia. Outside its native region, the emerald ash borer is an invasive species and is highly destructive to ash trees in its introduced range. Frontenac County lies within the boundaries of the Emerald Ash Borer Regulated Area of the Canadian Food Inspection Agency. The presence of the Emerald Ash Borer could have a significant impact on the natural features around the lake given that ash trees are a popular ornamental tree in the cottage areas (since they are moisture tolerant) and are also a predominant species in in lowland hardwood ecosystems including shoreline wetland areas. The expected loss of ash trees could provide opportunity for other invasive species such as buckthorn to take their place (OISAP, 2016).

**Photo 8 - Emerald Ash Borer**

*(www.nrcan.gc.ca)*

## Spiny Water Flea – not yet identified in the Sydenham Lake watershed

Spiny water flea are found in the Great Lakes and in more than 100 inland lakes in Ontario, because their main diet is zooplankton, they reduce food supplies for small fish and the young of sport fish such as bass and yellow perch. They are easily spread between waterbodies on angling equipment, in bait buckets, in live wells and bilge waters. Spiny waterflea introductions can result in an average of 30 to 40 percent decline in native populations of zooplankton. They also affect recreation angling, as their tail spines catch on fishing equipment, making it difficult to reel in lines.

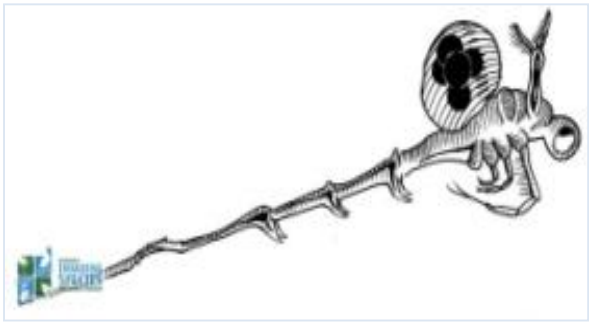


**Photo 9 - Spiny Water Flea**

*(Ontario Invading Species Awareness Program, 2016)*

The OFAH's Invasive species hotline advise:

- Learn how to identify spiny and fishhook waterfleas and how to prevent accidentally spreading these invasive species.
- Inspect your boat, trailer and equipment after each use. Remove all plants, animals and mud before moving to a new waterbody.
- Drain water from your motor, live well, bilge and transom wells while on land.
- Rinse all recreational equipment with high pressure (>250 psi) or hot (50oC / 122oF) water OR let it dry in the sun for at least five days.
- If you've seen an invasive waterflea or other invasive species in the wild, please contact the toll-free Invading Species Hotline at 1-800-563-7711, or report a sighting online.

## Round Goby - not yet identified in the Sydenham Lake watershed

Round goby prefer waters with rocky and sandy bottoms. They feed aggressively on insects and other small organisms found on lake and river bottoms. Adult round goby eat large quantities of zebra and quagga mussels, and occasionally small fish and fish eggs. Their aggressive eating habits and ability to spawn several times each season have helped them multiply and spread quickly

The round goby's aggressive habits and rapid spread have had serious impacts on native species.

The fish compete with and prey on native bottom-dwelling fish such as mottled sculpin (Cottus bairdii) and logperch (Percina caprodes). Round goby also threaten several species at risk in the Great Lakes Basin, including the northern madtom (Noturus stigmosus), the eastern sand darter (Ammocrypta pellucida), and several species of freshwater mussels.

Round goby have reduced populations of sport fish by eating their eggs and young and competing for food sources.

Researchers believe the round goby is linked to outbreaks of botulism type E in Great Lakes fish and fish-eating birds. The disease is caused by a toxin that may be passed from zebra mussels, to goby, to birds, resulting in large die-offs of fish and birds.

The OFAH's Invasive species hotline advise:

- Learn how to identify round goby and how to prevent the spread of this unwanted species.
- Never buy or use round goby as bait. It is against the law to use round goby as bait or to have a live round goby in your possession.
- Don't put any live fish into Ontario lakes, rivers or streams.

### *Observations – Natural Environment*

- The Sydenham Lake subwatershed contains a strong biodiversity of plants and animals, partly because it lies on the boundary between limestone bedrock and granite of the Frontenac Arch.
- The more populated regions to the south and west of lake have been cleared of dense forest systems and are primarily developed for agricultural purposes while areas to the north on the Canadian Shield remain relatively dense undeveloped coniferous and mixed forest systems.
- Sydenham Lake and surrounding catchment area contain substantial areas of wetlands including the provincially significant Eel Bay/Sydenham Lake Wetland Complex.
- The Sydenham Lake subwatershed contains a relatively high number of species and community types as well as numerous Species at Risk.
- The Sydenham Lake subwatershed lies completely within the Frontenac Arch Biosphere Reserve, which has been described as one of the most bio-diverse regions in Canada.
- The Gould Lake Conservation Area lands are important natural areas for water management purposes, provide high quality wildlife habitat and offer numerous opportunities for nature appreciation and recreation year round.

### *Recommendations for Lake Plan Actions*

- Conduct a thorough inventory of flora and fauna.
- Continue monitoring and research of Species at Risk and Invasive Species to ensure the overall health of the Sydenham Lake ecosystem.
- Conduct an evaluation of unevaluated wetlands under the Ontario Wetland Evaluation Service (OWES) to determine provincial and regional significance.
- Establish programs to provide information and education to property owners about the protection and rehabilitation of shoreline areas.
- Work with Watersheds Canada for shoreline naturalization. http://watersheds.ca/our-work/the-natural-edge/

# 11. Fishery

The following sources were referenced in this section:

- *Cooper, H.A., 1970. Sydenham Lake Survey.*
- *Leonard and MacDonald, 1990. Fish Habitat Survey for Sydenham Lake.*
- *Leonard and MacDonald, 1990. Nearshore Fish Habitat Survey for Gould Lake.*
- *Littkemann, Peter, 1959. Biological Report on Sydenham Lake.*
- *Ontario Ministry of Natural Resources and Forestry, 2014. Broad-Scale Monitoring Update.*
- *Smith, W.G, 1974. Sydenham Trapnet and Gillnet Report.*

## 11.1. Past Management and Events

Known stocking efforts started in 1914 with the introduction of 200 adult Yellow Pickerel. About 1.6 million fish of various sizes and life stages have been stocked in Sydenham Lake from 1914 to 1967. Table 11.1 illustrates the year, the species of fish and the number of hatchery plantings in Sydenham Lake.

Despite the significant effort to stock five different species, only Smallmouth Bass and Largemouth Bass have been considered successful.

The failure of stocking Lake Trout, Yellow Pickerel, and Maskinonge could be a combination of several factors; the lake is biologically unsuitable for a species, predation of stocking fish, and the lack of spawning sites for natural reproduction.

Large portions of the lake were, in the past, considered to be ideal for Maskinonge habitat and reproduction. However, all stocking efforts failed and it was suspected that part of the problem was that the planted fry were eaten by existing Bass, Northern Pike and Panfish populations (Cooper, 1970).

Table 11.1 - History of Hatchery Plantings in Sydenham Lake

| Year | Yellow Pickerel | Lake Trout | Smallmouth Bass | Maskinonge | Largemouth Bass |
|---|---|---|---|---|---|
| 1914 | 200 Adult | | | | |
| 1918 | | 20,000 | | | |
| 1922 | 100,000 | | | | |
| 1924 | 100,000 | | | | |
| 1927 | 100,000 | | | | |
| 1929 | | | 5,000 | | |
| 1935 | | | 2,500 | | |
| 1936 | | | 500 | | |
| 1937 | 250,000 | | | | |
| 1938 | 350,000 | | 50 Adults | 15,000 | |
| 1939 | 400,000 | | 6,000 | | |
| 1940 | | | 1,000 | | |
| 1941 | | | 2,500 | | |
| 1942 | | | 1,000 | | |
| 1943 | | | 500 | | |
| 1944 | | | 5,000 | | |
| 1946 | | | 750 | | |
| 1947 | | | 1,500 | | |
| 1948 | | | 3,000 | | |
| 1949 | | | 200 | | |
| 1950 | | | 500 | | |
| 1951 | | | 2,000 | | 5,000 |
| 1952 | | | | | 10,000 |
| 1953 | | | 2,000 | | |
| 1954 | | | 750 | | |
| 1955 | | | 5,000 | | |
| 1958 | | | | 80,700 | |
| 1959 | | | | 100,000 | |
| 1960 | | | | 20,000 | |
| 1961 | | 500 | | 20,000 | |
| 1962 | | 1,500 | | 40,000 | |
| 1964 | | 2,000 | | | |
| 1966 | | | | 20,000 | |
| 1967 | | | | 20,000 | |
| TOTAL | 1,300,200 | 24,000 | | 300,700 | 15,000 |

*Source - MNR - 1970 Sydenham Lake Survey*

Table 11.2 illustrates the results of trap netting surveys that were conducted in 1958 and 1970. However, due to differences in positioning of nets and individual techniques in setting the nets, comparing the results should be done with caution.

In September 1967, a commercial hoop net operation license was issued to Erick Pearson of Kingston. Over a four-year period the operation removed approximately 18.5 tons of Panfish including Pumpkinseed, Yellow

Perch, Crappies, Bullheads and Rock Bass (1970, Cooper). The commercial fishery season ran from October to April 30th. In 1970 the season was extended to May 15, but was immediately closed due to injuries to large numbers of game fish. Although Panfish abundance appeared to be less in 1970, than previously surveyed in 1959, it was noted at the time that further study was needed to determine if this operation was a cause in the decline. This commercial operation was discontinued because of the injuries to large numbers of game fish and public pressure in the area (1974, Smith). In 1974 a follow up survey was completed and there were 2.23 times as many fish caught in 1974 as in 1970, the majority of these being Pumpkinseeds and Bluegills.

**Table 11.2 - Trap Netting Results 1959 and 1970**

| Fish Species | August 1959 | | | June 1970 | | | June 1974 | | |
|---|---|---|---|---|---|---|---|---|---|
| | # Caught | CUE | % Caught | # Caught | CUE | % Caught | # Caught | CUE | % Caught |
| Bluegill | 1250 | 44.64 | 24.1 | 724 | 25.86 | 31.7 | 2902 | 103.64 | 54.6 |
| Crappie | 1173 | 41.89 | 22.6 | 623 | 22.25 | 27.3 | 604 | 21.57 | 11.53 |
| Brown Bullheads | 2002 | 71.50 | 38.6 | 270 | 9.67 | 11.8 | 278 | 9.93 | 5.2 |
| Pumpkinseed | 535 | 19.10 | 10.3 | 509 | 18.18 | 22.2 | 1040 | 37.14 | 19.5 |
| Largemouth Bass | 109 | 3.89 | 2.1 | 32 | 1.14 | 1.4 | 148 | 5.29 | 2.7 |
| Northern Pike | 70 | 2.5 | 1.3 | 20 | 0.71 | 0.9 | 29 | 1.04 | .5 |
| Rock Bass | 25 | 0.89 | 0.5 | 63 | 2.25 | 2.8 | 124 | 4.43 | 2.3 |
| Smallmouth Bass | 13 | 0.47 | 0.25 | 35 | 1.25 | 1.5 | 104 | 3.71 | 1.9 |
| Yellow Perch | 13 | 0.47 | 0.25 | 5 | 0.18 | 0.22 | 77 | 2.75 | 1.4 |
| Eel | 0 | 0.00 | 0.0 | 3 | 0.11 | 0.1 | 2 | 0.07 | 0.04 |
| TOTALS | 5,190 | | 100 | 2284 | | 100 | 5308 | | 100 |

*Source - Fish Surveys - 1970 Cooper, 1974 Smith*

Voluntary Creel Surveys were conducted by the MNRF between 1969 and 1982 and the results are provided in Table 11.3.

**Table 11.3 - Voluntary Creel Data for Sydenham Lake**

| Date | # of Anglers Checked | # of Man Hours Fished | Northern Pike | Yellow Perch | Rock Bass | Smallmouth Bass | Largemouth Bass | Panfish | Brown Bullhead | Brown Bullhead/ Yellow Perch | Black Crappie | Walleye |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May 17 and 18, 1969 | 19 | 126 | 3 | 15 | 25 | - | - | - | - | - | - | - |
| June 1, 12, 14, 15 and 22nd, 1969 | 118 | 312 | 86 | 5 | - | - | - | 44 | - | - | - | - |
| July 4th, 1969 | 24 | 72 | 5 | - | - | 7 | 2 | 11 | - | - | - | - |
| May 22nd, 1970 | 3 | 7.5 | 1 | - | 2 | - | 2 | - | - | - | - | - |
| July 9 and 23rd, 1970 | 13 | 33.5 | 33 | - | - | - | - | 6 | - | 6 | - | - |
| August 20th, 1970 | 14 | 21.5 | 3 | - | - | - | - | - | - | - | - | - |
| June 9th, 1971 | 13 | 26 | 6 | 1 | - | - | - | - | - | - | - | - |
| June 19th, 1971 | 53 | 144.5 | 40 | 9 | - | - | - | 43 | 2 | - | - | - |
| June 26th, 1973 | 26 | 65.5 | 1 | 3 | 31 | - | - | - | - | - | - | - |
| June 30th, 1974 | 49 | 100 | 6 | 4 | 10 | 3 | 16 | 15 | 23 | - | 7 | 2 |
| January 31st, 1982 | 4 | 2 | - | - | - | - | - | - | - | - | - | - |
| May 8th, 1982 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | - |
| May 9th, 1982 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - |
| August 11th, 1982 | 2 | 3 | 1 | - | - | - | 1 | - | - | - | - | - |

*Source - MNRF*

## 11.2. Status of Current Fish Community

### 11.2.1 Fish Species Composition

In 2010 fish populations were surveyed using large and small mesh nets to provide information on fish species present and their characteristics, such as growth, age and abundance. Figure 11.4 indicates that Bluegill were the largest proportion of fish caught (36%), followed by Yellow Perch (23%) and Pumpkin Seed (10%). The catch data indicated that 12 species and 1 unidentifiable specimen were surveyed in large mesh nets (Table 11.5). Figure 11.4 illustrates the proportion of fish caught in large mesh nets. Additional fish species observed in small mesh nets were Blackchin Shiner, Bluntnose Minnow, CARPS and MINNOWS, Common Shiner, Hornyhead Chub and Mottled Sculpin (Broad-scale Monitoring Bulletin, 2014).

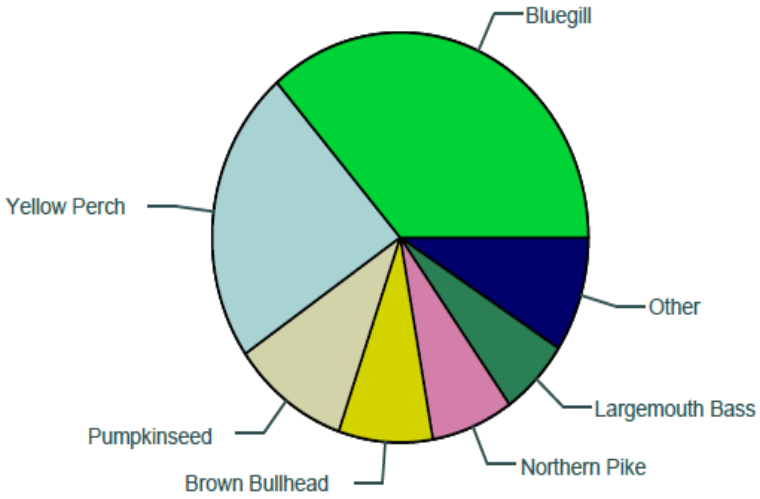



**Figure 11.4 - Proportion of Fish Caught in Large Mesh Nets - 2014**

Despite the past stocking efforts for Lake Trout, Yellow Pickerel and Maskinonge, no specimens were found in the 2014 survey.

**Table 11.5 - Data on Fish Caught on Sydenham Lake - Broad-scale Monitoring 2014**

| Fish species | Total Catch % | Maximum Length cm | Min. Length cm | Average Length Cm |
|---|---|---|---|---|
| Bluegill | 36 | 20.4 | 9.7 | 15.1 |
| Yellow Perch | 23 | 28.9 | 13.2 | 16.9 |
| Pumpkinseed | 10 | 23.8 | 9.1 | 15.7 |
| Brown Bullhead | 8 | 29.1 | 19.0 | 24.5 |
| Northern Pike | 7 | 78.9 | 25.0 | 57.8 |
| Largemouth Bass | 6 | 40.1 | 13.1 | 19.6 |
| Cisco | 2 | 25.2 | 16.8 | 20.3 |
| Yellow Bullhead | 2 | 27.5 | 12.8 | 18.4 |
| Rock Bass | 2 | 26.3 | 18.7 | 22.6 |
| Smallmouth Bass | 1 | 51.7 | 36.2 | 43.7 |
| Golden Shiner | 1 | 15.7 | 14.2 | 14.7 |
| Black Crappie | 1 | 25.7 | 17.7 | 20.6 |
| UNIDENTIFIABLE | < 1 | 14.3 | 14.3 | 14.3 |

*Source: MNRF, Broad Scale Monitoring Update Bulletin, 2014*

### 11.2.2 Fish Habitat - Sydenham Lake and Eels Bay

#### Lake Habitat

Sydenham Lake is considered to have a warmwater thermal regime and is comprised of three separate basins, Sydenham Lake Main Basin, Sydenham Lake East Basin and Eels Bay. The western portion of Sydenham Lake is considered to be the Main Basin and has a depth of 36.6 m (120 ft) and a mean depth of 6.7 m (22 ft). The eastern portion of Sydenham Lake is quite shallow, has 19 limestone islands and the mainland shoreline is well vegetated and is a Provincially Significant Wetland. The nearshore habitat of the main basin is mainly comprised of rock rubble, silt and sand. The bottom of the main basin is heavily silted, due to sediments carried into the lake by different sources such as wind, inflowing streams, wave action and accumulating remains of plant and animal life. The bottom substrate near the islands on the east end of the main basin is rocky. Marl was noticed in some shallow areas of the main body of the lake. Smallmouth Bass and larger pike are found in this area.

Eels Bay is relatively shallow (mean depth 1.6 m (5.2 ft)) and has a very irregular limestone bottom, 25 islands and several shoals of sedimentary material. The near shore habitat of Eels Bay is predominantly silt and mud with some areas of sand and rock rubble. The bottom of Eels Bay is covered in mud, except on the areas surrounding the islands. Significant amounts of aquatic vegetation exists in Eels Bay, and the entire shoreline is classified as a Provincially Significant Wetland. Largemouth Bass and Pike predominate in these areas.

Due to its depth, the main basin thermally stratifies, with the thermocline occurring between 5.4-8.9 m deep (17.8 and 29.1 ft) (Smith, 1970). This portion of the lake is about 120 ft in depth, which implies that the lake could support cold water fish species. However, past attempts at stocking lake trout had failed, and this may be due to a combination of the following: the lack of appropriate spawning shoals, unsuitable water quality or dissolved oxygen concentration, and over harvesting (Pers. Comm - Monique Charette, MNRF).

The eastern portion of the main basin and Eel Bay are too shallow to thermally stratify and are only suitable for warmwater fish species. Occasional oxygen shortages on these areas have resulted on limited fish kills during summer and are likely due to eutrophication process (!970, Cooper).

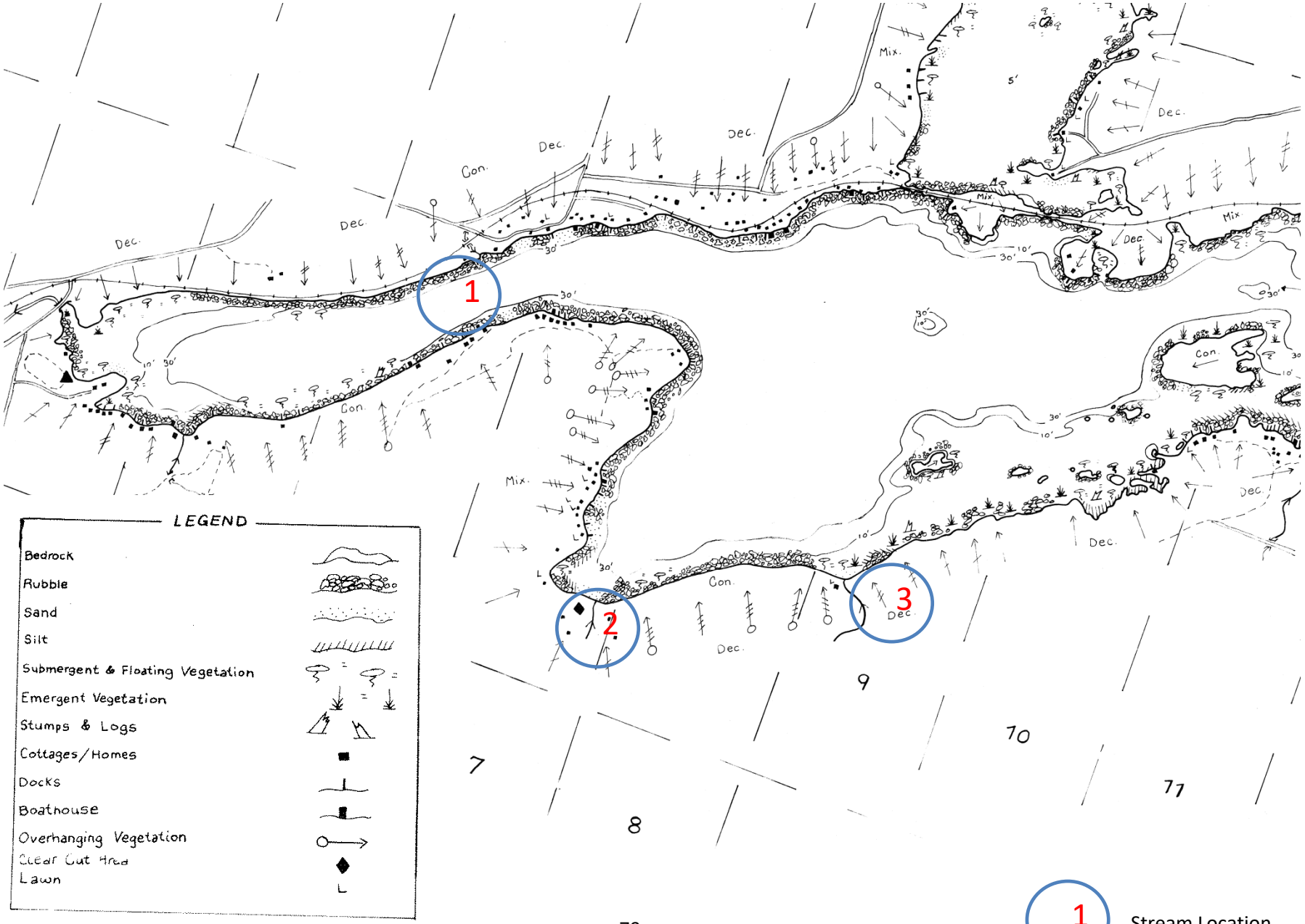
#### Stream Habitat

The location of thirteen small streams that flow into Sydenham Lake is shown on Maps 11.1, 11.2, and 11.3. Only two streams are permanent: one located along the south east shoreline, has a permanent flow of water that is fed by springs, and the other is the creek flowing from Gould to Little Long Lake (pers. comm - Monique Charette, MNRF). The other streams are intermittent and are unlikely to be considered fish habitat. However, during the spring freshet, high lake levels may flood the mouths of these streams. The 1959 Biological Survey indicated that 'northern pike, muskellunge and white suckers are often found spawning in creeks or flooded areas bordering the creeks'. Because of the inadequate water conditions in the tributaries it is believed that except for some minnows, game fish are not found to be inhabitants during the summer months. There is also one outlet from Sydenham Lake into Millhaven Creek. A dam exists at this outlet that prevents the movement of fish.

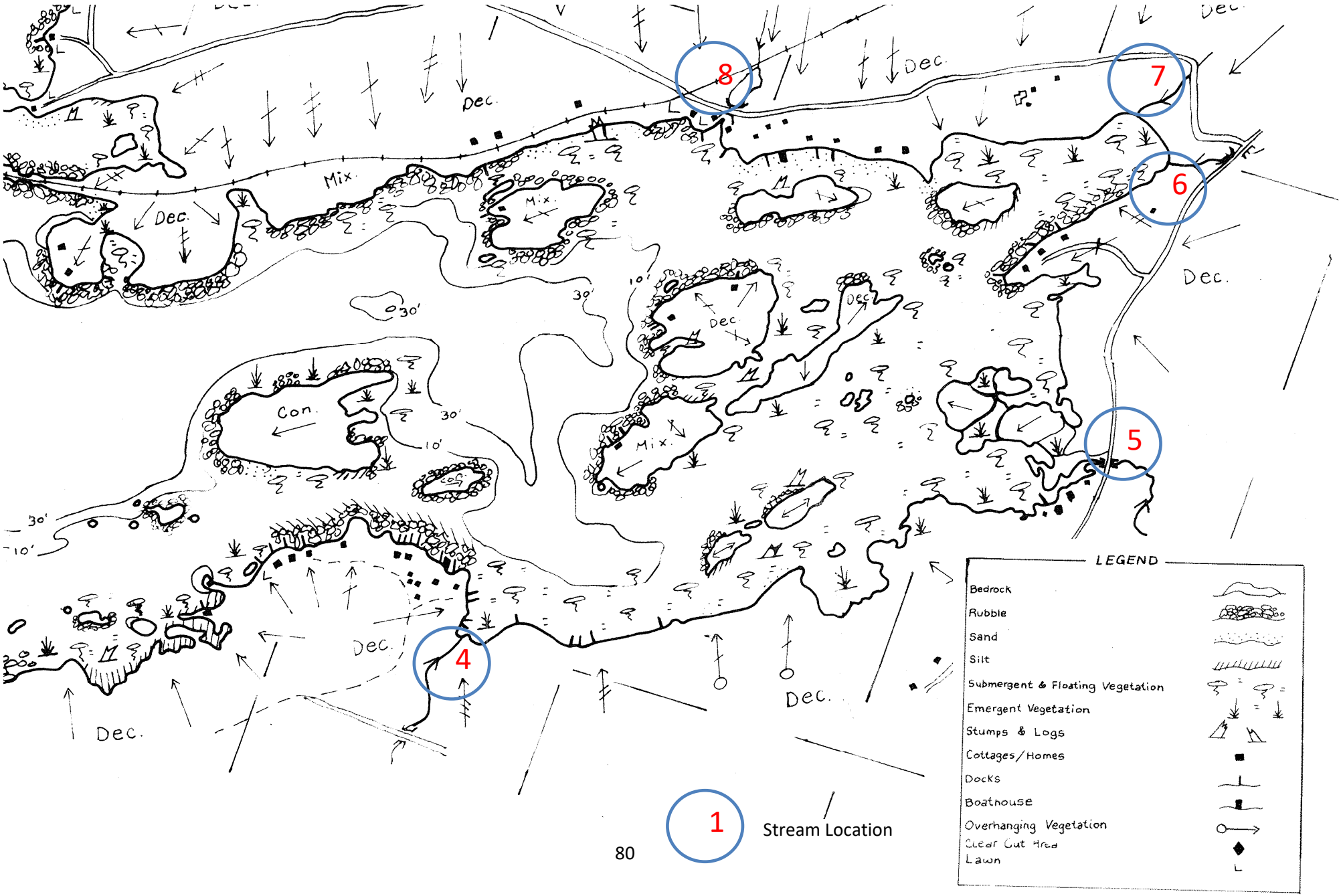
#### Known Spawning Areas

Near shore fish habitat was documented during the week of June 11 to 14, 1990 (Leonard and MacDonald, Fish Habitat Survey, 1990) to identify and inventory nearshore substrate, aquatic plants, and shoreline vegetation. Maps 11.1, 11.2 and 11.3 illustrate the type of nearshore substrate (bedrock, rubble, sand or silt), emergent (above water surface) and submergent (below water surface) vegetation. Additional mapping showing the location of critical habitat for bass, northern pike and other species is available but has not been included in the State of the Lake Report. Instead, these maps have been retained by the MNRF and the Sydenham Lake Association and will shared with the Township of South Frontenac to be used in conjunction with development applications along the shoreline.

**Map 11.1 - Fish Habitat - Sydenham Lake - Main Basin - 1990**



**Map 11.2 - Fish Habitat - Sydenham Lake - East Basin - 1990**



**Map 11.3 - Fish Habitat - Eel Bay - 1990**

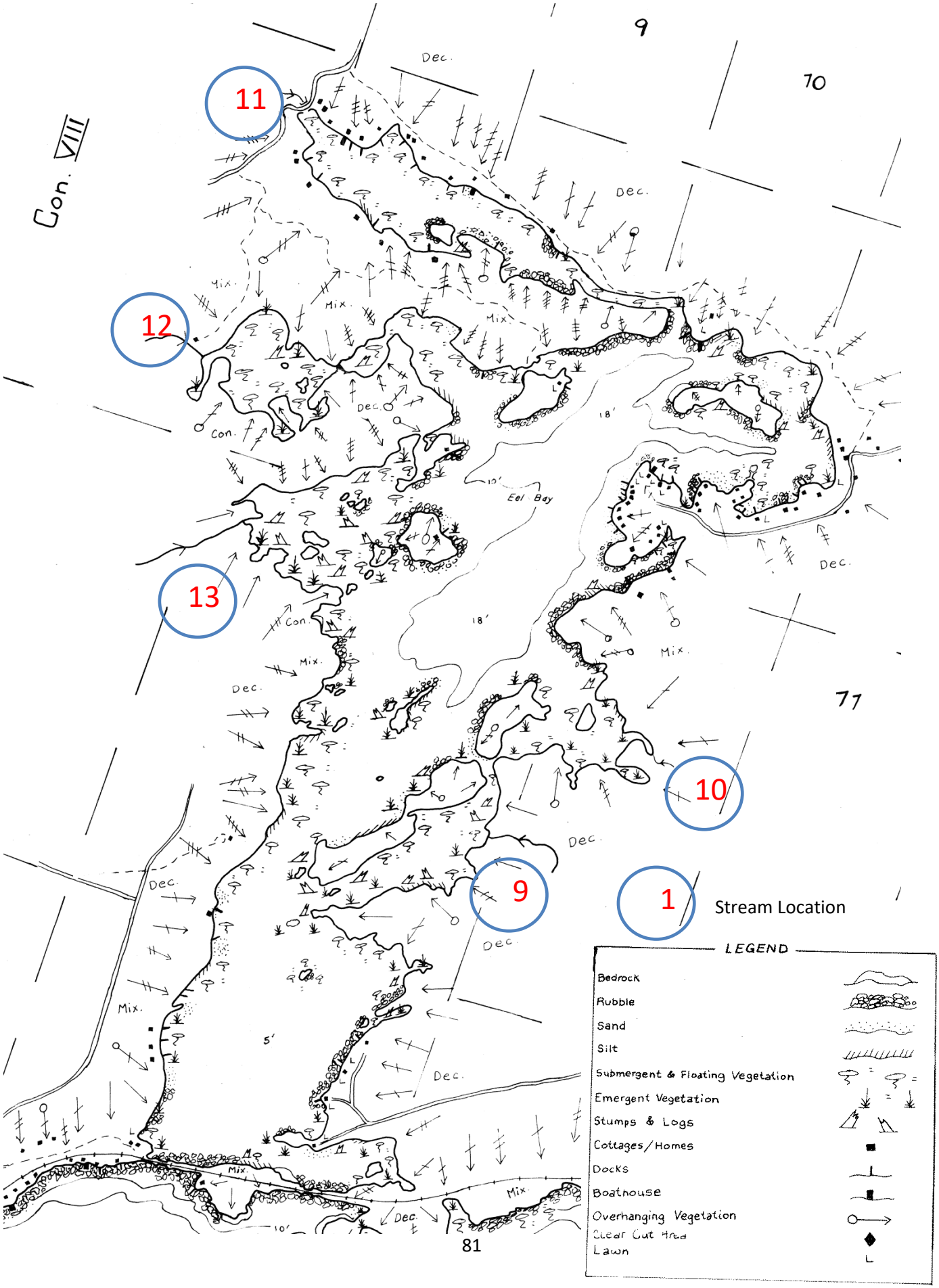


**Figure 11. 2 - Common Fish Species in Sydenham Lake**

| | | |
|---|---|---|
| Bluegill *(Lepomus macrochirus)* |  | • Warmwater fish - part of sunfish family<br>• Length 15-22.5 cm<br>• Preferred spawning habitats are bottoms consisting of sand, gravel or muck. |
| Yellow Perch *(Perca flavescens)* |  | • Coo lwater fish<br>• Length 15-30 cm<br>• Tolerates a variety of temperatures and habitats. Prefer areas of open water and moderate vegetation<br>• Spawns on aquatic plants |
| Pumpkinseed *(Lepomis gibbosus)* |  | • Warmwater fish - part of sunfish family<br>• Length 18-23 cm<br>• Prefers cool to warm water of lakes and slow-moving streams with aquatic vegetation<br>• Builds a nest in submerged aquatic vegetation in shallow waters (depth 6-12 inches) of ponds, lakes or slow moving streams. |
| Brown Bullhead *Ameiurus nebulosis* |  | • Warmwater fish<br>• Length 20-37 cm<br>• Prefers slow, warm waters<br>• Will clear a shallow nest, in a bottom of mud or sand or among the roots of aquatic vegetation, usually near the protection of a stump, rock, or tree (Scott and Crossman, 1998) |
| Northern Pike *Esox lucius* |  | • Cool water fish<br>• Length 45-75 cm<br>• Prefers vegetated bays, creek mouths and shoals of lakes. Spawns on vegetation in shallow flooded areas during spring freshet |
| Largemouth Bass |  | • Warmwater fish - part of sunfish family<br>• 35-55 cm<br>• Prefers warm, weedy water, and clear rocky lakes<br>• Spawning grounds vary from gravelly sand (more rarely) to marl and soft mud in reeds, bulrushes, or water lilies. |
| Rock Bass *Ambloplites rupestris* |  | • Cool water native fish - part of sunfish family<br>• Length - 15-20 cm<br>• Prefers cool lakes and slow moving streams<br>• Spawns in rocky bottoms<br>• Takes cover in strong sunlight under docks and sunken wood |
| Smallmouth Bass *Micropterus dolomieu* |  | • Warmwater fish<br>• Length 25-50 cm<br>• Prefers clear, rock lakes and rivers, shoreline rocks and points, offshore shoals, deep water<br>• Spawns in gravelly bottom in nests |
| Black Crappie *Pomoxis nigromaculatus* |  | • Cool water fish<br>• Length 18-25 cm<br>• Prefers warm, clear, vegetated lakes, open areas adjacent to cover and access to deeper water in winter and summer<br>• Male Black Crappie clear the bottom of sand, gravel, or mud, in water 10 inches to 2 feet deep, where there is some vegetation. |

*Source - OMNRF - Fish Ontario - Fish Online and Scott and Crossman, 1998*

### 11.2.3 Little Long and Gould Lake

Gould Lake is a small lake with a shoreline perimeter of 17 km (10.5 miles). The majority of the lake is located within the CRCA Gould Lake Conservation Area. Gould lake is very deep with a maximum depth reaching 202 feet. There are several small islands, a few wetland areas and relatively few shoreline residences. Overall, the lake appears to be in good condition as the majority of the lake is contained within the Conservation Area (1990, Nearshore Habitat Survey). Known fish species include Lake Trout, Largemouth Bass, Smallmouth Bass, Brown Bullhead, Rock Bass, Yellow Perch, Bluegill, Pumpkinseed and Bluntnose Minnow.

Gould Lake is a natural reproducing lake trout lake (1970, OMNR, Inland Ontario Lakes Designated for Lake Trout Management). In July 1990, the nearshore habitat was documented by cruising the shoreline and preparing a map illustrating the nearshore substrate, aquatic vegetation, and shoreline development (see Map 11.5).

### 11.2.4 Fishing Limits and Consumption Advisories

Sydenham Lake is in Fisheries Management Zone 18, which covers most of eastern Ontario. Table 11.4 provides the Zone 18 fishing seasons and limits. Table 11.5 provides the most recent fish consumption advisory information based on the level of mercury found in fish according to location, species and length.

**Table 11.4 - Zone 18 Fishing Seasons and Limits**

| Species | Open Seasons | Limits | |
|---|---|---|---|
| | | Sport Fishing Licence | Conservation Fishing License |
| **Largemouth and Smallmouth bass** | 3rd Sat in June to Dec. 15 | 6 | 2 |
| **Northern Pike** | Jan 1 to March 31, and 2nd Sat. in May to Dec. 31 | 6 | 2 |
| **Yellow Perch** | Open all year | 50 | 25 |
| **Sunfish** | Open all year | 300, only 30 greater than 18 cm | 15 |
| **Crappie** | Open all year | 30 | 10 |

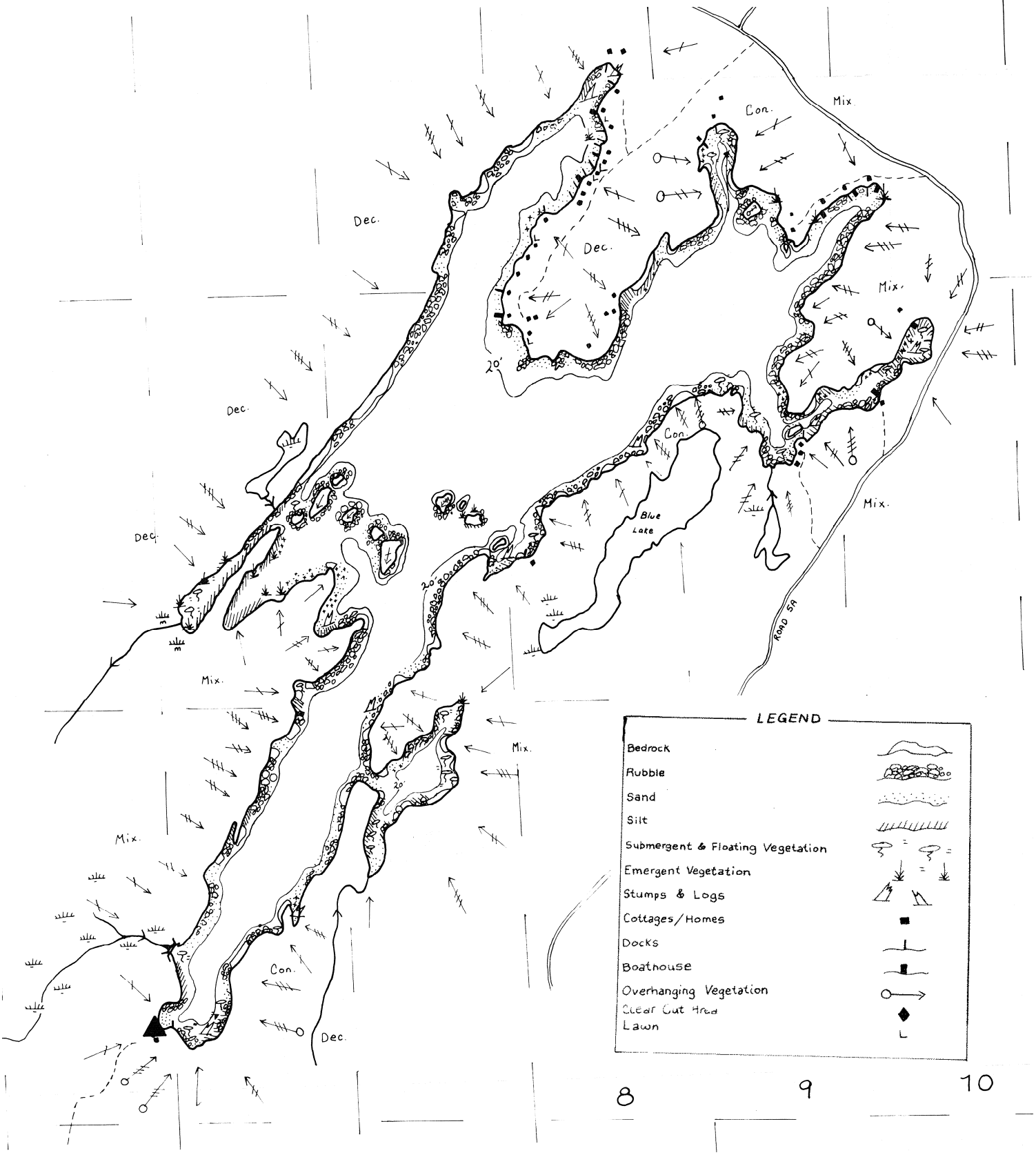
(*Ontario Fishing Regulations - Zone 18*)

**Table 10.5 - Number of Meals per Week Recommended for Fish of Variety of Lengths**

| Fish Species | 15-20 cm | 20-25 cm | 25-30 cm | 30-35 cm | 35-40 cm | 40-45 cm | 45-50 cm | 50-55 cm | 55-60 cm | 60-65 cm | 65-70 cm | 70-75 cm | >75 Cm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Black Crappie** | 32/12 | 16/4 | 8/4 | 4/0 | - | - | - | - | - | - | - | - | - |
| **Northern Pike** | - | - | - | - | - | 16/4 | 12/4 | 8/4 | 4/0 | 4/0 | 4/0 | 4/0 | 2/0 |
| **Smallmouth Bass** | 16/8 | 12/4 | 8/4 | 8/4 | 8/4 | 4/0 | 4/0 | 2 | - | - | - | - | - |
| **Yellow Perch** | 8/4 | | | | | | | | | | | | |

*Note - 8/4 = 1st number denotes recommended number of meals per month for the general population and / 2nd number denotes recommended number of meals per month for the sensitive population (women of child-bearing age and children under 15.*

**Map 11.5 - Gould Lake Fish Habitat - 1990**



### 11.2.5 Threats to Fish Population

#### Shoreline development

Development along the shoreline and in the water can cause harmful alteration to fish habitat. Shoreline property owners should be aware of best management practices to be followed when constructing new or replacing existing infrastructure. Permits from the CRCA should be obtained for all in water works to ensure protection of fish habitat. SLA provide information to shoreline property owners about best management practices to keep shorelines natural.

#### Angling Pressure and Fish Tournaments

Participants at the 2016 workshop indicated a concern about the impact that fishing tournaments may have on the fish population, shoreline residents and other recreational activity. However, limited information is available about past tournaments and who the organizers are. When fishing tournaments are organized, information about expected conduct (speed limits, boat wakes, fishing near docks) should be made available to tournament organizers and distributed to participants. Consideration should also be given to identifying sensitive areas (such as prime bass nesting areas) and requesting that pike fishers stay away from those areas until the spawning season is over.

#### Invasive Species

Invasive species may have an impact on the biology of a lake and can impact fish populations. Known invasive species in Sydenham Lake include zebra mussels and eurasion milfoil. Possible threats that may impact fish species include Spiny Water flea and Round Goby (see Section XXX Invasive Species). To lessen the likelihood of spread of these invasives, the OFAH's Invasive species hotline advise:

- Learn how to identify invasive species and how to prevent accidentally spreading them.
- Inspect your boat, trailer and equipment after each use. Remove all plants, animals and mud before moving to a new waterbody.Drain water from your motor, live well, bilge and transom wells on land.
- Rinse all recreational equipment with high pressure (>250 psi) or hot (50oC / 122oF) water OR let it dry in the sun for at least five days.
- Never buy or use invasive species such as round goby or rusty crayfish as bait. It is against the law to use round goby as bait or to have a live round goby in your possession.

#### *Observations – Fishery*

- Sydenham Lake is considered to have a warmwater thermal regime. Known fish species include Bluegill, Yellow Perch, Pumpkinseed, Brown Bullhead, Northern Pike, Largemouth Bass, Cisco, Yellow Bullhead, Rock Bass, Smallmouth Bass, Golden Shiner, Black Crappie
- Thirteen small streams flow into Sydenham Lake. Only two streams are permanent and may provide fish habitat. The other streams are intermittent and are unlikely to be provide fish habitat except where they enter the lake during high water levels in the spring.
- Despite the past stocking efforts in Sydenham Lake for Lake Trout, Yellow Pickerel and Maskinonge, no specimens were found in the 2014 survey.
- Gould Lake is a natural reproducing lake trout lake. Known fish species include Lake Trout, Largemouth Bass, Smallmouth Bass, Brown Bullhead, Rock Bass, Yellow Perch, Bluegill, Pumpkinseed and Bluntnose Minnow.

#### *Recommendations for Lake Plan Action*

- Work with the CRCA to educate shoreline property owners about the use of best management practices when constructing near the shoreline or in the water.
- Engage fishing tournament organizers to formulate appropriate rules/regulations to minimize the impact of these events on the natural environment and overall well being of the lake.
- Request that MNRF provide increased enforcement of fishing and ice fishing regulations.

# 12. Land Use

The following sources were referenced in this section:

- Cataraqui Source Protection Plan (CRCA, 2014).
- South Frontenac Official Plan.
- South Frontenac Zoning By-law.

## 12.1. Current Land Use in the Watershed

The land uses in the Sydenham Lake Watershed are comprised of a mixture of agriculture, urban settlement, rural residential, shoreline residential, and urban and resort commercial uses. The community of Sydenham is the one of the largest settlement areas in the Township of South Frontenac with an estimated population in 2016 of 567 (OMAFRA) and is located at the lake's outlet to Millhaven Creek.

Agricultural activities predominantly cover the northwestern and southern areas of the Lake Sydenham watershed, while wooded areas and wetlands cover the eastern portions of Sydenham Lake and the entire northern portion of the watershed (Map 12.1, Land Cover). Agricultural activities include cropland and pasture and there are no intensive livestock operations in the area. Agriculture lands to the northwest of the lake drain through 2 streams in the Western Catchment Area (Map 3.2, page 5); one stream is located on Sydenham Lake near the Bedford Road and the other through Bulls Eye Lake into Eels Bay. Agricultural lands to the south of the lake drain through 3 streams in the Southern Catchment Area; one located near Sheila Lane, one to the west of Georgia Lane and the other through a wetland located south of Morrison Road.

## 12.2. Current Shoreline Land Use

The land uses found immediately along the shoreline of the lake include permanent and seasonal residential, resort and urban commercial, and vacant lands. All shoreline properties are privately owned with the exception of 3 properties, Point Park and township office area (Township owned), a CRCA water access property located at the east end of the lake near the junction of Wilmer Road and Hogan Road, and the third property located at the west end of the Cataraqui Trail as it crosses Eel Bay. As well there are islands and shoals that do not appear to be private land and are likely Crown land. Two of these islands are located in the north end of Eel Bay and 14 Crown islands are in Sydenham Lake. According to the land assessment information there are also several parcels of land under the water that appear to be privately owned. This is likely due to the patenting of these lands prior to the dam being constructed and raising the water level of Sydenham Lake and Eel Bay.

An inventory of shoreline properties was undertaken using the property line (parcel fabric) information provided by the Township of South Frontenac (Map 12.2). This information was confirmed with similar data provided by the MNRF Land Information System and then reviewed with satellite imagery to determine whether the properties were built or vacant. The inventory was then compared with current zone categories (Map 12.3).

Table 12.1 illustrates the number of shoreline properties on the mainland and islands, grouped by type of zone category. The inventory included lots where the Cataraqui Trail exists between the property and shoreline, and properties with 2 zones (e.g., Environmental Protection and residential) were inventoried as residential.

In total there are 333 existing lots of record that are immediately adjacent to Sydenham Lake (Main and East Basin), Eel Bay and Little Long Lake: 290 properties on the mainland and 43 properties on islands. Sydenham Lake has a total of 170 mainland properties of which 26 (18%) are currently vacant, and 26 island properties, of which 19 (73%) are vacant. Eel Bay and Bulls Eye Lake have 95 mainland properties of which 22 (23%) are

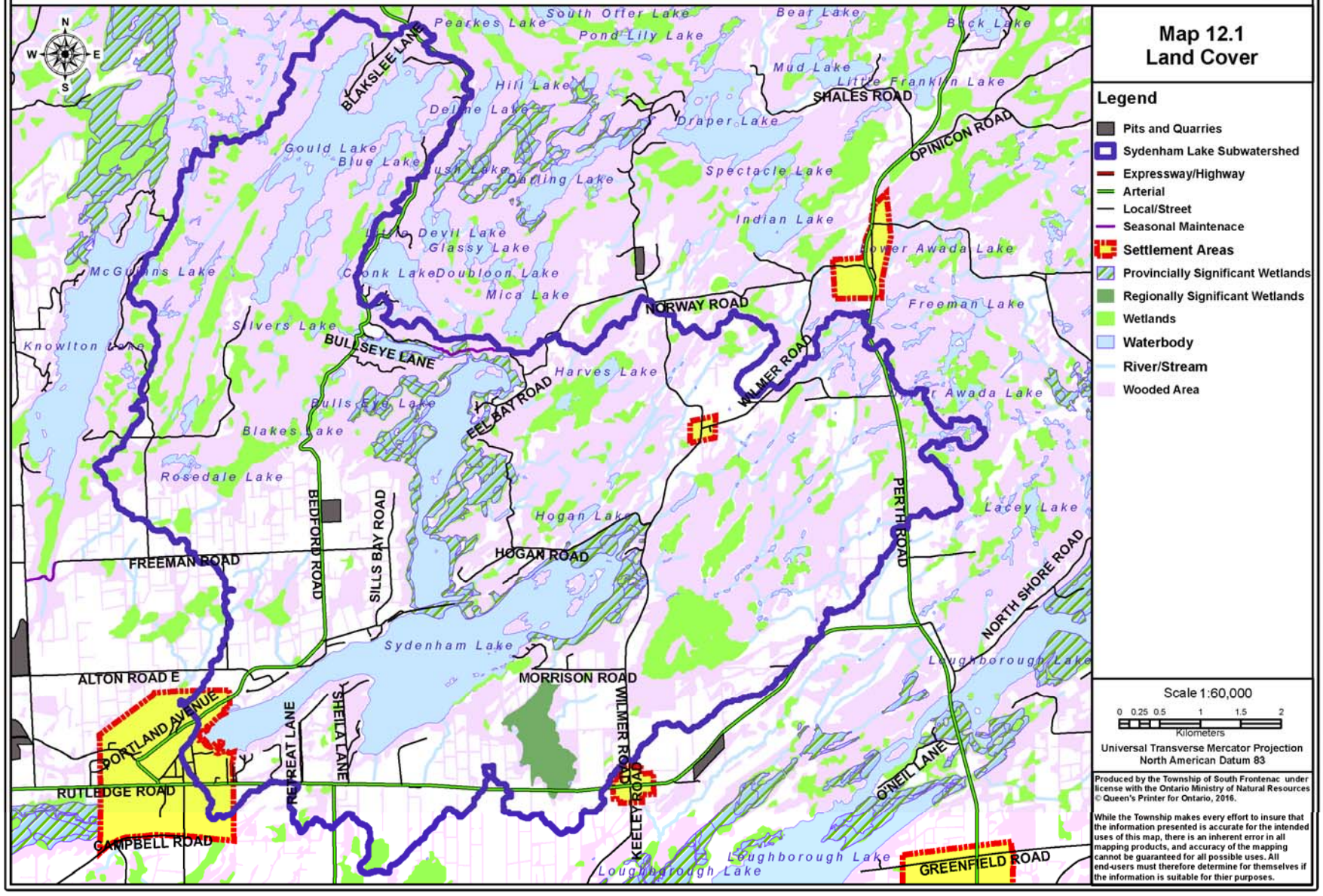
vacant, and 16 island properties of which 14 (87%) are vacant. Little Long Lake has 25 mainland properties with only 3 vacant and 1 vacant island property.

Many of the islands in Eel Bay and on Sydenham Lake are zoned Limited Service Waterfront Residential (RLSW), but are too small to meet the zoning requirements to obtain a building permit and therefore likely to remain vacant.

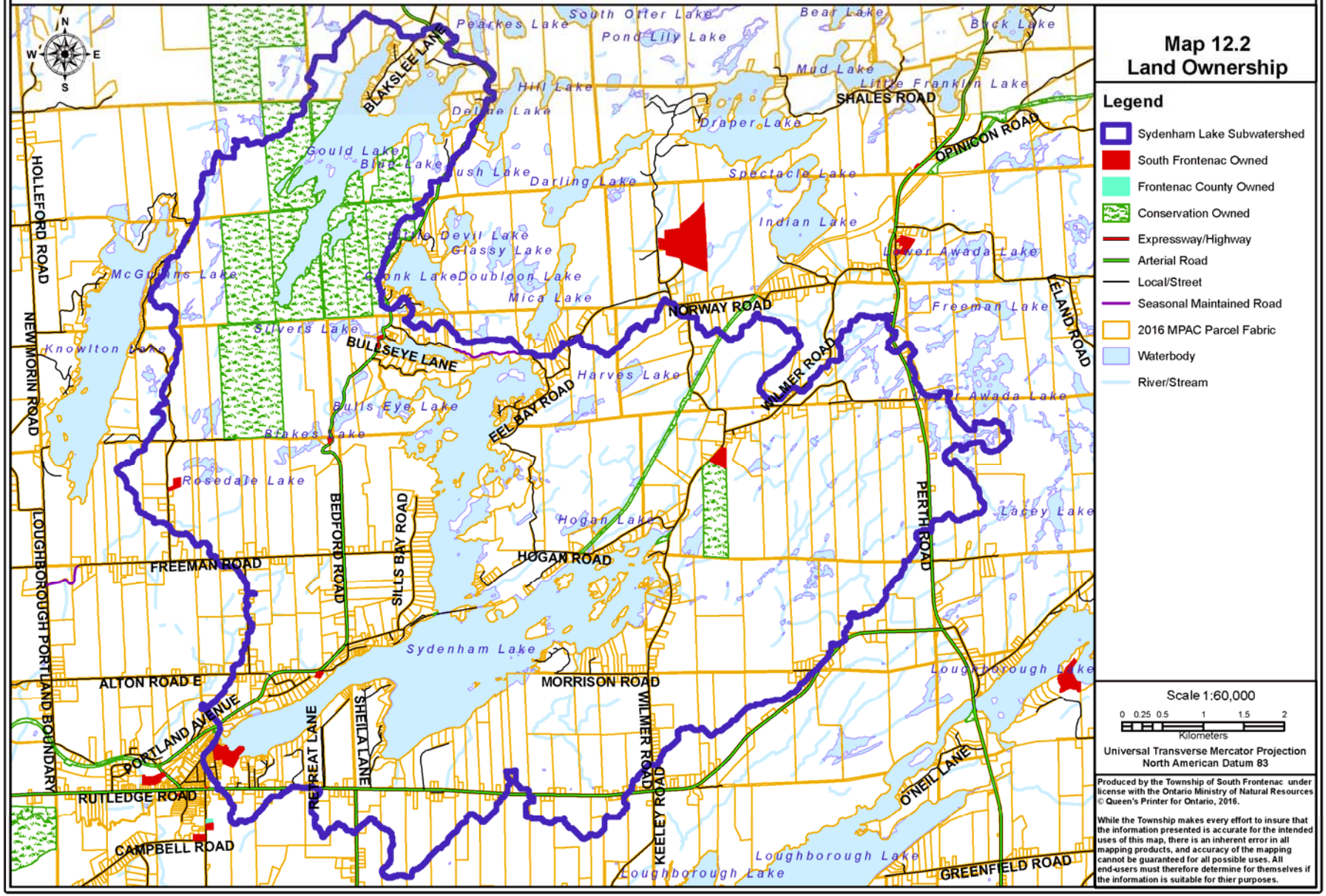
**Table 12.1 - Number of Shoreline Properties According to Current Zone Categories**

| Zone Categories | Sydenham Lake | | Eel Bay Bulls Eye Lake | | Little Long Lake | | TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|
| | Built | Vacant | Built | Vacant | Built | Vacant | Built | Vacant | TOTAL |
| **MAINLAND Properties** | | | | | | | | | |
| Rural (RU) | 12 | 8 | 3 | 8 | 3 | 1 | 18 | 9 | 27 |
| Urban (UC) | 3 | - | - | - | - | - | 3 | 0 | 3 |
| Recreational Resort (RRC) | 2 | - | 1 | - | - | - | 3 | 0 | 9 |
| Urban Residential (UR1) | 1 | - | - | - | - | - | 1 | - | 1 |
| Residential (R) | 9 | - | - | - | - | - | 9 | 0 | 9 |
| Waterfront (RW) | 37 | 1 | 51 | 8 | 9 | - | 97 | 9 | 108 |
| Limited Service Waterfront (RLSW) | 60 | 14 | 12 | 5 | 10 | 2 | 82 | 21 | 103 |
| Residential (R5) - Condo | 6 | - | 6 | - | - | - | 12 | 0 | 12 |
| Environmental Protection (EP) | 13 | 3 | - | 1 | | | 13 | 4 | 17 |
| Community Facility (CF) | 1 | - | - | - | - | - | 1 | - | 1 |
| **Mainland TOTAL** | **144** | **26** | **73** | **22** | **22** | **3** | **239** | **51** | **290** |
| **ISLAND Properties** | | | | | | | | | |
| Limited Service Island (RLSI) | 6 | 16 | 1 | 11 | - | 1 | 7 | 28 | 35 |
| Environmental Protection (EP) | - | 3 | 1 | 2 | - | - | 1 | 5 | 6 |
| Residential (R5) - Condo | - | - | - | 1 | - | - | 0 | 1 | 1 |
| Waterfront Residential (WR) | 1 | - | - | - | - | - | 1 | 0 | 1 |
| **ISLAND TOTAL** | **7** | **19** | **2** | **14** | **0** | **1** | **9** | **34** | **43** |
| **TOTAL** | **151** | **45** | **75** | **36** | **22** | **4** | **248** | **85** | **333** |

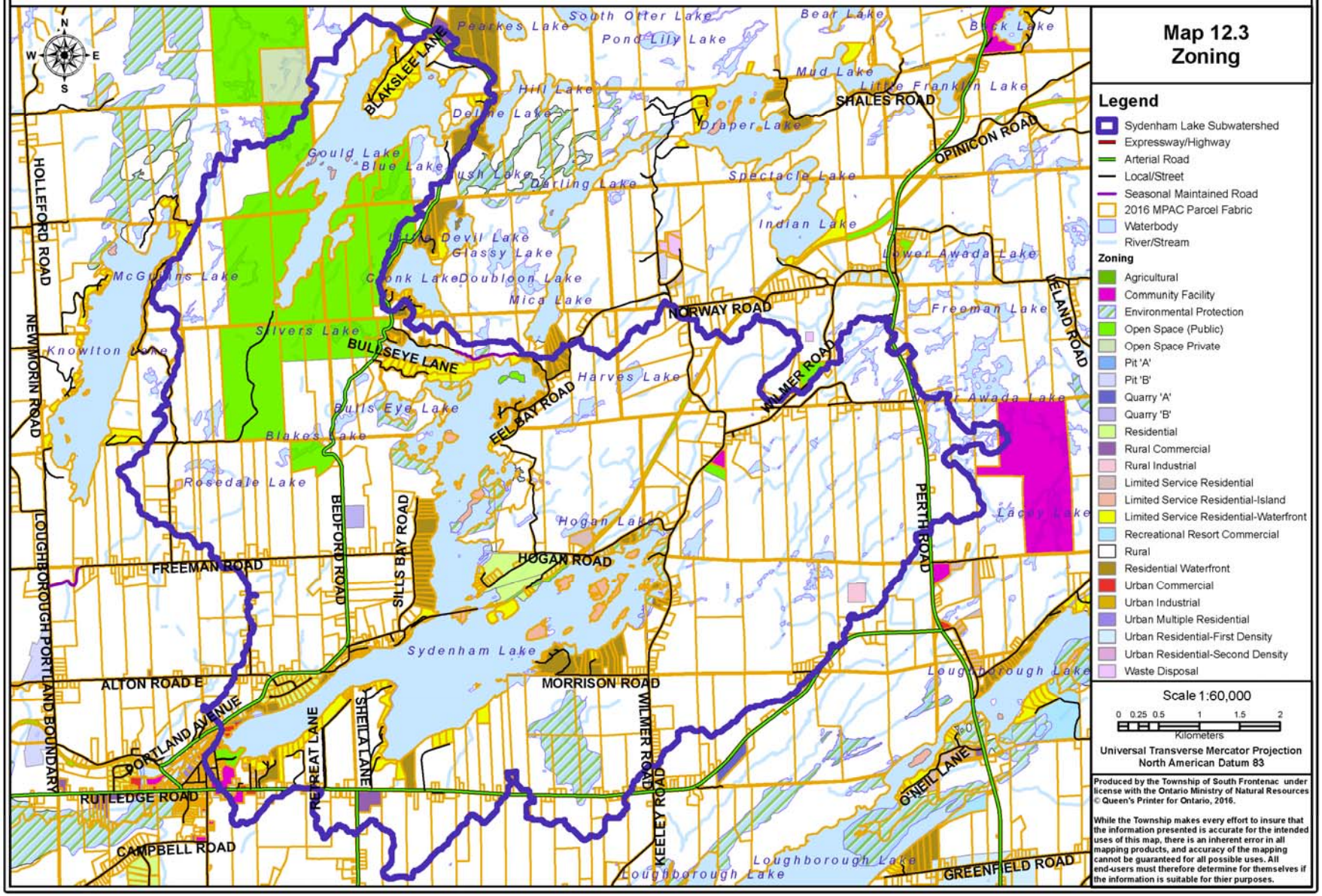
# Sydenham Lake State of the Lake Report



# Sydenham Lake State of the Lake Report



# Sydenham Lake State of the Lake Report



While there are no shoreline properties that are zoned Agriculture (A) there are 27 shoreline properties that are zoned Rural that permit agricultural activities to occur.

There are three properties zoned Resort Commercial (Table 12.3). Each of these properties have specific zone provisions that permit a maximum number of accommodation units as identified in Table 12.3. The zoning by-law permits a combined maximum number of accommodation units at these three resort properties of 62 units in the form of cottages, cabins, trailer sites, motor home sites and a dwelling for each property.

**Table 12.2 - Number of Commercial Accommodation Units**

| | Zoning | Cottages/Cabins | Trailer Sites | Motor Home Sites | Dwellings | Total |
|---|---|---|---|---|---|---|
| Glen Lor Lodge | RRC-20 | 12 | 29 | 1 | 1 | 43 |
| Sheila Lane | RRC 19 | 2 | 12 | - | 1 | 15 |
| Thakes Cabins | RRC-26 | 3 | - | - | 1 | 4 |
| TOTAL | | 17 | 41 | 1 | 3 | 62 |

In addition there are three properties located along the shoreline in the Village of Sydenham that are zoned Urban Commercial (UC) that allow a number of commercial uses (Table 12.3).

**Table 12.3 - Number of Other Commercial Zoned Properties**

| Property | Zoning | Use |
|---|---|---|
| Home Hardware | Urban Commercial (UC) | Outside Storage to hardware store |
| Home Hardware | Urban Commercial (UC) | Building - hardware store |
| Foodland | Urban Commercial (UC) | Building - grocery store |
| TOTAL Number | 3 | |

## 12.3. Potential for Development

There are two forms of development that could occur on these waterbodies - new development and redevelopment. New development refers to lot creation and building new residential, commercial or industrial buildings on vacant properties. New development requires a building permit and often a planning approval to be obtained from the Township, such as a severance application or zoning by-law amendment. Re-development includes the rebuilding or expansion of existing buildings.

New development - There are very limited opportunities for new development on these waterbodies due to the following factors:

- **Lot Creation** - There are very few shoreline properties with frontage in access of 180 m that could be split into additional 90 m lots. The Official Plan and Zoning By-law require a minimum of 90 m (300 ft) of shoreline frontage for new residential properties and there are only a few properties that may meet this requirement;
- **Building on Vacant Lots** - About 25% of shoreline lots are currently vacant. There are 30 vacant mainland lots and 28 vacant island lots that are currently zoned for residential purposes. Most of the mainland lots are likely able to obtain a building permit, however many of the vacant island lots do not have sufficient area and frontage for development.

- **Provincially Significant Wetland** - About 40% of the shoreline of Eel Bay and eastern Sydenham Lake is designated as a Provincially Significant Wetland. This designation generally prohibits additional development.
- **Expansion of Existing Commercial Resorts** - The 3 existing Resort Commercial Operations are at the maximum number of accommodation units permitted by the Zoning By-law and there is very limited room on these properties to permit expansion. Any increase in the number of accommodation units would require a zoning amendment.
- **New Resort commercial** development requires a minimum frontage of 250 ft along the shoreline, and although there are some lots that may meet this requirement, currently, there appears to be limited demand for new resort commercial development in southern Ontario.

Re-development - There are many opportunities for the redevelopment of existing properties on these waterbodies, including:

- **Rebuilding or expansion of residential uses** - The rebuilding or expansion of all existing structures can occur in accordance with the requirements in the zoning by-law (e.g., setbacks, lot coverage, etc.).
- **Bed and Breakfast** - BnB's are considered to be home occupations and are permitted in residential zones provided certain provisions of the by-law are met.
- **Expansion of Agricultural Uses** - There are 35 shoreline properties that are currently zoned Rural (RU) which may permit the expansion of agricultural uses. Most of the properties are located along the southern shoreline of the Main Basin where a wooded steep ridge separates agricultural lands from the lake.

## 12.4. Land Use Control -Official Plan and Zoning By-law

There are two documents that direct and regulate land uses in the Township of South Frontenac, the Official Plan and a Comprehensive Zoning By-law. Both documents are currently under review.

**Official Plan**

Schedule 'A' of the new official Plan identifies 5 land use designations in the Sydenham Lake watershed (Map 12.4).

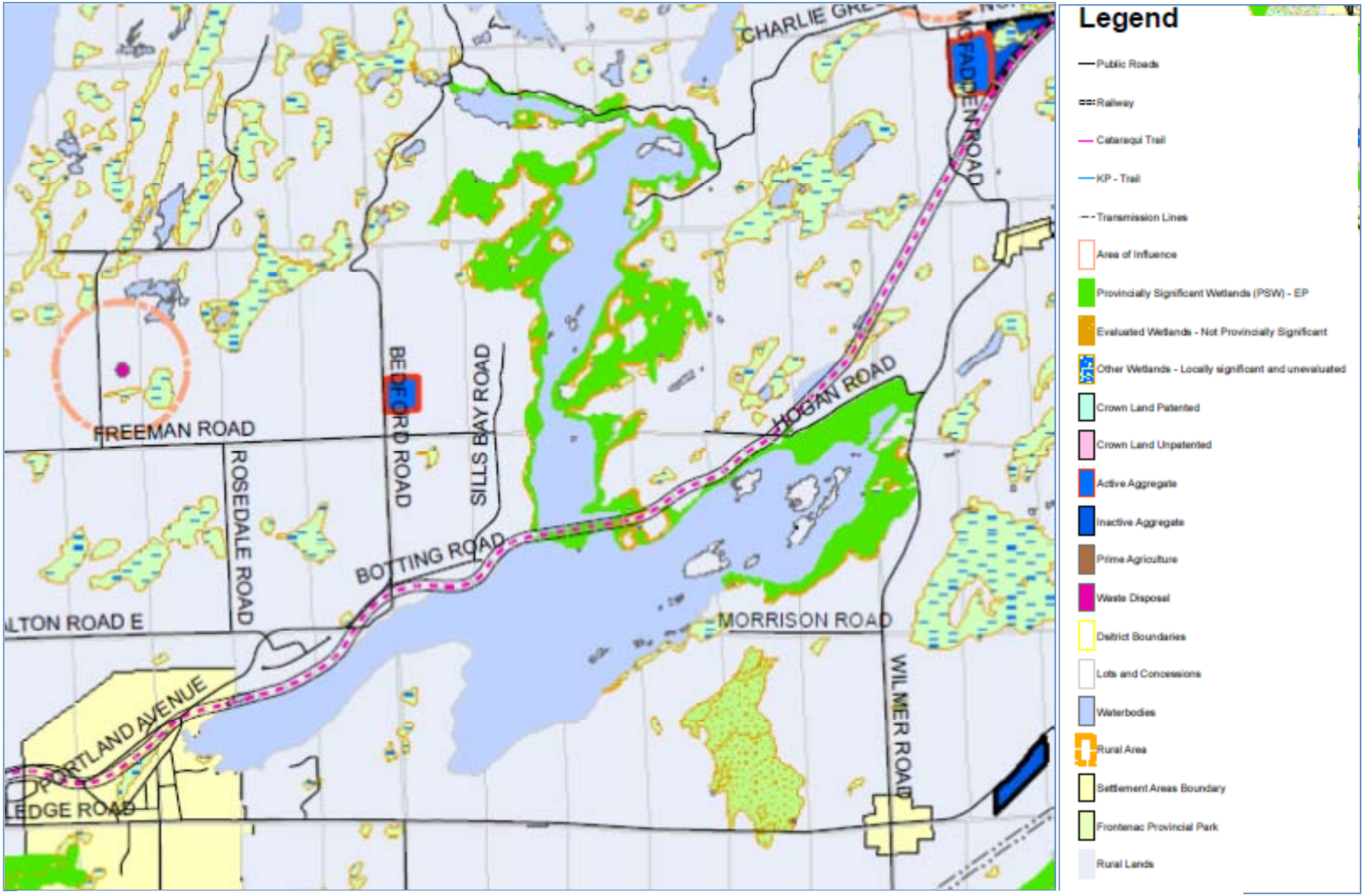
**Rural** - is the predominant land use designation located along the shoreline of Sydenham Lake and the lands in the watershed and provides for a range of land uses including agriculture, rural residential and limited service residential development and open space and conservation.

**Settlement** - includes the defined area within the Village of Sydenham. Specific policies are provided for a range of uses expected in a small community.

**Active Aggregate** - includes one small area on the Bedford Road that is designated for an existing gravel pit.

**Provincially Significant Wetlands** - covers all lands that have been evaluated and deemed to be provincially significant and prohibits development in these areas.

**Other Wetlands** - Local and Unevaluated - covers all other wetlands.




**Map 12.4 - Clipped Portion of Schedule 'A' of the New Official Plan**

## Zoning By-law

Map 12.4 illustrates the zoning categories of properties along the lake and in the watershed and Table 12.4 provides a list of requirements for lot coverage, water frontage, lot area and shoreline setback for the zone categories. Many of the older shoreline residential buildings that were built before the passing of the zoning by-law do not meet the 30 m shoreline setback requirement.

**Table 12.4 - Zoning By-law Requirements for Most Shoreline Lots**

| | # Shoreline Lots (built and vacant) | Building Requirements | | | | |
|---|---|---|---|---|---|---|
| | | Lot Coverage | Water Frontage | Lot Area (sq. metres) | Shoreline setback | Height |
| **RURAL DESIGNATION** | | | | | | |
| Waterfront Residential (RW) | 108 | 5% | 91 m | 10,000 | 30 m | 11 m |
| Limited Service Residential - Waterfront (RLSW) | 103 | 10% | Not required | 8,000 | 30 m | 11 m |
| Limited Service Residential -Island (RLSI) | 35 | 5% | 91 m | 2 ha | 30 m | 11 m |
| Rural Zone (RU) | 27 | 20%* | 76 m | 8,000 | 30 m | 11 m |
| Recreational Resort Commercial (RC) | 3 | 40% | 76 m | 8,000 | Depends on use | |
| Residential | 9 | 20 % | 76 m | 8,000 | n/a | 11 m |
| **SETTLEMENT DESGINATION** | | | | | | |
| Urban Residential First Density (UR1) | 1 | 5%** | 76 m | 8,000 | n/a | 11 m |
| Urban Commercial (UC) | 3 | 40%* | 76 m | 8,000 | n/a | 11 m |

** no special requirement for waterfront lots, ** for waterfront lots*

### *Observations - Land Use*

- There are 333 existing lots of record that are immediately adjacent to Sydenham Lake (main and east basin), Eels Bay and Little Long Lake: 290 properties on the mainland and 43 properties on islands. 248 properties (75%) are built, and 85 properties (25%) are vacant.
- Many of the vacant islands in Eel Bay and on Sydenham Lake are zoned Limited Service Waterfront Residential (RLSW), but are too small to meet the zoning requirements to obtain a building permit and therefore likely to remain vacant.
- While there are no shoreline properties that are zoned Agriculture (A) there are 27 shoreline properties that are zoned Rural that permit agricultural activities to occur.
- There are very limited opportunities for new development (lot creation, expansion of existing commercial, creation of new commercial operations) on these waterbodies.
- There are opportunities for the redevelopment of existing shoreline properties, including rebuilding or expansion of residential uses, Bed and Breakfast operations and expansion of agricultural uses.
- Many shoreline residential buildings were constructed before the passing of the zoning by-law and do not meet the required 30 m setback from the shoreline.
- The Official Plan and Zoning By-law are currently under review.

### *Recommendations for Lake Plan Actions*

- Continue to work with the Township in the development of the new Official Plan and Zoning By-law. Include policies that require the retention of shoreline vegetation and protects the natural character of the lake.
- Promote stewardship activities that support and complement the policies of the official plan and zoning by-law.

# 13. Social and Recreation

Sydenham Lake, Eel Bay, and Little Long Lake provide their residents and visitors a high quality natural environment within which to enjoy a sense of community, diverse recreational activities and quiet and tranquility. These were among the list of values identified by the participants in the August, 2016 community workshop.

**Table 13.1 - Socially Important Values - Sydenham Lake Community Workshop (2016)**

| | |
|---|---|
| **Quiet and Tranquility** | · A place to relax<br>· We value the quiet, especially early morning and at night<br>· 'Liveability'<br>· Not too many lights at night |
| **Sense of Community** | · Great sense of community displayed by people on the lake |
| **Recreational Enjoyment** | · Long-lasting recreation (family activities)<br>· Family enjoyment on and off the water<br>· Cataraqui Trail<br>· Ability to canoe, kayak, bike, hike – at my back door |
| **Appreciation of Wildlife** | · E.g., osprey, loons, beaver, fish, snakes |
| **Fishing** | · Fish population is plentiful |

The sense of belonging and social interaction is also clear from the workshop participants when they were asked to list some of their special memories of the lake. There are direct links to the Village of Sydenham, historical events, community events on and around the lake, extended family gatherings and activities, and enjoyment of the many outdoor facilities around the lake. The lake and its environment are central to the lifestyle and social engagement of those who live around the lake, and this was very evident when workshop participants were asked to express some of their values and fond memories.

**Table 13.2 – Memories Identified by Participants - Sydenham Lake Community Workshop 2016**

***Memories of the lake……***

- I've been here for 80 years, our cottage is 120 years old
- 50 years of memories
- The evolution from a cabin to a house
- The TRAIN - the train whistles into the late '70s
- The railway station
- When the mill burned down in the '40s; and when 3 burned in the '70s
- McGreer's Grocery: weighing babies; penny candy
- Peace and tranquility
- Ice skating on the lake
- Cross country skiing on the lake
- Teaching the kids to water ski
- Skiing at dusk and at dawn
- Campfires on the Point
- We found our house when we used to run on the trail
- Sunrise over the lake
- How the lake has brought our family together, providing the best 'quality time'
- Tubing and swimming with family members
- Seeing my first: bald eagle, trumpeter swan, rat snake
- Otters playing on shore
- Loon cries and other birds
- Spending the first night in our house and hearing the loons instead of traffic from town
- Events – at SLCC, Sydenham Triathlon, Fireworks
- Our kids learning to swim, dive, waterski, wakeboard, kayak, canoe, ice skate, snowshoe, and develop a love of the outdoors
- Seeing less garbage in the lake over time

**'Really a great place to live/enjoy/explore'**

Lake users include the full-time residents, cottagers, guests at the two commercial resorts, and day-users. Many of the day-users come to fish on the lake, and take advantage of the two public access points, at either end of Sydenham Lake. Others come to enjoy the beach and associated facilities at The Point, or to use the Cataraqui Trail. Sydenham Lake lies in Kingston's urban/rural fringe and because of this short distance it is anticipated that many recreationalists come from that urban centre.

Map 13.1 illustrates the location of recreational facilities located around Sydenham Lake.

## 13.1. Sydenham Lake Association

The Sydenham Lake Association (SLA) and its predecessors have a long history. The current iteration was established in 2012, as an incorporated, not-for-profit organization, with the mission: '……to enhance the enjoyment of Sydenham, Bulls Eye, and Little Long Lakes, now and for future generations'. The SLA undertakes projects and programs to benefit the lakes and the community and interests around the lakes, and helps to sponsor special events. Current membership of the SLA is approximately 125.

### Active communications tools

With regular emails, a website, Facebook Page, regular bulletins, and annual newsletters, the SLA keeps its members well informed on the activities of the association, and other relevant matters. The association also maintains communications with South Frontenac Township, Frontenac County, Cataraqui Region Conservation Authority, and the Ministries of Natural Resources and Forestry and Environment and Climate Change.

### Canada Day Fireworks

For many years, the SLA has sponsored the Canada Day fireworks, which takes place at The Point and draws people on land and water to the west end of the lake to this professional display of fireworks.

### Sydenham Triathlon

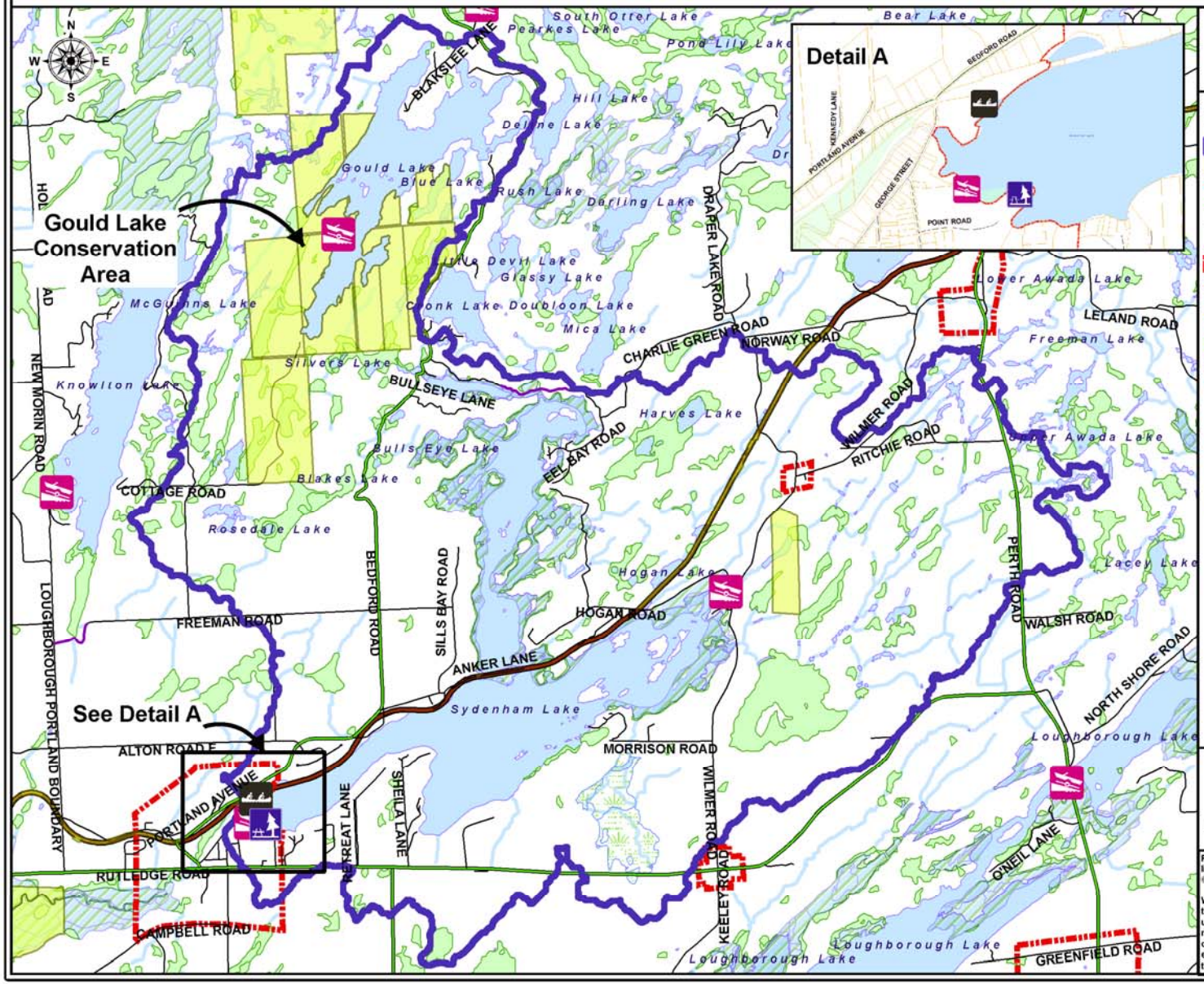
Another event sponsored by the SLA is the annual Sydenham Triathlon/Duathlon, which is centred at The Point, and takes runners through the village, along the Cataraqui Trail, and into the lake. The event attracts around 400 participants.

### Lake-Related Projects

The association undertakes a wide array of programs and projects on and around the lake. These include:

- Regular water quality monitoring, using the provincial Lake Partner Program;
- The ‘Share the Lake’ project consisting of installing a series of signs to remind users that there are others who are enjoying the lake, and that everyone should try to ‘share the lake;’
- ‘Watch your Wake’ signs, with speed limit signs have been erected at a number of locations including both public and private boat launches;
- In 2015, the SLA began a project to name the islands in the lake. One of the reasons for the project was to ensure water-access properties could have their locations identified for the purpose of emergency access.
- SLA members have been monitoring the time of ice in and ice out since 1987;
- Hosting various guest speakers to the Annual General Meeting of SLA;
- Measuring and mapping the lake depths (bathymetry). Lake depth measurements have been taken bathymetric maps will be printed and available for purchase.

# Sydenham Lake State of the Lake Report




## Map 13.1 Recreational Facilities

### Legend

- Sydenham Lake Subwatershed
- Conservation Owned Lands
- Expressway/Highway
- Arterial Road
- Local/Street
- Seasonal Maintained Road
- Settlement Areas
- Cataraqui Trail
- Provincially Significant Wetland
- Regionally Significant Wetland
- Wetland
- Waterbody
- River/Stream
- Sydenham Lake Canoe Club
- Public Boat Launch
- The Point

Scale 1:60,000

0 0.25 0.5 1 1.5 2

Kilometers

Universal Transverse Mercator Projection
North American Datum 83

## 13.2. Cataraqui Trail

The Cataraqui Trail follows a section of abandoned CN Railway running from Strathcona near Napanee to Smiths Falls. The trail runs adjacent to the north shore of Sydenham Lake and through the Village of Sydenham. Most of the trail corridor is owned by the Cataraqui Conservation Authority, having been granted title when CN Rail disposed of the land.

This trail is part of a large regional trail network, with links to the K&P Trail (Kingston to Sharbot Lake) at Harrrowsmith and to the Rideau Trail near Chaffey's Locks, which continues north to Ottawa. The portion of the Cat Trail from Harrowsmith to Chaffey's is also part of the Trans Canada Trail.

Users can walk, bike, ride horses all year long, and ski and snowmobile during winter.

## 13.3. Boat Launches and Public docks

There are two public access points on Sydenham Lake, one at the southwest end of the lake near The Point (managed by South Frontenac Township), and the second at the northeast, off Wilmer Road (managed by the Cataraqui Conservation Authority). These launches are very popular with local and non-local visitors, especially those who are coming to the lake to fish. The dock at the east end of the lake is used by duck hunters in the fall who hunt in the adjacent wetland. The proximity to Kingston allows easy access – a 30-40 minute drive from the city.

Two additional boat launches are available to resort visitors at Thake's Cottages on Eel Bay, and Glen-Lor Lodge on the south shore of Sydenham Lake.

There is also a set of docks available to the public located in the bay by the dam. These allow people to come to the village by boat, dock right beside the Home Hardware and Foodland grocery store, or walk to the Point or into the village if they wish.


## 13.4. The Point

The Point is a popular day-use park managed by the Township of South Frontenac. There are picnic areas, picnic shelters, a sandy beach, and a boat launch. Children's day camps operate at The Point during the summer, and it is the site for many special activities over the year including Canada Day festivities.

## 13.5. Sydenham Lake Canoe Club

Sydenham Lake Canoe Club, a competitive sprint canoe and kayaking club, was established as a 'group of gentlemen canoeists' in 1886. The club known as the Cataraqui Canoe Club was asked by a group of sailors in Kingston to join them to establish the Kingston Yacht Club in 1896. In the 80 years that followed, the Cataraqui Canoe Club had many temporary homes along the Kingston waterfront. In the 1980s, the Cataraqui Canoe Club constructed its own building on the Cataraqui River because the open waters of Lake Ontario proved to be too choppy for canoeing and kayaking. The club developed to form two streams, the competitive stream and the recreational stream. In the mid-1990s, members of the competitive stream were finding that

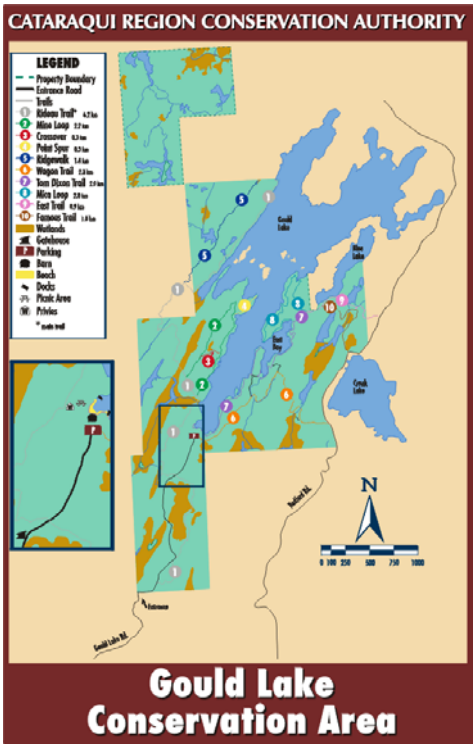
the lower water levels and resulting weediness on the river were making it difficult for club members to train for competitive events. In 1995, under the leadership of Olympian George Jones, a determined local Board of Directors, and a small grant from the Club, the competitive component left the Cataraqui Club to paddle on the deeper waters of Sydenham Lake. Sydenham Lake Canoe Club was officially established two year later in 1997. The club, now 20 years old, rests on a small tract of loaned land just off the south eastside of the Cataraqui Trail in Sydenham.

The club offers recreational canoe and kayaking lessons and day camp for youth, and a youth and adult competitive program. Though the club remains small, and highly competitive members often move on to larger clubs, it has produced three high performance female athletes: Natasha Ostopovich who medalled in canoeing in the Canada Games in 2005, Cia Myles Gonzalez, who medalled at Nationals in canoeing in 2014, and National Team Development Athlete Genevieve L'Abbe, who competed in the Junior Worlds Championships in kayaking in Portugal in 2015. The club boasts one of the best nationally sanctioned regatta racing courses in Ontario as the lake is known for its clean calm deep waters. Competitive regattas are held yearly on 'the Point' in Sydenham.

## 13.6. The Village of Sydenham

The Village of Sydenham is an important presence at the west end of Sydenham Lake. The village provides full services to those who live on and around Sydenham Lake, including: banking, shopping, gas, car repair, funeral services, elementary and high schools, and more. The village also includes the offices of South Frontenac Township, and a new library building. Those living on the lake can get access to the village by boat, and dock by the Home Hardware and Foodland grocer.

## 13.7. Gould Lake Conservation Area and Outdoor Education Centre




The land around the southern end of Gould Lake is owned by the CRCA, and operated as a public conservation area and an outdoor education centre for the Limestone School Board. Gould Lake Conservation Area consists of 589 hectares, and includes the head waters of the Millhaven Creek System.

Gould Lake is a day use area, with a beach, picnic areas, canoe rentals, and a series of trails. In addition to these public recreation facilities, the Limestone District Board of Education operates its outdoor education programs on this property. The main Rideau Trail and several side loops are located within the conservation area.

## 13.8. Boating and Fishing

Sydenham Lake is a popular for boating and fishing, for those who live or cottage on the lake and those who visit from elsewhere. In addition, the lake supports an active canoe club, with canoe and kayak lessons and competitions taking place all summer.

The two boat launches are popular for day-users who often come to the lake to fish, and are used by those who participate in local fishing tournaments a few times per season.

The level of boating traffic, size of boats, boat speeds, and wakes were identified as issues in the SLA survey as well as at the 2016 Workshop. Boating safety and boating etiquette need to be addressed.

## 13.9. Light Pollution

The brightening of the night sky is a universal problem and the popularity of landscape lighting adds to the unnatural level of light around the lake. Participants at the 2016 Workshop expressed a concern over loss of the dark skies above the lake. Several people thought that there is generally an over-use of lighting, with LED lighting being a particular problem, as well as cell tower lighting. The Township does not have a dark sky by-law.

### *Observations - Social and Recreation*

- The SLA supports community activities and coordinates several projects that promote awareness about community values and caring for the health of the lake.
- Sydenham Lake is within the urban rural fringe of Kingston, which makes it easily accessible to a large number of people.
- There are many recreational and community facilities available to the public including water access ramps, parks, conservation areas, Cataraqui Trail and the lake.

### *Recommendations for Lake Plan Actions*

- The SLA, municipalities and CRCA work together to collectively take action and promote education to protect the health of Sydenham Lake. They should meet on annual basis to review actions taken and establish new activities related to the lake.
- Establish a broad-based education program with focus on safety and respectful lake use, to include: speed limits, rules of conduct, management of boat wakes, noise abatement, and pollution control.
- Develop a Code of Conduct brochure for boating and lake use, to be distributed widely
- Promote awareness of the importance of reducing light pollution to the social enjoyment and ecological well being of the lake and provide educational materials to lake residents and users that will help shift lighting habits to improve night sky conditions around Sydenham Lake.

# 14. Recommendations for Lake Plan Actions

*The following is a summary of the recommendations contained in the State of the Lake Report to be considered in the development of the Sydenham Lake Stewardship Plan.*

| ***Recommendations for Lake Plan Action*** | |
|---|---|
| ***Lake & Watershed Characteristics*** | 1. Identify and assess general flow of water in inlets during peak (spring) and low flow scenarios (summer/fall).<br>2. Continue water quality monitoring based on the assumption of three distinct basins (Main, East & Eel Bay).<br>3. Monitor run off from farm land. |
| ***Climate Change*** | 4. Encourage local stewardship actions (such as reducing nutrient inputs, preserving and restoring riparian vegetation, inspecting and upgrading septic systems) to help buffer against impacts associated with climate change.<br>5. Implementation of farming best management practices within the entire subwatershed to reduce erosion and contaminated runoff entering lakes.<br>6. Implementation of stormwater best management practices within urban and rural areas.<br>7. Ensure maintenance of, and where needed, rehabilitation of, natural wetlands to promote water conservation and storage within the subwatershed. |
| ***Source Protection Plan*** | 8. Work with the Township to establish a septic system maintenance awareness program focusing on education, communication and voluntary action.<br>9. Work with the Township to complete a Road Salt Management Plan to lessen the impacts of road salt on Sydenham Lake.<br>10. Provide information to shoreline property owners those in watershed about how to keep the lake water healthy (e.g., restricting use of fertilizers, maintaining natural shorelines, restoring lawns to natural areas). |
| ***Geology and Soils*** | 11. Undertake a soil survey in watershed to characterize percentage calcium carbonate, percentage aluminum and percentage iron in native soils to better understand the capability of local soils to bind phosphorus coming from septic systems. |
| ***Water Levels*** | 12. Continue to work with CRCA to monitor water levels and continue to communicate and provide information to all shoreline property owners. |
| ***Water Quality*** | 13. Continue annual sampling of Sydenham, Eel Bay, and Little Long Lake and analyse for water clarity (Secchi disk depth) and total phosphorous – under the Lake Partners Program.<br>14. Establish a sampling program on Gould Lake.<br>15. Establish a sampling program for sodium and chloride levels in Sydenham Lake at the stormwater outfalls near the village and establish 'best management practices' to mitigate the impact of salt application. An effective sampling program would also include bacteria, Total Suspended Solids, oil and grease, and water flows.<br>16. Continue measuring timing of ice-on/ice-off on Sydenham and Little Long Lakes. Initiate on Gould Lake.<br>17. Establish a boat-washing station at the boat launch near the Point to reduce the spread of invasive species into and out of Sydenham Lake.<br>18. Establish an intensive education program re. invasive species on Gould Lake.<br>19. Monitor inflow and outflow temperatures and phytoplankton on Sydenham Lake. |

| *Recommendations for Lake Plan Action* | |
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| | 20. Work with the community and the township to establish a septic inspection program within the watershed.<br>21. Implement a storm water management program in Sydenham Village.<br>22. Consider applying the (voluntary) 'Love Your Lake' program to identify natural condition of shoreline areas, and suggestions for re-naturalization.<br>23. Consider need for applying 'best management practices' on surrounding farmlands, and means to implement the BMPs.<br>24. Consider revising policies in the Official Plan regarding the redevelopment of shore lots. For example, applications for a building permit should follow the principle of net improvement in terms of total phosphorous loading from the lot – by means such as planting shoreline vegetation, re-directing lot drainage. |
| ***Natural Environment*** | 25. Conduct a thorough inventory of flora and fauna.<br>26. Continue monitoring and research of Species at Risk and Invasive Species to ensure the overall health of the Sydenham Lake ecosystem.<br>27. Conduct an evaluation of unevaluated wetlands under the Ontario Wetland Evaluation Service (OWES) to determine provincial and regional significance.<br>28. Establish programs to provide information and education to property owners about the protection and rehabilitation of shoreline areas.<br>29. Work with Watersheds Canada for shoreline naturalization. http://watersheds.ca/our-work/the-natural-edge/ |
| ***Fishery*** | 30. Work with the CRCA to educate shoreline property owners about the use of best management practices when constructing near the shoreline or in the water.<br>31. Engage fishing tournament organizers to formulate appropriate rules/regulations to minimize the impact of these events on the natural environment and overall well being of the lake<br>32. Request that MNRF provide increased enforcement of fishing and ice fishing regulations. |
| ***Land Use*** | 33. Continue to work with the Township in the development of the new Official Plan and Zoning By-law. Include policies that require the retention of shoreline vegetation and protects the natural character of the lake.<br>34. Promote stewardship activities that support and complement the policies of the official plan and zoning by-law. |
| ***Social and Recreation*** | 35. The SLA, municipalities and CRCA work together to collectively take action and promote education to protect the health of Sydenham Lake. They should meet on annual basis to review actions taken and establish new activities related to the lake.<br>36. Establish a broad-based education program with focus on safety and respectful lake use, to include: speed limits, rules of conduct, management of boat wakes, noise abatement, and pollution control.<br>37. Develop a Code of Conduct brochure for boating and lake use, to be distributed widely<br>38. Promote awareness of the importance of reducing light pollution to the social enjoyment and ecological well being of the lake and provide educational materials to lake residents and users that will help shift lighting habits to improve night sky conditions around Sydenham Lake. |

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