Report on the State of Otty Lake and its Watershed

May 2007

Otty Lake Association and volunteers

With assistance from:

The Lake Management Planning Program

Intent

The intent of the Report on the State of Otty Lake and its Watershed is to provide a summary of what is currently known about the Otty Lake Watershed and how that information relates to the issues that are important to the Otty Lake community. This information will be used to make recommendations about land use policy and stewardship action to ensure the long-term health of Otty Lake. These recommendations will be contained in a second document, the Otty Lake Management Plan.

Executive Summary

In 2004 the Otty Lake Association (OLA) and its members began the process of developing a lake management plan (LMP). A LMP is a long-term action plan that is developed and applied by the lake community to protect the special character of Otty Lake.

The first step in the process was to recruit volunteers from the lake community to form the Otty Lake Management Planning Committee (OLMPC). One of their many tasks was to develop and distribute a survey to identify what the lake community valued about the lake. Once the issues and concerns of property owners and lake users were identified, OLMPC volunteers set to work collecting information and learning about the issues.

Decision makers and property owners need to know the current condition of the watershed before recommendations to protect the lake can be developed. As identified in the Intent, the Report on the State of Otty Lake and its Watershed provides a summary of what is currently known about the Otty Lake Watershed and describes how that information relates to the issues that are important to people that enjoy the lake. Members of the Otty Lake community will use this information to make recommendations about land use policy and identify stewardship action which will help to ensure the long-term health of Otty Lake.

The Otty Lake Watershed (includes all of the land that drains into Otty Lake):

- Is one of 14 subwatersheds of the larger Tay River watershed
- Includes seven small lakes in addition to Otty Lake, and many wetlands
- Contains generally poor agricultural land and is covered primarily in forest

Otty Lake has:

- A rocky shoreline with thin soil cover and steep slopes
- An average depth of 9 m (30 ft) and maximum depth of 27 m (90 ft)
- Five or more streams flowing into the lake: at least three seasonal, two year-round
- One slow outflow (Jebbs Creek): Given how much water comes into the lake and how much leaves, it would take 3 to 4.5 years for the entire lake volume to flow out through Jebb Creek

1. Surface Water Quality

- Measures of total phosphorus, organic nitrogen and ammonia were found to be higher than at some other area lakes and indicate good growing conditions for aquatic plants and algae
- Some water samples were found with high bacterial contamination although repeated sampling suggests that most bacterial problems are not persistent

2. Aquatic Vegetation

- Thick patches of invasive plants grow in the shallow areas and bays of the lake
- There have been problems in the past with algae blooms (i.e. 2002)
- Little is known about how aquatic plant growth has changed over time
- Because of high nutrient levels, future algae blooms may occur

3. Groundwater Quality and Quantity

- There is an adequate supply of clean groundwater. The water is generally hard meaning it has a high mineral content
- There has been an increased demand on groundwater resources as more cottages are converted to permanent homes with dishwashers, laundry facilities, full bathrooms, etc
- Because of the thin soil cover, the groundwater supply is naturally more susceptible to contamination from activities on the surface

4. Water Levels

- The flow of water out of Otty Lake is naturally slow
- The lake level fluctuates naturally depending on precipitation and air temperature although obstruction to water outflow and excessive water usage can also affect lake levels
- There are three to four active beaver colonies building or maintaining dams along Jebbs Creek every year
- The beaver population in the lake and along Jebbs Creek is thought to have decreased over the years as the availability of suitable trees for food and dam construction has declined

5. Development Pressure

- Including Burgesswood and Maple Glen subdivisions, there were 547 shoreline and near shoreline dwellings on Otty Lake in 2005, half of which are permanent homes
- There are approximately 47 vacant waterfront lots remaining on Otty Lake
- The conversion of cottages into permanent homes, large homes on small waterfront lots and suburban development have impacted on the historical cottage character of the lake.
- Otty Lake is close to services (only minutes away from the towns of Perth and Smiths Falls) and urban centres (a one hour drive from the cities of Ottawa and Kingston)

6. Fish and Wildlife Health

- There has been little recent scientific data collected about the condition of fish and wildlife in the watershed
- The lake appears to support healthy warm and cool water fish habitat and communities
- Jebbs Creek also sustains warm and cold water fish communities and provides important nursery habitat for fish from Otty Lake and the Tay River
- Threats to fish and wildlife include the loss of habitat through development and re-development, the removal of natural shoreline vegetation, decreased water quality, as well as over-harvesting and poaching

7. Mining Rights and Claims

- There are currently no active claims within the Otty Lake watershed
- The mineral rights of approximately 25 % of the properties reside with the crown
- All surface-rights-only land is at risk of future staking, exploration and mining

8. Shoreline Protection and Health

- More than 50% of properties on Otty Lake have greater than 50% ornamental shorelines (natural vegetation has been removed from more than 50% of the shoreline)
- Properties with altered shorelines on Otty Lake are up to twice as likely to have problems with erosion

9. Impacts of Boating

- Zebra mussels have been established in the lake since at least 2003 but other invasive species such as the spiny water flea may not yet have been introduced
- It is estimated that the majority of the boating traffic on the lake is motorized
- Potential impacts of boating include the spread of invasive species, erosion from boat wake, noise and safety concerns, as well as water and air pollution

10. Responsibility of Landowners in Protecting Lake Health

- Many people are not aware that their activities are harming the lake. However, it is the cumulative impact of human activities around the lake that can cause deterioration in the quality of the water, a reduction in the fish and wildlife and a decline in the overall quality of life in the watershed

11. Partnerships in Lake Management

- Various groups and organizations have contributed to the understanding and protection of Otty Lake
- Otty Lake property owners desire a constructive and participatory relationship with all government and non-government groups and organizations in planning for the future of the Otty Lake watershed

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- Rideau Valley Conservation Authority
- Scouts Canada
- Tay Valley Township
- Township of Drummond/North Elmsley

Acronyms

BSC	Bird Studies Canada
CSW	Centre for Sustainable Watersheds
CMAG	Citizens Mining Advisory Group
DFO	Department of Fisheries and Oceans
D/NE	Township of Drummond/North Elmsley
DOC	Dissolved Organic Carbon
FC	Fecal Coliform
HADD	Harmful Alteration, Disruption, or Destruction of fish habitat
LMPP	Lake Management Planning Program
LL Green	Lanark and Leeds Green Community
LMP	Lake Management Plan
MOE	Ministry of Environment
MNDM	Ministry of Northern Development and Mines
MNR	Ontario Ministry of Natural Resources
OBC	Ontario Building Code
OFAH	Ontario Federation of Anglers and Hunters
OMMAH	Ontario Ministry of Municipal Affairs and Housing
OPP	Ontario Provincial Police
OLA	Otty Lake Association
OLMPC	Otty Lake Management Planning Committee
OLPCC	Otty Lake Pollution Control Committee
PWQO	Provincial Water Quality Objective
REAL	Rideau Environmental Action League
RVCA	Rideau Valley Conservation Authority
SRO	Surface Rights Only
TKN	Total Kjeldahl Nitrogen
TP	Total Phosphorus
TVT	Tay Valley Township

*Note: Text that appears within this report in ***bold italics*** can be found in the Glossary of Terms on page 77.

The Lake Management Planning Process

What is a lake management plan?

A lake management plan (LMP) is a long-term plan of action developed by the community to protect the health and special character of a lake. A LMP will:

- Identify and protect the characteristics of a lake that are valued by the lake community
- Promote community discussion, education and action
- Set goals and objectives for the protection and enhancement of the lake
- Recommend land use policies that influence development on the lake
- Recommend stewardship action- ways to better care for your lake so it can be enjoyed by future generations

Who is involved in developing the plan?

The process of developing a LMP calls for a community-based approach that encourages communication and education: the process is as important as the end product. The Otty Lake community is made up of everyone who works, lives or plays within the Otty Lake watershed, including:

- Permanent and seasonal watershed property owners
- Commercial operations including camps, maple syrup producers and rental cottages
- Day users including anglers, boaters and picnickers

The Otty Lake community also relies on government and non-government groups and organizations as partners in protecting the health of Otty Lake:

- The Centre for Sustainable Watersheds
- Community Stewardship Council of Lanark County
- Friends of the Tay Watershed (FoTW) Association
- Leeds, Lanark and Grenville District Health Unit
- Ministry of Natural Resources (MNR)
- Rideau Valley Conservation Authority (RVCA)
- Tay Valley Township (TVT)
- CGIS Spatial Solutions
- Township of Drummond/North Elmsley (D/NE)
- Lanark and District Maple Syrup Producers Association
- LL Green and Rideau Environmental Action League
- Ministry of Environment (MOE)
- Scouts Canada

The lake planning process presents the opportunity for everyone with an interest in the lake to come together to discuss their concerns. Through these discussions, participants from different groups find they value the same things about the lake. Communication strengthens relationships and improves understanding of the issues. The end result is a better outcome for the lake and everyone around it.

The Lake Management Planning Process on Otty Lake

Driven by development pressures on the lake and costly appearances at the Ontario Municipal Board to protect the long-term sustainability of Otty Lake, the Otty Lake Association (OLA) made the decision in 2004 to undertake a lake management plan.

In the early days of lake management planning work on Otty Lake, the Otty Lake Management Planning Committee (OLMPC) described its guiding principle this way:

"Otty is a special and beautiful lake. The use of the lake is a privilege available to current and future generations who are responsible for its well being."

Since 2004, the OLA and other volunteers have worked consistently to gather the needed historical information, build sound working relationships with the municipalities of Tay Valley Township and the Township of Drummond/North Elmsley, and engage members of the Otty Lake community in the lake management planning process. Thousands of volunteer hours have been devoted to the development of a lake management plan.

In April 2004 the OLA circulated a survey to watershed residents to better understand what property owners value about the lake as well as their concerns and their vision for the future of the lake. In addition to the questionnaire, the OLA held a shoreline home visit program in 2004, focus groups with area residents and community partners in 2004 and 2005, and a stewardship workshop in partnership with Burgesswood Community Association and the Lanark Stewardship Council in 2005.

In summer of 2005 the OLMPC developed a Vision Statement for the lake management planning process based on survey feedback from the lake community and its partners:

"To protect and sustain the health of Otty Lake through the combined efforts of the residents and users of the Lake and its watershed, and of concerned community partners in government and non-government organizations."

Guided by the lake community's vision for the future of Otty Lake, both the Report on the State of Otty Lake and its Watershed and the lake management plan will address each of the eleven issues that were identified through the survey and focus groups:

1. ***Surface water*** quality
2. Aquatic Vegetation
3. ***Groundwater*** quality and quantity
4. Water levels
5. Development pressures and their impacts on the watershed
6. Fish and wildlife health
7. Shoreline protection/health
8. Mining rights/claims
9. Impacts of boating
10. Responsibility of landowners in protecting lake health
11. Partnerships in lake management

More information about these and other topics can be found on the Lake Management Planning Program website[1].

Report on the State of Otty Lake and its Watershed

Before recommendations can be developed to protect the long-term health of Otty Lake, decision makers and property owners need to know the current condition of the watershed. The Report on the State of Otty Lake and its Watershed provides a summary of what is currently known in 2005/06 about the Otty Lake watershed and how that information relates to the issues that are important to people that use the lake. This information will be used to make recommendations about land use policy and ***stewardship action*** to ensure the long term health of Otty Lake. These recommendations will be contained in a second document, the Otty Lake Management Plan.

Information about Otty Lake has been collected and conserved by individual property owners and has been tracked down by Otty Lake volunteers and staff at MOE, MNR, RVCA, TVT, D/NE and others. Summaries of the material assembled by volunteers were compiled and edited to produce this Report on the State of Otty Lake and its Watershed. Copies of the original data and reports are held by the Otty Lake Association.

The report is divided into sections that address each of the issues identified by the Otty Lake community. Each section explores how the issue affects you, how it impacts lake health, the history of the issue, trends over time and the current state of the watershed relative to the issue. This information will be updated periodically in separate reports which will be made available to the Otty Lake community.

Public agencies and some of the legislation that determines their responsibility in the Otty Lake watershed are listed after each section and are summarized in Appendix 1. More information about any of the legislation referred to in this report can be found on the Ontario Statutes and Regulations website (http://www.e-laws.gov.on.ca) or the Department of Justice Canada website (http://laws.justice.gc.ca/).

[1] Lake Management Planning Program website: www.rideauvalley.on.ca/programs/LMP_Program/index.html

How Otty Lake got its name[2]

Otty Lake got its name from Captain Allen Otty of the Royal Navy. Born in England, he crossed the Atlantic in 1814 to Kingston, Ontario. There, he was assigned captain of a ship charged with the transport of naval stores between Kingston and Montreal.

In March 1816 a group of men including Colonel Francis Cockburn, Captain Otty and Lieutenant Joshua Jebb, left Rideau Lake at what became known as Oliver's Ferry to explore inland in search of a suitable water route between Ottawa and Kingston. They had not traveled far when they found a smaller lake which the Colonel named "Otty Lake" after the Captain. They named the outlet of Otty Lake "Jebbs Creek", and the creek into which it flows, "Pike Creek", later to become known as the Tay River.

Otty Lake and Watershed Description

The entire area of land that drains water into Otty Lake forms part of the Otty Lake ***watershed*** (Map 1). The watershed includes all of the land around the lake that drains water into Otty Lake. When it rains, the water is either absorbed into the ground and enters the groundwater supply, or it flows overland until it enters the small lakes, wetlands and streams that run into Otty Lake.

As water flows downhill, it carries with it any contaminants, nutrients and sediments it has encountered along the way and deposits them in the lake. Good land management within the watershed is important because the activities on land can have a direct impact on the health of Otty Lake.

Location and Watershed Topography

Otty Lake is located in Lanark County, 5 km southeast of the Town of Perth. The lake lies in a south-westerly to north-easterly direction (44° 50' N, 76° 13'W) and spans the boundary of two townships: Tay Valley Township and Drummond/North Elmsley Township (Map 1).

The Otty Lake watershed is one of fourteen smaller watersheds that make up the larger Tay River watershed. From Otty Lake the water flows into the Tay River which meets the Rideau River, then north into the Ottawa River and ultimately into the St. Lawrence Seaway and the Atlantic Ocean.

The total area of the land within the Otty Lake watershed is 49.2 km^2 (18.9 sq mi). The ***watershed slope*** is gradual and is angled from west to east and south to north which means that water flows out of the watershed through the north end of the lake at Jebbs Creek.

[2] J. S. M^{c}Gill, 1979. A Pioneer History of the County of Lanark.

The watershed boundary to the south includes Mills Lake and a large portion of the Mica Mines Conservation Area (Map 1). The southeastern border of the watershed runs between Otty Lake and both Adams and Big Rideau Lakes and captures a portion of the Tay Marsh. The western border runs from Narrows Lock Rd. along Ferrier Rd. all the way to Rideau Ferry Rd. Several small lakes fall within the boundaries of the Otty Lake watershed, including (from south to north):

- Mills Lake
- Rock Lake
- Mud Lake
- McLaren Lake
- Andrew Lake
- Doctor Lake
- Thoms Mud Lake

Several unnamed and unevaluated wetlands also fall within the watershed boundaries.

Otty Lake

Otty Lake has a surface area of 6.4 km^2 (2.5 sq mi), a total shoreline length of 35 km (22 mi) and is approximately 131 m (429.8 ft) above sea level. The shoreline around the lake is rocky and irregular with outcrops as high as 30 m (100 ft). The differences in elevation along the shoreline are particularly obvious in the northwestern and southern sections of the lake where the shoreline slopes are rocky and steep. There are gentler slopes on sections of shoreline on the northeastern side of the lake because of the difference in geology (see Bedrock and Surface Geology, page 14).

The southwestern portion of Otty Lake has an average water depth of 12 m (40 ft) and maximum depth of 27 m (90 ft). The northeastern section of the lake is shallower with an average depth of 6 m (20 ft) and a maximum depth of 18 m (60 ft).

Within Otty Lake there are 31 islands ranging in size from very small outcrops up to 3.7 ha (9.2 acres). Twenty of the islands belong to the province while eleven are privately owned. Over the years there have been reports of littering, graffiti and other forms of vandalism on some of the provincially owned islands.

The majority of the shoreline around Otty Lake is privately owned. The only public lands on the lake include several islands, the Mica Mines Conservation Area, a portion of which is rented by RVCA to Scouts Canada, and the public boat launch owned by Tay Valley Township. Other public lands near Otty Lake but outside of the watershed boundary include the Perth Wildlife Reserve and Murphy's Point Provincial Park.

Bedrock and Surface Geology

Otty Lake watershed lies on the edge of the ***Canadian Shield***. The Canadian Shield is a geological area that commonly has steep slopes, thin soil cover, many rock outcrops and poor drainage. Since water cannot be absorbed into the rock, depressions in the rock surface can become filled with water and create localized wetland areas.

The Canadian Shield is made up of rocks that were formed more than 590 million years ago during the Precambrian era. The southern and northwestern portions of the lake are on the Shield and are made up of Precambrian rocks (Map 2).

The majority of the Precambrian rocks within the watershed are composed of rocks and sediments deposited between 1300 and 1200 million years ago. Rocks of this age were formed during the Grenville Province Formation and give the lake its rugged character. The Grenville Formation includes extensive areas of crystalline limestone, quartzite and garnet gneiss[3].

Approximately half of the total land area of the watershed, including the southeastern shore of the lake, is made up of rocks from the Paleozoic age (590 to 240 million years ago) (Map 2). These rocks appear more subtle than the Precambrian rocks and tend to have gentle regular slopes, thicker soil coverage and better drainage. Predominant Paleozoic rock types include fine rounded quartz grains and a composite of quartz boulders in sandstone [3]:

Soils

The majority of the thin layers of silt, sand, gravel and organic material covering the bedrock in the Otty Lake watershed were deposited by glaciers. The variety of original material (bedrock, glacial till, sediments deposited in glacial lakes, and post-glacial bog deposits) has led to a variety of soil types and characteristics in the present day [3].

Much of the soil layer immediately surrounding the lake is classified as sandy ***loam*** and is generally thin (less than 0.9 m (3 ft) deep) although thicker pockets of soil can be found within the irregular landscape[3]. Areas of the watershed with sandy loam soil generally have good drainage while other areas with clay loam may not. Swamps dominated by acidic organic soils are common in low areas.

Climate

The Otty Lake region experiences a ***temperate climate*** with cold winters and warm summers. Data which most closely reflects the climatic conditions in the Otty Lake watershed was collected at Drummond Centre (45° 01' N, 76° 15'W) between 1984 and 2004[4] (data was not available for every month in 2005).

Over the 20 years for which data is available, the average monthly temperatures have remained relatively constant with minimum temperatures in January and February (average=-15°C (5°F)) and maximum temperatures in July and August (average=26.1°C (80°F)) (Figure 1). The most extreme temperatures in 19 years occurred in January 1994 (-23.7°C (-11°F)) and July 1988 (29.5°C (85°F)). The frost-free period in the watershed averages 193 days.

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[3] Gold, P. E., S. D. Rogers and R. Beesley, 1975. Background Study for a Remedial Lake Management Plan for Otty Lake.
[4] Environment Canada website: http://www.climate.weatheroffice.ec.gc.ca/climateData/dailydata_e.html?timeframe=2&Prov=CA&StationID=4268&Year=2005&Month=9&Day=13

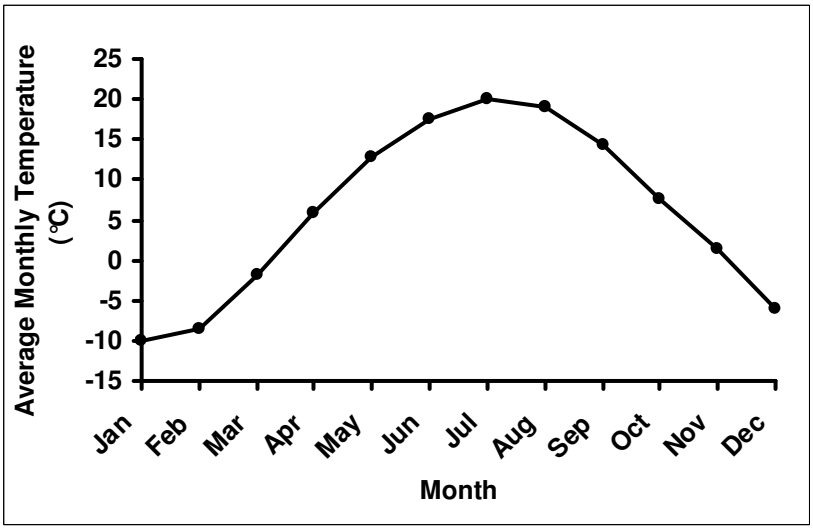

Figure 1: Average monthly temperature calculated from data collected at the Drummond Centre Weather Station from 1985 to 2004

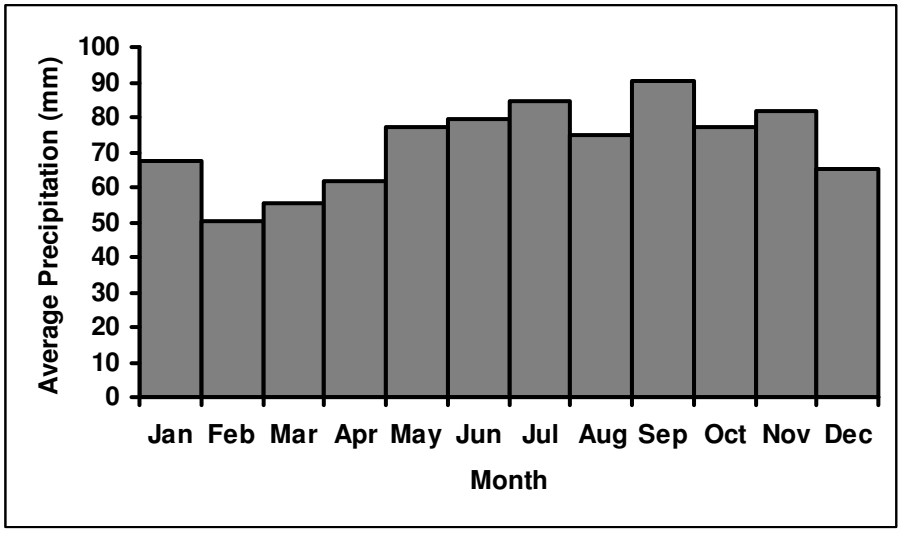

Figure 2: Average monthly precipitation calculated from data collected at the Drummond Centre Weather Station from 1985 to 2004

The average amount of precipitation per year over the 19 year span is 860 mm (34 in) with an average of 28% falling during the summer months (June, July and August) (Figure 2). 2000 was the wettest year with 1020 mm (40 in) of total precipitation while 2001 was the driest year with only 700 mm (28 in). Taking into consideration extreme precipitation, April 2001 was the driest month with less than 10 mm (0.4 in) of rain while September 1986 was the wettest month with close to 180 mm (7 in). Average snowfall for the area per year between 1985 and 2004 was approximately 180 cm (71 in).

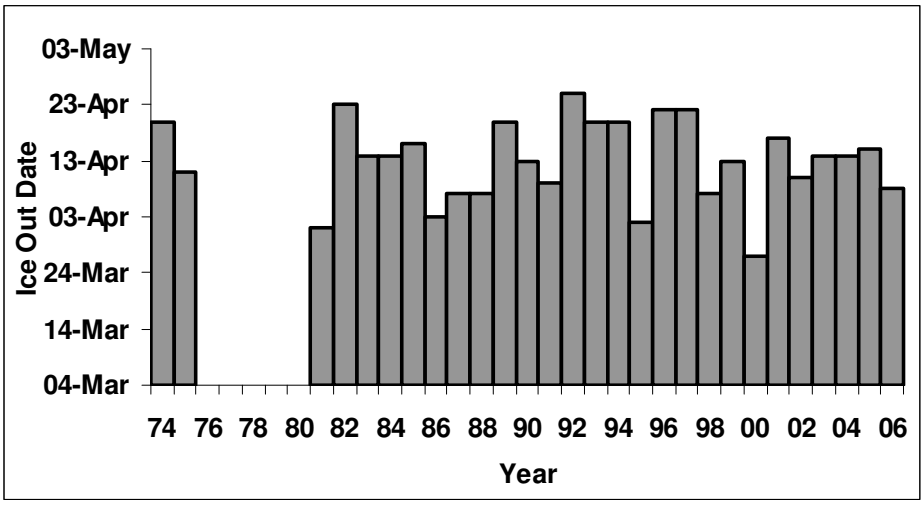

Figure 3: Average annual ice out date as recorded by two volunteers on Otty Lake between 1974 and 2006.

Records of the date when the lake became ice free or "ice out dates" have been kept by Susan Trower and Jack and Ann Wotton on Otty Lake for many years. On average, the lake was free of ice by April 13th between 1974 and 1999 but between 2000 and 2006 the average ice out date was approximately three days earlier (April 10th). Figure 3 shows the change in ice out dates over more than 20 years.

Hydrology

A survey conducted by MNR staff in 1970 recorded Otty Lake as being 9.2 km (5.7 mi) long, 1.2 km (0.8 mi) wide with a surface area of 6.4 km^2 (2.5 sq mi) [5]. The total volume of the lake was estimated to be 56.41 $x10^6$ m^3 (19.92 $x10^8$ ft^3) with an average depth of 9 m (30 ft) and maximum depth of 27 m (90 ft).

There are five or more streams which drain into Otty Lake. At least three of the streams are seasonal and flow only when there is heavy rainfall. Two of the streams flow year-round; one drains Thoms Mud Lake and the other drains McLaren Lake. The annual inflow of water to Otty Lake from all stream inputs as well as surface runoff and rain is estimated to be $15.69x10^6$ m^3 ($55.41x10^7$ ft^3)[5]. More than one quarter (18%) of the watershed is covered in water (Map 3).

Otty Lake drains out through Jebbs Creek and runs into the Tay River. The outflow of water through Jebbs Creek is not controlled by a dam or other structure and varies only according to the height of water in the lake. If the lake level is high, more water will flow out of the lake than if lake levels are low. Seasonal changes in water levels on Otty Lake average about 0.5 m (1.6 ft).

Because the outflow through Jebbs Creek is generally slow, only approximately 28% of the water in Otty Lake is exchanged for new water annually. The turn-over time for the lake (the length of time required for all water to be replaced with new water) is between 3 and 4.5 years, depending on precipitation and temperature, obstacles to outflow like beaver dams, etc.

[5] Ontario Ministry of Natural Resources, 1975. Lake Survey Summary Sheet.

Land Cover

Land cover of the Otty Lake watershed is dominated by species that can tolerate the well drained rocky terrain, including [3]:

- Red oak
- White birch
- Trembling aspen
- White pine
- Eastern hemlock

Hard maples are found in well drained areas with thicker soil while species in poorly drained areas of the watershed include:

- Eastern white cedar
- Black willow
- Balsam poplar

A substantial portion of the watershed was at one time cleared for agriculture but today some fields have been colonized by several types of juniper bushes, cedars and sumac groves. An area northwest of Otty Lake was also cleared of mature trees but is now a large marsh area.

For a more detailed list of the vegetation found within the Otty Lake watershed, see Appendix 2.

Land Use

Prior to European settlement, First Nations people likely visited the Otty Lake watershed for fishing and hunting but their impact on the land and water was minimal. Some aboriginal artifacts have been reported in the watershed.

European settlers looking to start a new life in Upper Canada began arriving in the Perth region of Lanark County in the early part of the 1800s. To encourage settlers, the Crown began offering land grants of 100 to 200 acre lots in 1805. A list of original property owners around Otty Lake (recipients of land grants from the Crown or owners of the land prior to the sub-division of lots for cottages) is available through the OLA.

Land settlement of the early 1800s saw many small farms emerge on the limited tillable farmland in the northwest and southeast portions of the Otty Lake watershed. The main cash crop was oats until a favorable market for livestock (sheep, hogs, cattle and horses) developed.

The initial source of revenue for many farmers was from timber products. The oak staves, square timber, planks, boards and potash produced as the land was cleared were shipped to Montreal while local cedar was used for fencing on the farms. Because of its close proximity to the Town of Perth, several acres of bush around Otty Lake were also logged for fuel wood for the town in the early 1900s. By this time, most timber of economic value had been harvested.

In other areas of the Otty Lake watershed the land was too poor for farming so some settlers turned to mining to sustain their livelihood. In 1886 both mica and apatite deposits were discovered and a number of mines went into operation. Today, several abandoned mica mines can still be found on Otty Lake properties along the Otty Lake North Shore Road and to the south in the Mica Mines Conservation Area. For more information about mining, see Mining Rights and Claims,

page 56)

Beginning in approximately 1922, some farmers began to sell their Otty Lake shoreline property for cottage development. By the year 2000, much of the farmland adjacent to the lake had been sold off and the land developed for cottages and homes. More than one quarter (19%) of the remaining land in the watershed is used for agriculture and the remainder is covered in secondary growth forest (51%), wetland (12%) and water (18%) (Map 3).

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1. Surface Water Quality

1.1. How does this affect you?

According to the survey conducted by the OLA in 2004, ***surface water*** quality was the single most important issue on the lake. Seasonal and permanent residents, campers, visitors and municipalities all depend on clean, safe lake water. A polluted lake is not only ugly, it can be unsafe for recreational use (swimming and fishing) and can have an impact on human and wildlife health. Bacteria and harmful chemicals entering the lake through faulty septic systems and surface runoff can be dangerous.

After a heavy rainfall, contaminants including sewage organisms and natural soil bacteria are carried in surface runoff into the lake. Contamination generally shows up in the lake within 12 to 48 hours after a heavy rainfall. Contaminants are of particular concern in lakes like Otty where the soil cover is thin and cracks in the rock provide a direct route for contaminants from the land to the lake.

Protecting water quality also means protecting property values. A reduction in water quality due to excess nutrients and algae can result in reduced property values around the lake; the desirability of lakefront property is directly related to the aesthetics and quality of the water.

1.2. How is the lake affected?

The biological productivity of a lake (also known as trophic status) can be estimated with measures of light penetration, oxygen levels and nutrient availability. Light penetration is a function of how much algae there is in the lake; as the amount of algae in the lake increases, the clarity of the lake decreases and light penetration is reduced. Total Phosphorus (TP) is a measure of the amount of nutrients available in the lake for plant growth. Dissolved oxygen levels indicate the lake's ability to sustain fish and other aquatic life. If light penetration and oxygen levels are low and the nutrient measures are high, the lake is classified as highly productive or ***eutrophic***. On the other hand, if light penetration and oxygen levels are high and nutrient levels are low, the lake has low productivity and is ***oligotrophic***.

Otty Lake is moderately productive or ***mesotrophic*** meaning it is capable of producing and supporting moderate populations of living organisms. Excess nutrients entering the lake from septic systems, lawn fertilizers and other human

activities on shore have the potential to increase the lakes productivity as well as the potential for algae blooms and excessive weed growth. For more on the effects of excess plant growth on the lake see Aquatic Vegetation, page 27.

1.3. History

Measures of water quality on Otty Lake have been collected for more than 30 years (since 1971) although what was measured and the techniques that were used have changed over time. Public perception and concern about the quality of water on Otty Lake dates back at least that long and can be traced through a variety of newspaper articles and reports.

Public concern over water quality on Otty Lake in 1971 prompted the MOE and the Ontario Water Resources Commission to conduct water sampling and interviews with property owners to identify their concerns. A Cottage Pollution Inspection and Abatement Program was also conducted to examine sewage disposal systems and test water quality. The first community group (the Otty Lake Pollution Control Committee (OLPCC)) was also formed that same year.

According to the results from the 290 interviews conducted in 1971, swimming and boating were the most important recreational activities on the lake at that time. It is interesting to note that although swimming was listed as the most important activity, boating was mentioned more frequently as the activity most suitable for the lake. A likely reason for this is that 82% of seasonal and 62% of permanent residents responded that they perceived a pollution problem on the lake. Inadequate septic systems and overdevelopment were thought to be the most likely causes of the pollution.

The 1971 Cottage Pollution Inspection and Abatement Program sewage system survey found that 208 of the 333 sewage systems that were examined were faulty (62%). These results suggested that although the water quality was still relatively good, faulty septic systems posed a threat to water quality that could be corrected by immediate action.

Beginning in 1973 with the encouragement and help of the Ministry of the Environment, an Otty Lake water quality monitoring program was established. Over the next 30 years fecal counts were sampled at 32 sites around the lake. This program continues today with *E. coli* and nutrient level monitoring.

In 1975, the Ministry of Natural Resources (MNR) conducted a survey of Otty Lake and estimated the nutrient supply entering the lake on an annual basis. Overland runoff from natural sources was estimated to contribute the majority of phosphorus to the lake per year (523 kg (1153 lbs)) although shoreline development also contributed (312 kg (688 lbs))[5].

By 1977, the Townships of North Burgess and North Elmsley had passed property standard bylaws to better control shoreline development and its impacts on water quality. Although the OLPCC was pleased at the direction the municipalities were taking, they were frustrated by the lack of enforcement of the bylaws. The water quality had not yet deteriorated to a crisis situation but threats to water quality still existed.

Around this same time, acid rain and the acidification of lakes became another issue for Otty and other lakes on the Canadian Shield. Without a limestone buffer, these primarily Precambrian rock lakes were thought to be at threat of serious acidification within 20 years time. This news did not alleviate the fears of Otty Lake residents who began looking for alternative approaches to get the provincial government to take action towards protecting the lake.

1.4. Trends

1.4.1. Water Quality

Otty Lake has a relatively long record of water quality measurements. Field collection and laboratory methods, as well as the parameters of the water that were measured, have changed over the years[6]. These challenges, in addition to differences in period and frequency of sampling over the years, make it difficult to compare data from year to year. Although trends over time are more difficult to interpret, the data does provide an indication of the condition of the lake and is sufficient for setting goals for future lake stewardship.

Data presented in this report was collected through the MOE Self-Help, MOE Lake Partners, RVCA Watershed Watch Programs, and the Otty Lake Association[7]. Samples collected through the Self-Help and Lake Partners Program were collected from one site at the deepest point in the lake between 1971 and 2005 with the purpose of monitoring the following parameters:

- ***Chlorophyll a***: a pigment that makes plants and algae green and can be used to determine the quantity of algae in the water
- ***Water clarity***: measured by lowering a black and white disk (Secchi disk) into the water
- ***Total Phosphorus*** (TP): a measure of all the forms of phosphorus in a sample
- ***Total Kjeldahl Nitrogen*** (TKN): a measure of the organic nitrogen and ammonia resulting from wastewater and manure discharges into the lake.

In 1994, total phosphorus became the standard for assessing trophic status in lakes. The Lake Partners Program began sampling from multiple sites near shore in addition to the deep site and provided more accurate measurements of TP. In 2001 the Watershed Watch Program began monitoring phosphorus and nitrogen distribution around the lake and sampling for bacterial pollution (E. Coli) close to the developed areas to see if there was a problem with septic and grey water entering the lake.

[6] More information about protocol, laboratory methods and parameters measured is available through the RVCA or the OLA
[7] Rideau Valley Conservation Authority, 2002. State of the Lake Environment Report for Otty Lake

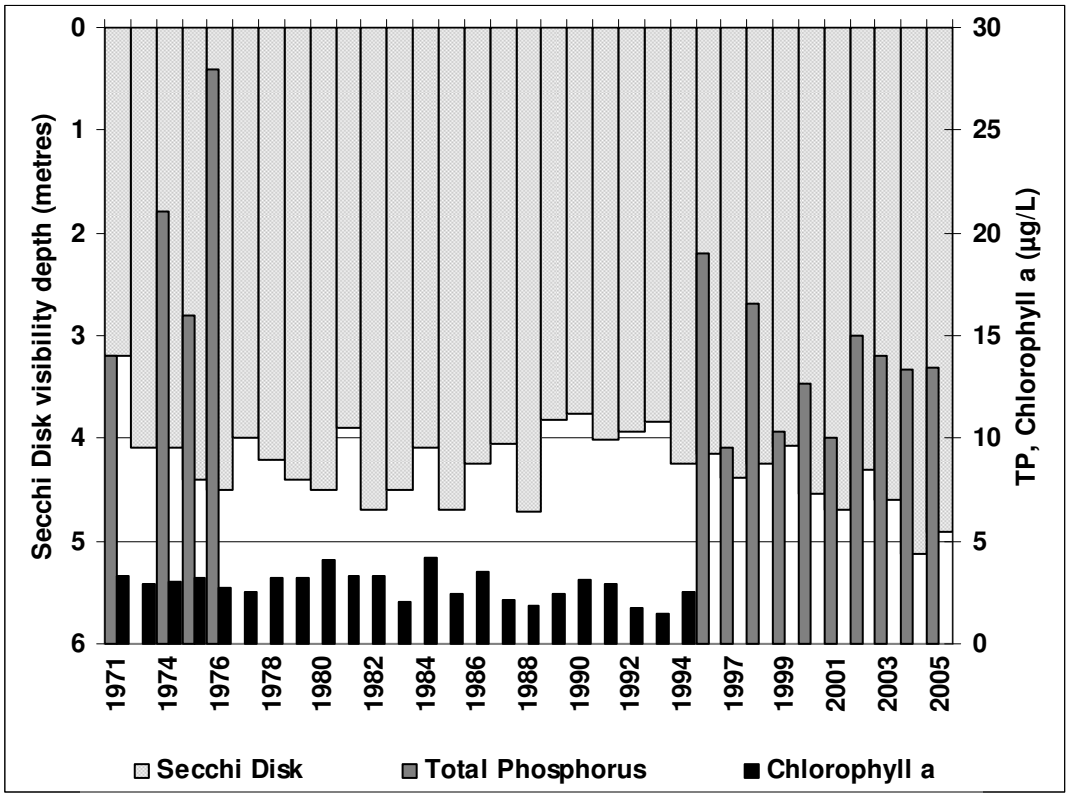


Figure 4: Average annual water clarity (based on secchi disk depth) and nutrient concentration (total phosphorus (TP) and chlorophyll a) across sample sites on Otty Lake between 1971 and 2005.

Chlorophyll a

Samples of chlorophyll a were collected from 1971 to 1994 at the deepest point on the lake and were used as an estimate of potential plant growth. The ***Provincial Water Quality Objective*** (PWQO) for chlorophyll a was 5 micrograms per litre (µg/L). None of the annual averages of samples taken at the deep point had more than the PWQO in twenty-three years of sampling. The overall trend indicates a reduction in the annual average chlorophyll a concentration (Figure 4).

Water Clarity

Water clarity has been measured using a Secchi disk at the deep point of the lake since 1971. Water clarity measures have ranged from 2.4 m (8 ft) at the lowest clarity to 6.3 m (21 ft) at the greatest. Average water clarity over 31 years of data is 4.2 meters (14 ft) (Figure 4).

Total Phosphorus

Results of total phosphorus (TP) sampling done as part of the MOE Self-Help Program in the 1970's showed elevated average loadings in two years (1974 and 1976, see Figure 4). There did not appear to have been a corresponding impact on plant or algae growth (as measured by the chlorophyll a concentration). Between 1971 and 2005 more than twenty individual measures of TP approached or exceeded the PWQO of 20µg/L (a guideline used to avoid nuisance concentrations of algae in lakes), although these high levels were not persistent. Since 1996, elevated levels of TP were

recorded in individual samples in four years (1996, 1998, 2002 and 2004) but overall TP has remained fairly consistent with an average annual concentration of approximately 14µg/L.

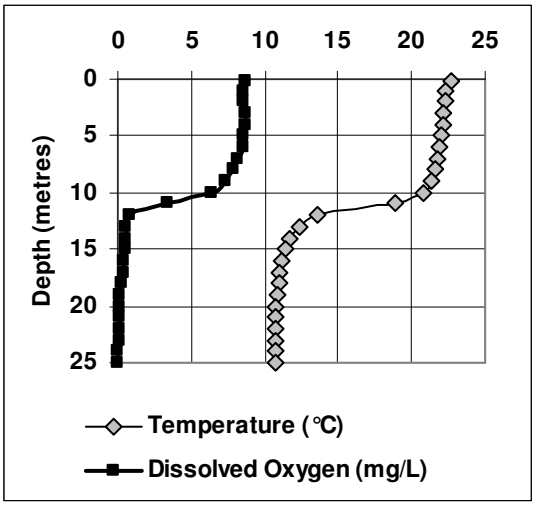
Higher concentrations of TP were found at two inlet streams in 2002 (the inlet from McLaren Lake (Site E, average=21.3 µg/L) and an intermittent inlet from the wetland at the most southerly tip of Otty Lake (Site C, average=26.6 µg/L)). It appears that the phosphorus did not migrate across the lake but instead settled to the bottom and/or was diluted as it entered the lake.

TP concentrations are also routinely higher at the outlet from Otty than in the rest of the lake (average for 2002= 21.6 µg/L). The outlet into Jebbs Creek is a relatively narrow bay where the TP appears to be “re-concentrated” or accumulated.

The concentration of TP in solution at the bottom of the lake has fluctuated over the years but none of the samples has shown significantly high concentrations. This is surprising since phosphorus is released from the lake sediments into the water when oxygen levels become low below the ***thermocline*** in the warmer months.

Dissolved Oxygen and Temperature

Dissolved oxygen and temperature profiling is important because both factors affect the chemistry of the lake environment as well as the aquatic organisms. A dissolved oxygen and temperature profile was done at the mid-lake site in early September 2002 when the oxygen concentrations would have been at or near the lowest for the year and temperatures the warmest. The profile showed there was ample depth suitable for a cool water fishery above the thermocline however the portion of lake depth below the thermocline (***hypolimnion***) was ***anoxic*** meaning it held almost no oxygen (Figure 5). The 2002 profile was virtually identical to another profile done in September 1974 suggesting that the anoxic condition



below 12 m (39 ft) may be typical for Otty Lake.

Figure 5: Temperature and dissolved oxygen profile taken September 9, 2002

Anoxic conditions indicate that too much oxygen is being consumed when plant and animal material on the lake bottom decay. As oxygen is used up, phosphorus trapped in the sediment at the bottom of the lake is released and reenters the water column. Depending on wind and temperature each year, the extra phosphorus in the anoxic zone could become mixed with the surface water and result in algae blooms.

Total Kjeldahl Nitrogen

The RVCA has adopted a concentration of 500 µg of TKN /L as a reference or guideline to indicate the presence of excessive nitrogen in the absence of a provincial water quality objective[8]; the higher the concentration of TKN and the greater the number of samples exceeding this reference, the greater the potential for excessive aquatic plant growth.

From 1996 through 2001, 41 samples were taken at the deep point of Otty Lake and analyzed for the concentration of TKN (Figure 6). The average concentration for that period was 461 µg/L and of the 41 sample results, 5 were above the guideline concentration, which is quite good. For the 7 samples taken at the deep point in 2002, the average TKN concentration was 484 µg/L, with one result above the guideline, again quite good. However, while it is sample results from the centre of a lake that are considered to represent the overall "health" of that lake, sources of nitrogen from around the lake contribute to those results. In 2002 a total of 64 additional samples were taken from various other sites around Otty Lake and over half of those (36) had concentrations above 500 µg/L.

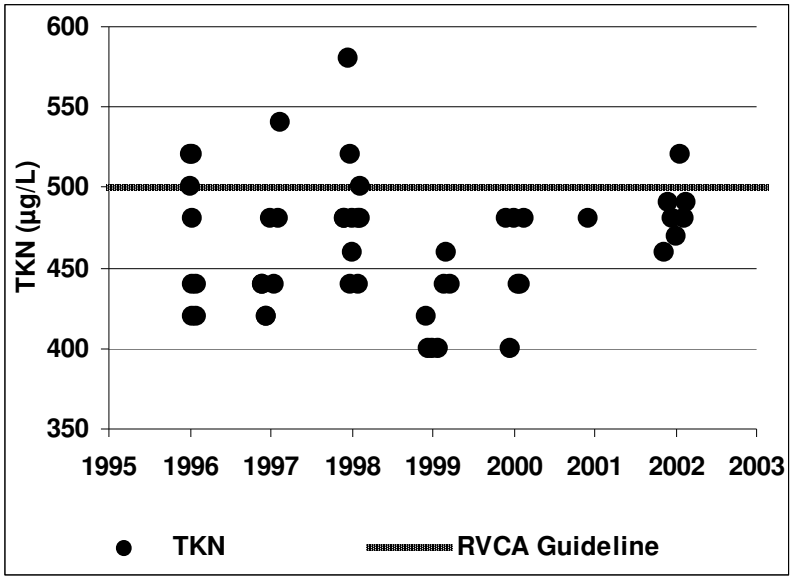


Figure 6: Individual Total Kjeldahl Nitrogen (TKN) samples collected in spring/summer at the deep site on Otty Lake between 1996 and 2002.

[8] McNeely, R.N., V.P. Neimanis and L. Dwyer. 1979. Water Quality Sourcebook: A Guide to Water Quality Parameters. Inland Waters Directorate, Water Quality Branch, Ottawa, Canada.

The bloom of blue-green algae that accumulated at the northeast end of the lake in 2002 occurred as a result of elevated concentrations of TP and TKN. Such blooms and increasingly profuse weed growth can be expected in shallow areas of Otty Lake as long as nutrient levels remain high.

Alkalinity

Alkalinity is a measure of the amount of carbonates in the water. Carbonates neutralize acids from runoff or precipitation (acid rain) and, when combined with calcium, carbonates provide the building blocks for shell construction by mussels and other ***invertebrates***. Lakes on the Canadian Shield tend to have low alkalinity (low levels of carbonates) due to their geology and are therefore more susceptible to the effects of acid rain but less susceptible to colonization by zebra mussels.

The alkalinity of Otty Lake in 1971 was 112 mg of calcium carbonate ($CaCO_3$)/L, a relatively high level of carbonates for a lake on the edge of the Shield. High alkalinity suggests Otty Lake has a good buffer against the effects of acid rain but not against invasion by zebra mussels.

Zebra mussels were most likely introduced to Otty Lake in 2001. The extent of the impact they will have on the ecology of the lake remains unknown but effects may include increased water clarity, increased aquatic vegetation growth and decreased oxygen levels. In the meantime, all lake residents, cottagers and occasional visitors need to take a stewardship approach and prevent the introduction of other invasive species.

Dissolved Organic Carbon

Dissolved organic carbon or DOC (dissolved compounds found in water that are derived from organic materials such as plant matter) has been receiving greater research attention in recent years. It appears that DOC can interfere with the nutrient uptake process by aquatic plants in Canadian Shield lakes if there is enough of it from the “right” source (incoming rather than found naturally (resident) in the lake). High DOC can slow down the decay process so that branches or other debris that fall into the water will accumulate on the bottom in much the same condition as when they fell. Because research is ongoing into the effects of DOC, the main purpose in measuring DOC concentrations now is to build a dataset that can be compared to research results. No firm conclusion can be drawn at this time since only one year of data has been collected.

Bacteria

One subgroup of ***fecal coliform bacteria***, *Escherichia coliform* (*E. coli*), is used as an indicator of the possible presence of other harmful bacteria and pathogens in water. The main sources of these harmful bacteria are animal (decay of dead animals, defecation near and in the water) and human waste (septic systems and grey water). Levels above the PWQO of 100 counts/100 mL can mean that the water is unsafe for swimming. As a general precaution, untreated lake water should not be used for drinking water and use for washing and cooking should be limited.

The OLA conducted fecal coliform (FC) sampling done at thirty-two sites around the lake each year from 1973 to 2003. Of the 5,484 samples, only 66 (1.2%) had counts equal to or greater than 100 per 100 mL over the 30 years. Sites with high FC counts are resampled to ensure the problem is not persistent and none of the samples showed repetitive contamination. Some extreme results may have been due to septic system failures and steps have been taken over the years to rectify such problems. This data belongs to the association and is being analyzed in detail by Lorne Gold, a resident of Otty Lake. From 2003 to 2004, the OLA measured *E. coli* at 32 sites but since 2005 only 10 sites have been monitored.

Benthic Invertebrates

In addition to chemical testing, the RVCA began sampling for ***benthic invertebrates*** (the bugs that live on the lake bottom) in 2004. A more long range picture of what kinds of creatures the lake can support is provided when both the water chemistry and the invertebrate community are considered.

Three sites have been sampled on Otty Lake since 2004. Benthic invertebrates were sorted, counted and identified to determine Taxa Richness (TR). TR is related to ***species diversity*** and will increase with increasing habitat diversity, suitability, and water quality; the healthier the community, the greater the number of taxa found.

The results of the benthic invertebrate sampling are inconclusive at this time because of the limited number of samples available after three years. However, there is an indication that there are stable populations of tolerant species (organisms that can live in any water quality conditions). Tolerant species are expected in lakes because of the limited habitat availability in the soft sediment lake bottom.

Two of the benthic sample sites are near water sampling sites found to have elevated TP concentrations in 2002. Follow-up benthic sampling will improve understanding of the invertebrate populations in Otty Lake and overall lake health.

1.5. Current State of the Resource

1.5.1. Nutrients

The historical data and the results of Watershed Watch sampling from 2002 and 2003 indicate that Otty Lake is at the mid-mesotrophic stage. It has higher quantities of nutrients than some other area lakes[9] with some TP samples exceeding the PWQO and generally high concentrations of TKN. Phosphorus is the ***limiting nutrient*** for plants so relatively minor (downwind bays rather than the whole lake surface) algae blooms should be expected.

[9] Including Pike, O'Brien, Farren, Crosby, Bobs (West basin), Long (Tay Valley) and Christie Lakes

1.5.2. Bacteria

Persistent occurrences of *E. coli* counts exceeding the PWQO over two or more sample dates would indicate the possibility of a bacteria pollution source that needed to be further investigated. None of the samples in recent years (2002 to 2005) have indicated persistent bacterial contamination.

The bacteria results for Otty Lake indicate that there are generally low levels of bacteria in the water. While all parts of the lake were not sampled, the results indicate that the water in Otty Lake does not pose a health concern for cottagers and residents for swimming and other water contact recreational use. Regular attention and maintenance of septic and grey water systems is advised to eliminate sources of bacterial pollution as well as nutrient loading.

1.6. Who Regulates the Resource?

The Ministry of the Environment is responsible for enforcing regulations as they pertain to surface water quality under the following legislation: the *Environmental Protection Act*, the *Nutrient Management Act*, the *Ontario Water Resources Act*, and the *Environmental Assessment Act*. The Ministry of Natural Resources is responsible for enforcing the *Lakes and Rivers Improvement Act*.

Thanks to the following volunteers and community partners that provided information for the Surface Water Quality section of this report:

- Lorne Gold
- MOE
- RVCA Watershed Watch
- RVCA
- Environmental Youth Corps
- David Code
- MOE Lake Partners Program
- MNR
- Leeds Grenville and Lanark Health Unit
- OLA Historical Files

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2. Aquatic Vegetation

2.1. How does this affect you?

The density of aquatic plants or “weeds” in Otty Lake is of concern to many property owners. When plant growth becomes excessive, the lake looks unappealing and may be spoiled for recreational activities; swimming is unpleasant, boat propellers get tangled and clogged and retrieving a fishing lure is a chore. Even paddling a canoe becomes heavy work as the plants cling to the paddle on every stroke. Consecutive years of excessive plant growth can result in reduced property values and more importantly, a decreased quality of life on the lake.

2.2. How is the lake affected?

Aquatic vegetation is a natural component of a lake ecosystem. The different types of aquatic plants can be assigned to two general categories:

- ***Submergent***: aquatic plants which live for the most part under water.
- ***Emergent***: aquatic plants with floating leaves or leaves that stick out of the water

Both of these forms of vegetation play an important role in the healthy functioning of the lake ecosystem and provide breeding habitat, shelter and food for the various fish, birds, reptiles, amphibians and other aquatic animals. Aquatic plants also provide oxygen to the water, cycle nutrients in the lake and filter harmful radiation from the sun.

Aquatic plant growth is limited by nutrient availability in the lake, specifically phosphorus. Although present in the lake naturally, phosphorus also enters the lake through a variety of ways including surface runoff, older or faulty septic systems and other sources, and is used by aquatic plants to increase growth rates and reproduction.

In the fall, plants die off, settle to the bottom of the lake and are decomposed by bacteria. The limited supply of oxygen that is needed to keep fish alive over the winter may be used up as plants decompose. If possible, fish will move into more oxygen-rich water to avoid suffocation. As the oxygen is used, phosphorus is released from the sediments for use by plants the next year.

2.2.1. Eurasian water-milfoil

The aquatic plant that clogs the shallow bays of Otty Lake is an invasive species called Eurasian water-milfoil. When parts of this exotic plant break off they are able to settle and grow an entirely new plant in water up to 6 m deep. This ability allows Eurasian water-milfoil to outcompete native species and reduce the number of different native plants in the lake. It also has the potential to degrade water quality and deplete oxygen levels in the lake as discussed earlier.

Eurasian water-milfoil is able to begin growing in low water temperatures and can grow shoots to the surface early in the season. It then forms a thick canopy that shades the surrounding plants. The plants it shades would otherwise provide a good food source for ducks and other waterfowl. Although the thick canopy does allow for high survival rates of young fish, it supports fewer numbers and kinds of aquatic invertebrates that serve as food for fish.

Once Eurasian water-milfoil has become established it is unlikely that it can be eliminated. The only practical option is to control its growth. As with all aquatic vegetation, the cheapest, most effective way to limit growth is to control the quantity of nutrients entering the lake.

2.3. History

A survey of the aquatic vegetation in Otty Lake was conducted in the summer of 1974. The most dense and widely distributed species included:

- Water-milfoil (it is unknown whether it was a native or invasive species)
- Canada waterweed
- Tape grass
- Several species of pond weed

These species tend to be abundant in shallow, fertile lakes and ponds in North America. Most of the aquatic plant growth was observed in the shallow bays at the northern end of Otty Lake. The extensive areas of shallow water with good light penetration in the central and southern parts of the lake did not yet have a thick growth of plants.

2.4. Trends

The survey conducted in 1974 documented a variety of native submergent and emergent vegetation in Otty Lake (Appendix 3, plants identified by Diana Nuttall are also included). Eurasian water-milfoil has been shown to successfully outcompete native species including tape grass, a species of plant that grows below the surface that was very abundant in 1974. Unfortunately the impacts of Eurasian water-milfoil on the native diversity of aquatic plants in Otty Lake are unknown.

Eurasian water-milfoil remains a problem for those people who like to boat, swim or fish in Otty Lake. In years when there are a lot of plants, recreation on the lake is negatively affected. Boat motors either cut the plants into pieces and spread the problem around the lake or the weeds become tangled on the propeller. Few people want to swim in dense plant growth and even though the fishing may be good, specific weedless lures and heavy tackle are required to effectively fish in dense milfoil.

2.5. Current State of the Resource

In August 2006, the Lanark Stewardship Council's Stewardship Rangers completed an aquatic vegetation survey of Otty Lake. The results of this survey will be compared to the aquatic vegetation survey done in 1974 to estimate changes in vegetation density and species composition.

2.6. Who Regulates the Resource?

The best way to restrict the spread of aggressive plants is to identify the source of excess nutrients and limit their input into the lake. Physical removal of aquatic vegetation is another method of control but it is labour intensive and must be repeated since plants will return if the growing conditions are favorable.

If you notice a problem with aquatic vegetation in front of your property, contact the RVCA. Their staff can recommend methods for dealing with the problem that will ensure the health of the lake is protected. If removal of the aquatic vegetation is determined to be the most effective course of action after consulting with the RVCA, a proposal must be submitted to the MNR . A permit from MNR is required for aquatic vegetation removal and, depending on the extent of the proposal, the application may also be referred to the Ministry of Environment.

In the case of Eurasian water-milfoil, harvested plant fragments must be removed well away from the water since each piece of plant remaining in or near the lake can grow into a new plant and make the infestation worse. Harvesting the plant does not destroy the plant roots and may have to be repeated during the season.

Other methods of control that require a permit include hand pulling (impossible if the patch of plants is well-established), hand cutting and raking (only effective early in the season and since the roots are not removed the weeds will grow again) and installing a barrier on the bottom of the lake (silt will build up on the barrier and must be cleaned off every 6 to 8 weeks to prevent new milfoil growth). All forms of removal require long-term follow up.

It is important to remember that no in-water work is permitted on Otty Lake between March 15th and July 1st. Avoiding any disturbance of the lake bottom at this critical time of year helps to protect the many species of fish that are spawning and rearing young.

Thanks to the following volunteers and community partners that provided information for the Aquatic Vegetation section of this report:

- EcoScapes
- MNR
- OLA files
- MOE
- RVCA
- Lanark County Stewardship Council/ Stewardship Rangers

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3. Groundwater Quality and Quantity

3.1. How does this affect you?

Some waterfront cottages and homes on Otty Lake still draw water from the lake for drinking and other domestic uses while the majority of dwellings within the Otty Lake watershed rely on private wells. Many people take clean water for granted and don't realize that the quality of the water below ground is directly linked to their activities above ground.

When it rains, some of the water seeps into the ground and into deep reservoirs called ***aquifers***. These reservoirs form in the pore spaces between loose soil materials or in fractures in the bedrock where water can collect. Although science can explain how aquifers are replenished, it is often difficult to locate where the groundwater is recharged for specific aquifers or determine how much water is available in the aquifer for use.

The risk of well contamination depends on the kind of aquifer (soil or bedrock), the type of well that was installed and the construction techniques used. Land management in the area where the aquifer is recharged can also cause contamination.

Some of the activities that can contaminate groundwater include excessive fertilizer application on farm lands or hazardous chemicals stored close to the wellhead. Oils, paints and other chemicals spilled on the ground can also eventually seep or leach into the groundwater. These chemicals can be harmful in drinking water at only a few parts per billion and can stay in the environment for years.

3.2. How is the lake affected?

Groundwater and surface water are interconnected, meaning contamination of one source could pollute the other. As rain falls on the ground, some of the water runs over the surface of the land and into the lake while a small amount evaporates back into the atmosphere. Some of the water is also absorbed into the ground and becomes part of the groundwater supply. Groundwater either remains below ground or is returned to the surface through wells, marshes or springs that feed into Otty Lake.

3.3. History

Many property owners test their water on a regular basis although the information is not shared publicly. Most of the available information on groundwater quality and quantity on Otty Lake has been collected through the site investigations done between 1987 and 1990 prior to the development of four local subdivisions in the northeastern and southwestern portions of the lake. The information is localized and only provides a glimpse of the health of groundwater in the area.

The four site investigations reported that the groundwater around Otty Lake meets the provincial drinking water standards and is fit to drink. The water is generally hard with the presence of turbidity, sodium, fluorides and iron and some level of water treatment is required. The water quantity was adequate for household use and no water shortages were noted at the time. Drilled wells in the area were found to range between 10 m to over 100 m deep. No follow-up studies have been conducted and no known water quality or quantity issues have been identified.

A drilled well consists of a hole bored into the ground or into the hard rock. The upper portion of the well is lined with a casing of suitable material such as steel which prevents the collapse of the borehole walls and prevents contamination from the surface. A properly constructed drilled well is generally accepted to be safer than a dug well although there is still a risk of contamination if the sealing around the outside or top of the casing is breached.

3.4. Trends

A survey conducted by the Ministry of Environment and Ontario Water Resources Commission in 1971[3] found that 75% of seasonal residents imported their drinking water from a municipal supply or obtained their water from a well and 75% of the permanent residents were supplied by well. Although the lake was generally perceived as unsuitable for drinking purposes, the remaining 25% of seasonal and permanent residents without access to a well were likely to use the lake water as their domestic water supply.

In another survey conducted by the provincial Environmental Youth Corps (EYC) in 1993, 86% of respondents imported their water or had a well (48% imported their drinking water, 36% had drilled wells and 2% had dug wells[3]) while 11% of respondents continued to get their water from the lake.

Of the 49% of people that got their water from a well or the lake, 44% of them treated the water. Methods of treatment included water softeners (40%), sterycil or charcoal filters (40%), boiling (9%), ultraviolet radiation (3%) and chlorine or reverse osmosis (8%).

To put the groundwater use around Otty Lake into perspective, the 1993 EYC survey reported approximately 1590 water-using facilities on the lake, including toilets, sinks, baths, showers, dishwashers and washing machines. As the number of permanent residents on Otty Lake increases, the number of water-using facilities will also increase, placing increased demand on groundwater resources.

3.5. Current State of the Resource

Due to the lack of local groundwater studies or information from area residents, it is difficult to comment with certainty on the state of the Otty Lake groundwater resources. It is safe to say that historically no major groundwater quantity or quality issues have been brought to the attention of the regulatory agencies.

An increase in development around the lake and the trend towards the conversion of cottages to four season homes suggests that the demand on groundwater resources will continue to rise. New homes and converted cottages are more likely to have multiple toilets, shower and or baths, laundry facilities and dishwashers which all increase water use.

Another urban practice seen around the lake is the creation of manicured lawns and ornamental gardens. Lawns normally require only one inch of water per week but lake residents often over-water because groundwater is readily available.

With the emergence of better waste-water technologies and improved well and septic system construction, the possibility of groundwater contamination has been reduced but not eliminated. As individual property owners become aware of the risk of well contamination, the incidents of groundwater pollution are likely to decrease. Area residents should continue to test their water regularly and watch for activities or incidents that could contaminate the lake or groundwater.

3.6. Who Regulates the Resource?

Individual property owners have a legal responsibility for the condition of all wells on their property, under the authority of Ontario Well's Regulation (Reg. 903) which sets rules for who can construct or work on a private well. To learn more about your well, well records can be requested through the Ontario Ministry of the Environment. Otty Lake property owners can also take well water samples to the Health Unit in Smiths Falls for bacterial and chemical analysis.

There are a number of federal and provincial acts/regulations in place to prevent groundwater contamination from high risk sources and minimize the environmental impact from high yield water taking. The *Environmental Protection Act 1990*,

Ontario Water Resources Act 1990 and *Safe Drinking Water Act 2002* are examples of laws guiding the management of water resources.

The Ontario government is in the process of developing the *Clean Water Act 2005* to provide additional legislation to ensure the sustainability and safety of water resources by protecting the drinking water supplies right at the source.

Thanks to the following volunteers and community partners that provided information for the Groundwater Quality and Quantity section of this report:

- Tay Valley Township
- OLA files
- MOE
- Township of Drummond/North Elmsley
- RVCA

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4. Water Levels

4.1. How does this affect you?

There is a saying- “if someone on the lake likes the water level, there is someone else who doesn’t”. Lake water levels fluctuate naturally through the seasons and the years but unfortunately, these fluctuations can cause a variety of problems to property owners.

When water levels are high, older homes and cottages that were built close to the lake on low-lying ground are susceptible to flooding. There were few restrictions on the setback of structures and septic systems in the past leaving these older properties susceptible to flood damage. Prolonged flooding of septic systems can also result in septic failure and contamination of the surface water with untreated sewage.

Although not likely to cause property damage, low water can make boating and other recreational activities difficult or even unsafe. Extremely low water levels can beach floating docks and make launching or accessing a boat difficult. Rocks and shoals that are normally submerged become hazardous to boats while shallow bays and channels are inaccessible.

4.2. How is the lake affected?

Lake hydrology is influenced in large part by watershed features such as slope, geology, land use and vegetation cover. Water enters Otty Lake through precipitation, groundwater springs, surface land runoff, and inlet streams. Water exits the lake through evaporation, uptake by plants (transpiration), groundwater seepage, and the one outlet at Jebbs Creek. If enough water is prevented from leaving the lake by beaver dams or other obstructions, low lying shoreline may flood.

Beavers are attracted to water bodies bordered by deciduous trees or shrubs suitable for food and building materials. One beaver is capable of cutting down an average of 216 trees with diameters up to 40 cm in a single year[10]. They use the branches and small tree trunks to construct dams and lodges and create ponds of standing water deep enough to store their winter food supply[10].

Beaver dams can hold back a substantial amount of water but will allow for limited water flow. Many property owners are not aware that something as harmless as grass clippings can clog a dam, rendering it completely impervious to water. Without a minimal flow through the dam, higher water levels can occur upstream.

Water levels on the lake fluctuate naturally with the seasons and weather. Fortunately, changes in water level are not believed to have a negative impact on lake water quality. The cumulative impact of poor shoreline and groundcover condition, faulty septic systems and nutrient input to the lake through poor land use practices have a much greater impact on water quality than fluctuating water levels.

Otty Lake has a large volume of water relative to the amount of water that drains into the lake from the surrounding land (a high ratio of lake volume to watershed area), therefore the water in Otty Lake has a long residence time. Estimates of lake volume and discharge rates suggest it takes between three and 4.5 years[11] for the volume of water in the lake to exit through the outlet. Because of this long residence time, the observed condition of the lake in a given summer (algal blooms, excessive growth of aquatic plants, etc) is a function of the quality of the water that flowed into the lake through surface water runoff, groundwater discharge and precipitation over the previous four years. For more information about nutrient cycling in the lake, see Surface Water Quality (page 19).

One misconception people have is that a seasonal drawdown of lake levels is necessary to allow for the shoreline to "bake" and slow the growth of aquatic plants. Plant growth is not affected by low water levels and in fact, a constant lake level throughout the summer provides consistent habitat for the aquatic organisms that live in the lake. Although many organisms are able to adapt to changing water levels, they can present a challenge to more sensitive species.

4.3. History

Otty Lake was subject to natural fluctuations in water levels until 1965 when a concrete dam was constructed at the outlet to Jebbs Creek. Before the dam was built, the outlet appeared to be approximately four feet deep which allowed the lake to adequately flush in the spring time when water input was high. According to anecdotal evidence, it was not uncommon for the outlet to Jebbs Creek to dry up prior to installation of the dam. Fill was likely deposited at the dam site at the time of dam construction, resulting in greater water retention in the lake and reduced flow rates.

The dam structure was built on top of the fill and drastically reduced the natural flushing action of the lake. Once the flow was reduced, water leaving the lake deposited silt on the lake bottom at a faster rate which in turn increased the biological

[10] Hinterlands Who's Who Mammal Fact Sheet, http://www.hww.ca/hww2.asp?id=82
[11] Michalski, M. 1992. Rideau Lakes Basin Carrying Capacities and Proposed Shoreland Development Policies

oxygen demand on the lake bottom. It has been suggested by long term property owners that the health of fish populations and the lake in general deteriorated as a direct result of the dam. Regarding the change in water level, one property owner reported that it became possible to cross Mud Lake with a large boat at all times of the summer once the dam was in place.

A report compiled by Ministry of Natural Resources (MNR) and Rideau Valley Conservation Authority (RVCA) in 1980 recommended that the dam and accumulated debris and obstructions be removed to allow maximum flow rates each spring. The report also suggested maximum effort by trappers to remove beaver along Jebbs Creek was essential to maintaining flow. The dam was removed in 1980 and over the next few years RVCA and concerned cottagers periodically removed obstructions and debris from the creek. According to one longtime property owner, water levels did not return to pre-1964 levels following the removal of the dam.

4.4. Trends

Factors that affect the water levels on Otty Lake include weather (specifically precipitation and temperature) and obstructions to flow at the inlets and outlet of the lake and along the length of Jebbs Creek.

4.4.1. Weather

The weather has a significant impact on Otty Lake water levels. Hot, dry and windy weather can result in lower lake levels due to increased evaporation from the lake surface and reduced water input. When the weather is cool, overcast and rainy, lake levels are higher. Weather data collected from Drummond Centre, ON provide a rough estimate of temperature and precipitation for the Otty Lake watershed in relation to changes in lake water levels between 1985 and 2005 (Figure 7).

Lake residents have recorded water level with respect to local permanent references. The water level they record, therefore, depends on the location. The annual change from spring to fall, however, should be the same for all sites. The estimated values for these annual changes are plotted in Figure 7 for the period 1985 to 2005.

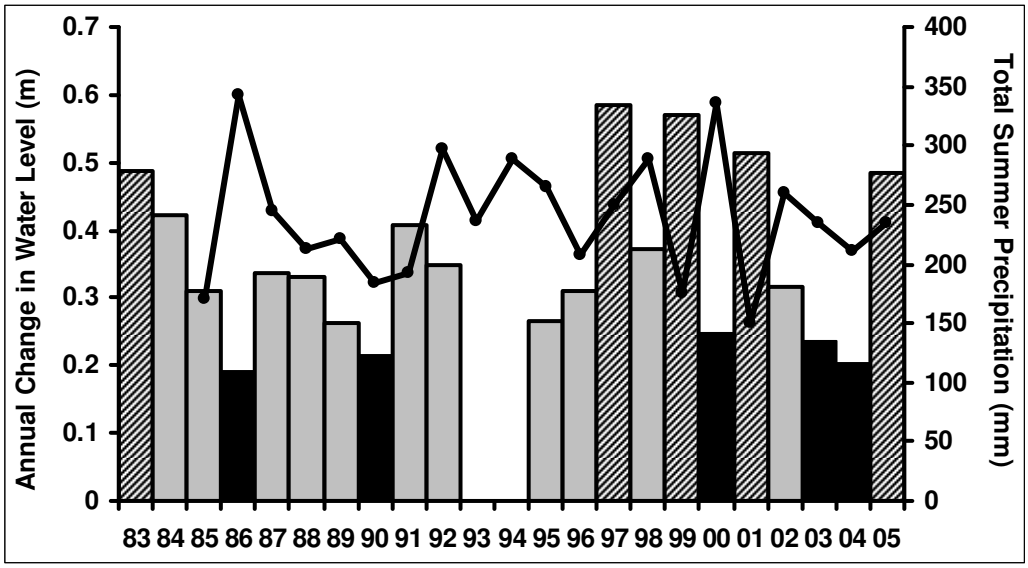

Figure 7: Annual change in lake water levels (m, bars) and total summer precipitation (June, July and August average in mm, black line) for the Otty Lake watershed region between 1985 and 2005 (Cross-hatched bars = large change in water levels, low water; Black bars = little change in water levels, high water).

One example to illustrate the effect of the weather on water levels is the summer of 1997. The weather that summer was warm (average =19.3℃ (66.7 F)) and there was lower than normal rainfall (summer total = 250 mm (9.8 in)). Water was lost through evaporation but was not replaced by rainfall (a 0.58 m (23 in) difference between spring and fall water levels) so by the end of the summer the water levels were low. Other years when water levels were low include 1999, 2001 and 2005 (cross-hatched bars in Figure 7).

In contrast, the summer of 2000 was cooler (average=18℃ (64.4 F)) with more rainfall (summer total = 336 mm (13.2 in)) and the water level dropped less than 0.25 m (10 in). Other years when the water levels were considered high include 2003 and 2004 (black bars in Figure 7).

4.4.2. Obstructions to flow

The drop in elevation from the average water level of the lake to the Tay River is only approximately 0.6 m (23.6 in) over the 4.5 km (2.8 mi) length of the creek. Some residents have expressed concern that the height of the creek bed under the bridge at Rideau Ferry Rd. may be only slightly lower than the average level of the lake and therefore may obstruct water flow.

Another common obstruction along the inlets to Otty Lake and in Jebbs Creek are beaver dams. The number of dams on the various inlets and their impact on Otty Lake is currently unknown. In general, beaver dams slow the flow of water and allow silt, nutrients, toxins and other material to filter out into the sediment behind the dam, allowing cleaner water to flow downstream. Beaver dams also reduce erosion and increase the amount of water stored in the groundwater aquifers. Unfortunately when dams are breached, much of the silt and debris that was filtered out of the water is washed into the lake. Some property owners around Otty Lake regularly manage the beaver dams along the streams by ensuring a controlled flow through the dam without a full breach and release of all of the water.

The major impact on the lake of beavers and beaver dams in the outlet creek is a decrease in the fluctuations of lake levels. According to local sources, beavers have been a part of the biodiversity on Otty Lake and Jebbs Creek since at least 1952[12]. It has been suggested that numbers have decreased over the past 10 to 15 years in response to the availability of food trees. One Jebbs Creek resident indicated that only two beaver colonies were observed on the creek in 2005 while in 1992 there had been four.

In 1990, the Otty Lake Association and RVCA made a verbal arrangement to each remove debris and open beaver dams on Jebbs Creek. The RVCA owns and maintains the Perth Wildlife Reserve on the latter end of Jebbs Creek and is responsible for maintaining creek flow through its property. The upper portion of the creek from Otty Lake to the Perth Wildlife Reserve is privately owned and beaver dam removal can be done by the OLA only at the discretion of the property owner.

In 2004 and 2005, RVCA staff conducted a beaver dam survey and removal program along Jebbs Creek within the Perth Wildlife Reserve. In the fall of 2004, one dam was left untouched, three were removed and four were found already submerged. In fall of 2005, the standing dam from 2004 had become submerged and two of the dams that had been removed in 2004 had been rebuilt indicating beaver had recolonized the area. Only one of the rebuilt dams and one of the submerged dams needed to be removed by RVCA staff in 2005.

4.5. Current State of the Resource

In the summer of 2004, concern over high water levels led to the formation of a Water Level Committee on Otty Lake to provide lake residents with information about factors affecting lake levels and possible impacts on lake health. The committee contacted RVCA and Department of Fisheries and Oceans staff to obtain available information and get advice on how best to address the communities concern.

After a lengthy evaluation of the information, the committee concluded that the removal of beavers from Jebbs Creek was not a practical solution. The size of beaver populations fluctuates naturally with the availability of food, habitat, and the number of natural predators. Young beaver leave their families in their second or third spring and can travel up to 250 km in search of their own territory. Removing dams and trapping beavers at the wrong time of year may only make it easier for young beavers in search of territory to move in and rebuild the dam.

According to beaver dam surveys done by RVCA in 2004 and 2005, an average of 2-3 beavers (groups or individuals) are estimated to be building or maintaining dams on the portion of Jebbs Creek within the Perth Wildlife Reserve every year. The number of beavers and dams on private property in the upper section of the creek is unknown but it is estimated there are 3 or 4 active beaver colonies along the entire length of Jebbs Creek. The RVCA will continue to remove beaver dams within the wildlife reserve if needed.

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[12] From a discussion at the August 31st, 2004 Otty Lake Association Lake Management Planning Focus Group meeting

The removal of beavers from private property along Jebbs Creek is done at the discretion of the property owner. In the event there is a real risk of property damage from flooding upstream, the RVCA can provide guidance to individuals, the OLA and the municipality to help resolve the problem.

4.6. Who Regulates the Resource?

Water levels are for the most part determined by local precipitation and temperature and are therefore not regulated by any agency. The Ministry of the Environment regulates the removal of water from the lake for agricultural, industrial or commercial purposes through the *Ontario Water Resources Act* although this is not an issue on Otty Lake.

With regards to obstructions to flow such as beaver dams, property owners on Jebbs Creek (including RVCA) are responsible for the removal of the dams if water levels threaten to flood neighbouring properties. RVCA and MNR staff are available for consultation on how best to resolve the problem.

Landowners have the right to secure appropriate measures to remove beaver from their property although only licensed trappers and farmers can legally trap beaver. The MNR is responsible for issuing permits for trapping and should be consulted before hunting or trapping beaver. For more information on how to control beavers on private land, see the MNR Extension Note on beaver at http://www.mnr.gov.on.ca/mnr/forests/extension_notes/pdf/bvr.pdf.

Thanks to the following volunteers and community partners that provided information for the Water Levels section of this report:

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- DFO
- RVCA
- MNR

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5. Development Pressures and Land Use

5.1. How does this affect you?

Commuting to and from the lake in all seasons has become easier and safer with well maintained highways and all terrain sport utility vehicles. Only minutes from the towns of Perth and Smith Falls and a one hour drive from the rapidly expanding City of Ottawa, Otty Lake has become home to retirees as well as working professionals. Rising property values have made it difficult for people to maintain both a primary residence and a cottage so many people have elected to live on or near the lake and commute to work every day. As the population of Eastern Ontario continues to grow, maintaining the health and rural character of the lake while meeting the demands for development and redevelopment of the remaining waterfront properties will present a challenge.

Even though the majority of the development pressure to date has been on land adjacent to the lake, attention will shift to the undeveloped land within the Otty Lake Watershed. Some people are concerned that as more of the watershed is developed and as the population around the lake increases, the tranquility, privacy and overall quality of life may be lost.

5.2. How is the lake affected?

Not only can increased development impact on the quality of life on Otty Lake but water quality and the overall health of the lake can also be affected.

As the average age of homes and cottages around the lake increases, the age and function of the sewage storage and treatment infrastructure becomes a concern. However, the trend towards permanent homes and major renovations of cottages also results in updated wastewater systems.

Without municipal sewage treatment, each home or cottage relies on private septic systems to effectively store or treat both the sewage and household waste water. Improperly functioning septic systems can contaminate the lake with harmful bacteria as well as nutrients. As more urban demands are placed on these rural systems (laundry facilities, dishwashers, showers and baths, etc.) the possibility of septic system failure increases (see section on septic systems on page 45).

Having become used to urban conveniences such as large homes, manicured lawns, and hardened surfaces, people moving to the lake may impose these expectations on the rural environment. The effect of an urban lifestyle on a lake is cumulative – the combined effects of all harmful activities and practices from all properties around the lake and on the land that drains into the lake impact on the lake. As the population in the Otty Lake watershed increases, the landscape will change and stresses on the lake will increase.

Manicured lawns and large areas of hardened surfaces increase the volume of unfiltered surface runoff that enters the lake. A natural shoreline is the best way to protect the lake. Trees, shrubs and other vegetation provide privacy as well as a buffer between the development and the water. The root systems filter out many of the nutrients, sediments and harmful chemicals before they reach the lake. A natural shoreline also provides habitat for fish and wildlife that is otherwise lost when lots are cleared for development. Minimum setbacks for waterfront structures ensure that a natural shoreline could be maintained. For more information about the Otty Lake shoreline, see Shoreline Protection and Health (page 59).

5.3. History

Land which included the Townships of North Burgess and North Elmsley (now part of Tay Valley Township and the Township of Drummond/North Elmsley) was settled by Europeans in the early part of the nineteenth century and was relinquished by the First Nations people to the Crown by Crawford's Purchase on October 9, 1783[13].

[13] Aboriginal Lands and Treaties in Southern Ontario: http://www.archives.gov.on.ca/ENGLISH/aborige/appmap2.htm

By October of 1816, 1400 settlers had arrived in Perth, stimulated by the government's 100 acre grants of land. An estimated 5 farms bordered Otty Lake in the early 1880's and many of the local farmers enjoyed fishing on the lake and frequently launched their boats from the north shore.

The first permanent settler in the area was Benjamin Brown who in 1805 obtained title to 200 acres of land. Ten or more other land grants were made by the government between 1815 and 1866. The first known summer cottage on Otty Lake was built on the east end of the lake in the late 1880s by George Kerr who owned and operated the Perth Bottling Works. By the late 1920s there were six cottages on that part of the lake.

Between 1900 and 1910 some summer cottages and other structures were beginning to appear on the North shore of the lake, near the site of the present youth camp (Camp Shomria). The camp is located on the original site of the two-storey Connaught Hotel – also variously known as Bungalow Inn and the Otty Lake Park. Perth people frequented the area for picnics, boating and swimming as it was easily accessible by road from Perth. The property was later used to stage social events and offered guest cabins, a snack bar and gasoline facilities for boats.

Around the year 1922 some farmers began to sell their Otty Lake shoreline property for cottage development and by 1928 there were an estimated 20 to 25 cottages on the shores. A substantial portion of the original market for cottage properties came from the Town of Perth and recreational development on the lake was promoted by local businessmen. By 1960 there were 239 dwellings on Otty Lake with water frontage.

5.4. Trends

5.4.1. Population

The population within the former North Burgess and North Elmsley Townships has grown relatively slowly but steadily over the years in part because of the seasonal cottage industry (Figure 8). The close proximity of Perth and the City of Ottawa made Otty Lake a desirable cottage and recreation area.

By the late 1960s cottage development around the lake had reached its peak and concern about overcrowding and the impact it would have on the lake increased. A large number of the properties around the lake were developed between 1950 and 1970 although very few were used as permanent residences. In the 1990's people began staying at the lake all year round and by 2006 the population on Otty Lake is split evenly between permanent and seasonal residents (Figure 9).

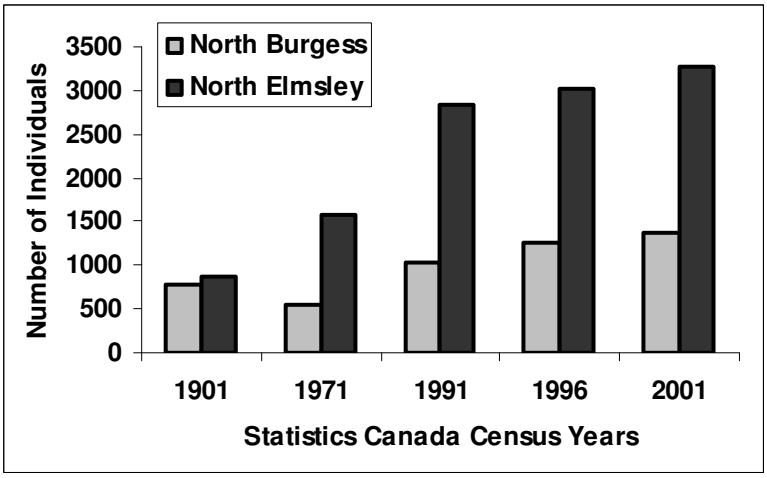

Figure 8: Population growth within the former municipalities of North Burgess and North Elmsley over 100 years based on Statistics Canada data[14].

5.4.2. Development

Between 1960 and 1975, the number of cottages on the lake increased by more than 50%. Just over 10% of the property owners at that time chose to live permanently on the lake (Figure 9).

By the mid 1970's, there were three commercial cottage rental establishments (27 cottages total), a marina and a small grocery store, 40 permanent residences and approximately 300 seasonal cottages on the lake. As the number of cottages on the lake continued to increase, concern over the sustainability of the development and the health of the lake mounted.

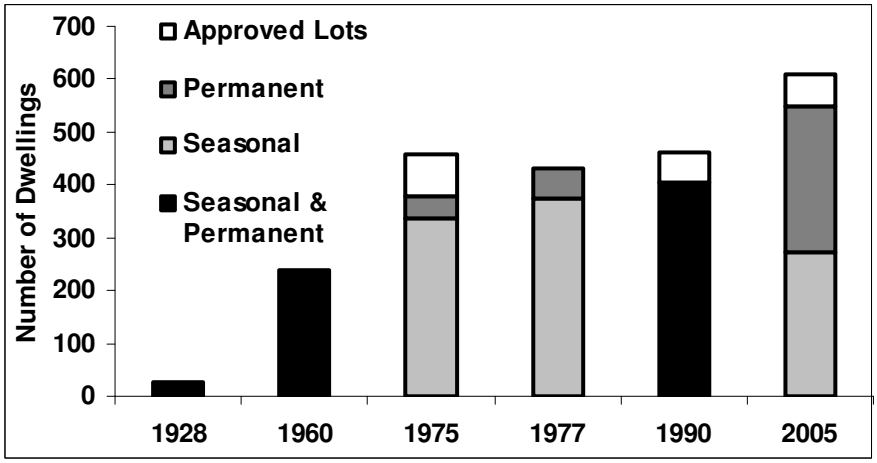

Figure 9: Development on Otty Lake between 1928 and 2005. The number of seasonal and permanent residences, as well as the number of approved lots, are shown when information was available.

The average water frontage per cottage lot in 1971 was 51.5 m (169 ft), ranging from 6 to 805 m (20 to 2640 ft). Many of the older cottages were built on small parcels of land. Development on small lots is undesirable because it limits the

[14] Statistics Canada, Community Profiles website: http://www12.statcan.ca/english/profil01/CP01/Index.cfm?Lang=E

municipality's ability to minimize the impact of development through buffers or setbacks. For example, a structure on a small lot is liable to cause an increase in the relative amount of hardened area and a decrease in the natural vegetation cover and the distance between the septic system and the lake. Fewer than 40% of the septic systems surveyed in 1971 were functioning at a satisfactory level, indicating that the water quality of the lake was at risk. Because these factors increase the likelihood of high nutrient input from properties to the lake, the Townships developed restrictions on maximum lot coverage as well as building and septic system setback requirements.

By 1978 there were 362 property owners and 430 dwellings on record but there were still estimated to be at least 62 vacant lots with minimum required waterfront. Although some of the lots were constrained by the topography or environmentally sensitive areas, development continued and by 1995 there were 401 reported property owners.

5.4.3. Municipalities

The municipal governments of Tay Valley Township (TVT) and the Township of Drummond/North Elmsley (D/NE) are responsible for providing services and implementing land development and land use policies within the Otty Lake watershed. The Otty Lake watershed lies within the former municipalities of North Burgess (which amalgamated with South Sherbrooke and Bathurst Townships in 1998 to form TVT) and North Elmsley (amalgamated with Drummond Township to form D/NE).

Municipalities are able to control development through Zoning By-laws and Official Plans which set out specific requirements including setbacks from water, lot coverage and maximum building height. As the municipalities were amalgamated, individual planning documents and policies had to be harmonized to ensure consistency within, but not between, the new jurisdictional boundaries.

Over the years the municipalities have benefited from the development of waterfront lands. A substantial portion (close to 50%) of the municipal tax revenues were collected from seasonal use properties although, historically, the tax base from seasonal residents was more important to North Burgess than North Elmsley Township.

Growing awareness of the importance of properly functioning septic systems has evolved over the last 40 years. Industry standards and government regulation reflect these changing times. A septic re-inspection program initiated in 2002 by Tay Valley Township has developed a means by which a large portion of the Otty Lake waterfront properties can be assessed and monitored over time (see Septic systems, page 45 for more information about the re-inspection program). There is currently no septic re-inspection program available for properties within the Township of Drummond/North Elmsley.

5.4.4. Official Plans and Zoning By-laws

Prior to 1975, development on Otty Lake was not restricted by the municipalities and proceeded according to standards set out in the Ontario Building Code (OBC) and the County of Lanark through the District Health Unit. Setbacks were not regulated as they are now so property owners were able to build their cottages more or less where they pleased. As of 1975, the Ontario Ministry of Housing required all municipalities to develop Planning Boards and Zoning By-laws to guide development within their boundaries. The Tay Valley Planning Area Board was created and, with the cooperation of the

Ministry of Housing, a plan was produced to govern development in the Town of Perth and the Townships of North Burgess, Bathurst, South Sherbrooke and part of North Elmsley.

The first Tay Valley Official Plan (OP) was published in December of 1976 and provided a framework by which development proposals could be assessed. All new development was required to be on septic sewage systems set back a minimum of 30 m (100 ft) from the nearest shore. The plan also required that Building Inspectors be appointed and that all properties within the municipal boundaries would be subject to the regulations of the OP.

The first Tay Valley Official Plan also placed a freeze on all development within 457 m (1500 ft) of lakes within the planning area until individual lake studies could be developed. The development freeze was limited in that it could only restrict new severances and subdivisions but could not stop development on existing lots.

This Secondary Plan for Otty Lake was completed by 1978 and was amended to the 1979 consolidation of the Official Plan for Tay Valley (Amendment no. 4, Sec. 5.7). It outlined a series of recommendations to address the growing public concern over pollution and shoreline crowding including:

- The installation of private tile beds for sewage should “be conditional wherever possible upon the use of a fill material known to have a good phosphorus retention capability.”
- Development should not interfere with the natural systems of the lake.
- Infill development must be no closer than the infill line or 15 metres from shore, whichever is the greater, and that environmentally sensitive areas should not be altered to adversely affect the vegetation, elevation or permeability of the site,
- All structures except boathouses and docks to be set back at least 30 metres from the high water mark. And all sewage systems shall be set back at least 30 metres from Otty and McLaren Lakes high water mark.

The Otty Lake Secondary Plan attracted the attention of local lake associations who requested that these reforms be extended to all lakes within the planning area.

While the secondary plan had been underway, the OLPCC had maintained communication with representatives from both municipalities and had formed a Property Standards Committee. An important product of this committee was North Burgess By-law no. 77-12, the Property Maintenance and Occupancy Standards By-law, which listed specifications and minimum standards for septic systems and leaching beds, and came into force July, 1979. Highlights of the Property Standards By-Laws adopted by the Townships of North Burgess and North Elmsley include:

- All sewage systems (other than holding tanks) no less than 15 m (50 ft) from shore.
- The bottom of a leaching bed (weeping tile) must be at least 1 m (3 ft) above the high water mark or water table or rock.
- The septic tank must have at least 2 compartments, and a minimum 1893 L (500 gallon) capacity
- Leaching bed must be at least 46 m (150 ft) long, pipes at least 2 m (6 ft) apart, except for aerobic systems
- Sewage of any kind not to be discharged into water or drainage area or on ground surface

- Sewage not to be allowed to leak or escape. Maximum fine: $1000 per day.

By-law 77-12 was later amended by North Burgess Township to create two zones around the lake: Zone 1 where development had already occurred and Zone 2 where development had not yet occurred. Each zone was to have:

- A minimum lot area of 0.4 hectares (1 acre)
- A minimum lot frontage of 45 metres (150 ft)
- A minimum water setback of 15 metres (50 ft) for developed areas and 30 metres (100 ft) for areas yet to be developed

Municipal Property Standard By-laws relating to sewage system installation were later replaced by the Ontario building Code Act, 1992. Current By-laws are addressed under section 5.5 on page 47.

5.4.5. Residential Development

The first major residential development on Otty Lake was the Maple Glen subdivision, located on the north shore (Map 4). The first stage of development took place in 1979 and after some negotiation the developer was able to obtain approval from North Elmsley Township in 1981 for another 18 lots.

Additional lots and the Trillium Estates subdivision were later created to the north of Maple Glen, both having access to the Otty Lake north shore road. The user-in-common areas for the Maple Glen subdivision include beach and boat dock areas. Other subdivisions around Otty Lake include:

- Elmsley Acres (D/NE) - created in 1988 on land bounded by Otty Lake and Jebbs Creek. Negotiations between the developer and the OLA focused on certain environmentally-sensitive lands and wetlands, and the distances between sewage beds and the shores.
- Burgesswood Subdivision (TVT) - developed on approximately 500 acres including land purchased to ensure water access on Little Otty. A formal proposal was made in 1977 and final approval was received in 1980. By 2006 there were 70 lots in Burgesswood, most of them generously proportioned at 2.5 acres each. By separate agreement, 15 additional lots were created on the shore of Otty Lake and Little Otty. These projects proceeded after an impact study commissioned by the Otty Lake Association showed limited impact to the lake.
- Wiseman Subdivision (Chaloa Acres South, Phase III, D/NE) – approximately 30 lots developed in 1988-89 following negotiations with the Otty Lake Association and Council regarding the environmentally-sensitive wetland areas on the north shore of Marl Bay at the entrance to Jebbs Creek, the 13-metre per lot requirement for a user-in-common shore, and the required size of estate lots, in accordance with the Official Plan.

5.4.6. Septic Systems

Much of the concern about water quality today is related to either phosphorus loading or bacterial contamination. Shoreline development and the associated sewage treatment systems that have been installed (or not) over the years are

of particular concern. Older septic systems, privies and grey water pits often do not meet current health and building codes and are prone to malfunction, thereby releasing untreated sewage containing both phosphorus and harmful bacteria directly into the lake or water table.

Cottages developed in the 1920's were likely equipped with an outdoor privy; a pit dug into the ground with a privacy structure over top of the hole. In many cases the wastewater from washing and cooking would have found its way more or less directly back into the lake. As systems became more elaborate and more people installed indoor plumbing, steel drums were used as septic tanks and simple weeping beds were installed, often too close to the waters edge for proper filtration of the wastewater.

Filtration of the wastewater occurs as the liquid percolates down through sand and crushed stone and particles are captured on individual grains of sand and soil. Over time, the filter material becomes saturated with waste particles and the bed becomes clogged and unable to filter as effectively. When this happens, the septic system has malfunctioned and is sending untreated liquid into the lake either under or above ground. Over the years the municipalities have imposed greater setbacks for septic systems to ensure that if the system does fail, it is far enough back from the lake that immediate contamination will not occur.

5.4.6.1. Septic systems on Otty Lake

A sewage system survey conducted in 1971[3] found that although 75% of respondents had flush toilets, only 63% of the septic systems had been installed after 1950 (37% were older than 20 years). Of those systems reported, 23% had septic tanks (56% had less than a 500 gallon capacity and 58% were steel tanks which are subject to corrosion over time), 19% had a tile field (more than half of the fields were less than 3 m (10 ft) above the lake) and 11% had a pit privy less than 15 m (50 ft) from the lake. A survey of 333 septic systems conducted that same year found that only 39% were up to standard.

In 1974, Ontario regulators set the septic tank capacity to a minimum of 500 gallons and many property owners were required to replace their 200 gallon systems. Approximately 75% of the systems classified as directly polluting and public health nuisances in 1973 were also corrected. By 1975, 81% of the properties on the lake had a septic tank system and 15% still used pit privies[3]. The number of older systems was reduced as residents brought their systems up to standard.

A Sewage System and Shoreline survey conducted by the Environmental Youth Corps in 1993[15] found that only 64% of the septic systems on the lake were performing adequately. The remaining systems may have been adding nutrients and bacteria to the lake through groundwater or surface runoff. Problems with systems included the presence of old corroded steel tanks and tile beds that were overgrown with trees and shrubs

[15] Peace, E. 1993. Environmental Youth Corps Otty Lake Sewage System and Shoreline Survey.

A total of 87 Otty Lake septic systems were inspected through the Tay Valley Septic Re-Inspection program between 2000 and 2005[16]. There were no visual concerns for 60% of the systems that were inspected. The remaining systems (40%) were not up to standard for a variety of reasons, the most common of which included that the system was located too close to the lake, the tank was in poor condition, there was excessive plant growth on the tile bed or other signs of malfunction.

The survey conducted by the Environmental Youth Corps in 1993[15] also found that 54% of property owners that responded used phosphorus free products in their homes while 14% used some and 18% did not consider phosphorus content when selecting their household products. Interestingly, 13% of people did not know if the products they used contained phosphorus or not.

One encouraging result suggested by the survey was that 72% of property owners did not use any fertilizers, insecticides or herbicides on their lawn or garden. A larger percentage of people used fertilizer on their properties (14%) than insecticides (5%) or herbicides (6%) and a small percentage used all three (3%).

5.4.7. Lake Capacity

Over the years, several methods have been used to estimate the ***carrying capacity*** of Otty Lake but there have been inherent problems with each method used. Carrying capacity generally refers to the level of development beyond which the lake health and character are degraded. The following are offered as examples of some of the methods used to estimate the carrying capacity of Otty Lake. Any values of carrying capacity presented here do not reflect the actual carrying capacity of Otty Lake.

One of the methods used in 1975 by the Ministry of Natural Resources (MNR) was the Boat Limit System which calculated the capacity of a waterbody to accommodate a safe level of recreational activity. Based on a safe boating capacity of 1 boat per 10 acres, the development capacity was calculated to be 548 cottages[3], approximately 70 more cottages than were already developed on the lake.

Another method used to estimate development capacity was based on nutrient loading. Phosphorus is a nutrient that is found naturally in limited supply in the lake ecosystem. When phosphorus levels are low, water clarity tends to be high and plant growth is limited. As development around the lake increases, land use practices which result in increased phosphorus loading also tend to increase (clearing of natural vegetation, use of lawn fertilizers, improper maintenance of septic systems, etc), leading to excessive plant growth and algae blooms (for more information about phosphorus, see Surface Water Quality, page 19). The expectation was that by estimating the amount of phosphorus entering the lake under a variety of development scenarios, the effects of development on the health of the lake could be predicted.

Several phosphorus based models have been used over the years to try to calculate the capacity of Otty Lake for development but there have been problems with the assumptions made in each of them. Past and present phosphorus

[16] Willie, S., 2005. Tay Valley Township Sewage System Re-Inspection Program.

loading models assume that all of the phosphorus that enters the septic systems of properties within 300 m (984 ft) of the lake will eventually reach the water. Current research indicates that more phosphorus may enter the lake through surface runoff than from properly functioning septic systems that are approved by current Ontario Building Code standards and which retain much of the phosphorus from the wastewater.

Another problem with nutrient based lake capacity models is that they only take into account the phosphorus input from properties within 300 m from the lake. Surface runoff can travel much farther distances depending on the geology and slope of the land within the watershed. More scientific evidence is needed before capacity measures based on phosphorus loading can be defended with confidence. In the mean time, the impact of development on Otty Lake can be mediated by ensuring adequate setbacks, minimum lot sizes and ensuring that natural vegetation is maintained as a buffer along the waterfront.

5.5. Current State of the Resource

In 2005, there were a total of 547 dwellings on Otty Lake; 273 seasonal and 274 permanent homes (including Maple Glen and Burgesswood subdivisions). Only 6 of the 11 privately owned islands have been developed although one of the six cottages is no longer in use. Scouts Canada Valley Highland Area maintains Camp Whispering Pines on land leased from RVCA at the southwest end of the lake.

Commercial land uses within the Otty Lake watershed include a children's camp (Camp Shomria), two cottage rental operations, one operational dairy farm and several maple syrup operations. Oliver's Mapleworks is a larger commercial operation (about 2000 taps) but at least six hobby operations (fewer than 2000 taps) have also been identified.

Concerns about development on the lake include the conversion of cottages to permanent residences and the development of large permanent dwellings on remaining waterfront properties. Environmental changes have also affected development requests from Otty Lake inhabitants e.g. the threat of mosquitoes with West Nile virus has resulted in the enclosure of some decks into screened in porches or all- season rooms (usually on the lake side of homes and cottages). These increased hard surfaces result in a reduction of the natural vegetation and soils between buildings and lake that are used to absorb run-off. A municipality's ability to control the type of conversion and development is limited by the guidelines outlined in the Official Plan and Zoning By-laws. Minor variances can be requested where intended land use does not meet the requirements set out in municipal planning policies. In both municipalities minor variance applications are evaluated by an independent body appointed by Council called the Committee of Adjustment. In TVT, all planning applications for land within 100 m (328 ft) of water must include a Site Plan Control Application which is circulated to the RVCA and approved by the Township. Differences between the planning policies for waterfront development in Tay Valley Township and the Township Drummond/North Elmsley are shown in Table 1.

Table 1: Differences in the planning policies of the two municipalities with jurisdiction in the Otty Lake watershed, Tay Valley Township (TVT) and the Township of Drummond/North Elmsley (D/NE)

	TVT	D/NE
Lot Area (minimum)	4050 m^2	4000 m^2
Lot Frontage (minimum)	60 m	50 m
Yards (minimum):		
Front	30 m	30 m
Exterior Side	10 m	7.5 m
Interior Side	6 m	3 m
Rear	7.5 m	7.5 m
Height of Building (maximum)	9 m	11 m
Lot Coverage (maximum)	10%	15%

The differences between the planning policies of the two municipalities can frustrate property owners that must work within the policies of their municipality while others on the lake have different restrictions These planning policies have been put in place to protect the long-term health of the lake by requiring minimum lot size and frontage that ensures no overcrowding of cottages and homes, preserving the character of the lake (building height) and limiting hardened surfaces which increase runoff (lot coverage).

Water clarity is a measure of the amount of algae in the lake and algae is limited by the amount of nutrients available for growth. Since nutrients are introduced to the lake in large part by the people that live around the lake, property owners around Otty Lake can have a direct influence on their property values in the future.

Although property values and hence municipal tax revenues tend to increase with increased size of structure, poor water quality resulting from poor land use practices and planning reduces property values. For example, a municipality in Maine with an estimated tax valuation of $211 million (60% of which was lakefront property) would lose almost $10.5 million if the water clarity on local lakes were to decrease by 1 m[17]. The municipality would then be forced to raise the taxes of non-shoreline residents to compensate for the lost property values on the lakes. Another study done in Maine showed that properties on lakes with a one meter increase in clarity had higher property values (2.6 to 6.5%) while a one meter decrease in clarity led to a 3.1% to 8.5% decrease in property value[18].

Currently (summer 2006) there are 292 undersized lots on Otty Lake (143 in TVT and 149 in D/NE) ranging from approximately 0.6 acres (0.02 ha) to 0.96 acres (0.39 ha).There are approximately 23 vacant lots remaining on the shoreline of Otty Lake within the Township of Drummond/North Elmsley and 24 in Tay Valley Township, some of which are quite large. In addition to the vacant waterfront properties, many of the original settlers' backshore fields have returned

[17] Maine DEP Lake Assessment Program, More on Dollars and Sense:The Economic Impact of Lake Use and Water Quality. http://mainegov-images.informe.org/dep/blwq/doclake/econlong.pdf

[18] Boyle, Kevin and Roy Bouchard, 2003. "Water Quality Effects on Property Prices in Northern New England, " LakeLine Vol 23(3), pp 24-27

to their natural state as a result of a decline in farming and could also be developed. There is the potential for at least 47 additional cottages or homes on Otty Lake and considerably more within the watershed. Some of these lots, however, may be undersized or difficult to develop because of proximity to wetlands.

Additional lots can be created in two ways: by consent (severance) or by plan of subdivision (a plan of subdivision generally requires technical reports and data which address the environmental impacts of the development). Any large lots that remain on the waterfront or within the watershed could therefore be subdivided into multiple lots. Since 2002 there have been 2 severance, 3 minor variance, 2 site plan and 8 zoning applications for waterfront properties within TVT. On waterfront properties on the D/NE side of the lake there have been 1 severance, 1 zoning and 8 minor variance applications.

5.6. Who Regulates the Resource?

The appropriate agencies must be contacted before beginning any of the projects listed in Table 2 to ensure the proper permits are acquired (if necessary) and impacts to the environment have been minimized.

Table 2: Agencies to be contacted prior to starting projects in and around the lake.

Project Type	RVCA	Lanark County	TVT or D/NE	MOE	MNR	DFO*	MMA
Planning Applications/ Minor Variance Site Plan Zoning	√		√				
Septic Permit Approval			√				
Severance	√	√	√				
Subdivision Approval		√		√			
Shoreline Stabilization	√				√		
Dock	√				√	√	
Boathouse	√		√		√	√	
Aquatic Plant Harvest	√				√	√	
Dredging	√				√	√	
Floating Raft / Mooring Buoy	√					√	
Spills and Water Contamination				√			
Official Plan Amendments							√

* On Rideau Canal waterway only.

Thanks to the following volunteers and community partners that provided information for the Development Pressures and Land Use section of this report:

- OLA Land Use Committee
- Tay Valley Township
- RVCA
- Township of Drummond/North Elmsley

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6. Fish and Wildlife Health

6.1. How does this affect you?

The presence of wildlife forms an integral part of many people's lake experience. It is why many people want to get away from it all and head to "cottage country". The sound of a loon calling at dusk, the sight of the first trillium in bloom and stories of "the one that got away" provide both a rush of excitement and a sense of peace that all is well with the world.

In addition to our personal enjoyment of particular species, each indigenous plant and animal within the watershed is an essential part of the ecosystem that sustains us. Besides the more glamorous species we notice every day, we depend on many less charismatic species to filter and cycle the nutrients that enter the lake, recycle and remove contaminants from the air we breath, shade us from solar radiation, and the list goes on. Our quality of life is directly linked with the natural world.

6.2. How is the lake affected?

A lake is so much more than a hole in the earth's surface filled with water. It is a living system that is brought alive by the variety of organisms that live, breed and die within it. These organisms are responsible for the cycling of nutrients, chemicals and energy within the lake and therefore have a direct impact on the health of the whole system.

Each organism plays a role in the lake at some point in its life or death. Waste products (dead organisms, feces, runoff, etc.) that enter the lake are broken down and used for growth or reproduction by animals that become prey for other animals. In this way nutrients are used and reused to sustain a healthy, balanced ecosystem.

The loss of biodiversity (the number of different species within the watershed) as a result of human activities is of concern on Otty Lake. Although it may appear as though species are reduced in number or lost as a result of natural diseases or competition, populations are made more susceptible to extirpation (local extinction) by human activities including:

- **Poaching**: Fishing or hunting out of season can result in reduced reproductive success and a decrease in population size.
- **Invasive species**: The unintentional introduction of an invasive species through contaminated boats, boat trailers and fishing tackle can mean the loss of native species through competition and the alteration of essential habitat.
- **Habitat alteration or destruction**: The removal of shoreline vegetation and the alteration of the shoreline impacts fish and wildlife populations

To prevent the extinction of species in Canada and the loss of biodiversity, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) was formed to review the status of wildlife at risk. Species at risk in Canada are protected by both National and Provincial Acts and are designated by the Committee to one of the five following categories: ***extinct***, ***extirpated***, ***endangered***, ***threatened*** and ***special concern***.

6.3. History

6.3.1. Fish

The first fish survey conducted in the early 1900s identified a healthy northern pike population in Otty Lake. The next recorded survey conducted by the Ministry of Natural Resources (MNR) in 1974 concluded that the most prevalent fish species in the lake included northern pike, smallmouth and largemouth bass, yellow perch, rock bass, pumpkinseed and other various forage species.

6.3.2. Wildlife

The first European settlers in the watershed cleared some of the land for agriculture and harvested the timber for fuel and building material. Although the landscape was altered and wildlife habitat became more fragmented, the density of development was low and probably did not result in significant changes in fish and wildlife populations.

6.4. Trends

6.4.1. Fish

There have been few scientific surveys over the years to monitor fish populations in Otty Lake. The majority of the fisheries information was collected by Wally Robins, an avid fisherman on Otty Lake, and relates to the small and large mouth bass populations although some information is available for northern pike and carp. Wally's information is used to describe the current state of the resource.

Based on Wally's information, it appears that there has been a decline in the northern pike fishery over the years. Two factors are thought to be responsible for the decline. Shoreline and near-shoreline development resulted in the removal of shoreline vegetation and alteration of the shoreline structure (retaining walls, docks, boathouses) which impacted prime spawning locations and forced the pike to congregate and spawn in a few remaining areas. The close proximity of these fish and the physical nature of spawning allowed a lymphocystic disease (a skin disease spread from fish to fish via physical contact) to spread throughout the population. The disease was often fatal in fish already stressed due to marginal habitat conditions.

6.4.2. Wildlife

Sightings of various bird species within the Otty Lake watershed have been recorded by volunteers over the years and compiled for this report by Rosemarie Hoppe-Wilhelm (Appendix 4). The information is helpful in determining the overall biodiversity of the area. Individual species abundance is unknown but can be estimated from bird counts compiled at nearby Murphy's Point Provincial Park. The data suggest that sightings of a number of bird species have increased between 1985 and 2005 although the change may not be statistically significant (Appendix 5). Breeding bird species from

the Perth area was also collected through the Ontario Breeding Bird Survey (Region 25, Square 18VQ06[19]) and is presented in Appendix 6.

Another monitoring program conducted by volunteers on Otty Lake is the Canadian Lakes Loon Survey. Monitoring of loon pairs on the lake since 1991 suggests that the number of breeding loon pairs on the lake has declined over the years (Figure 10).

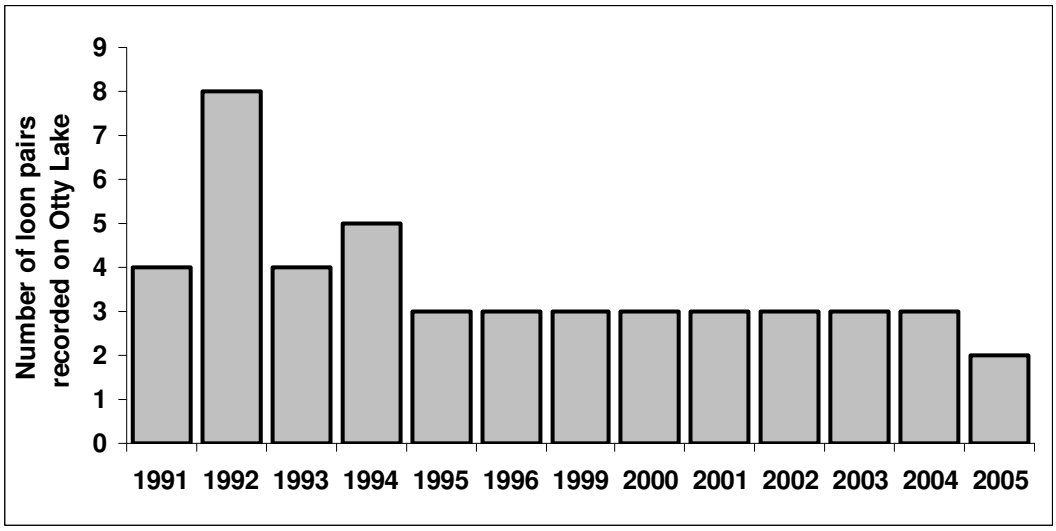

Figure 10: Canadian Lakes Loon Survey, 1991 to 2005.

Besides the information collected by volunteers for the Breeding Bird Survey and Loon Watch, a Great Blue Heronry with 80 nests was discovered between Andrew and Otty Lakes in 1978. There is little other information about the occurrence or abundance of wildlife in the Otty Lake watershed that can be used to determine trends over time.

6.5. Current state of the resource

6.5.1. Fish

Otty is a moderately productive or ***mesotrophic*** lake, meaning it tends to produce and sustain healthy fish populations. A mesotrophic lake is good for fish because it has moderate but not excessive vegetation growth and there is a ***thermocline***; a distinct separation between the warm water at the surface and the cold water below. In Otty Lake there are also rock structures and branches in the water that provide ideal habitat for both predator and prey fish.

Otty Lake is thought to support healthy cool and warm water fish habitat and communities although there have not been any scientific surveys to confirm the current state of fish populations[20]. For a full list of species, including the estimated condition of each population, see Appendix 7.

[19] Ontario Breeding Bird Atlas: http://www.birdsontario.org/atlas/atlasmain.html
[20] Jennifer Lamoureux, RVCA Aquatic and Fish Habitat Biologist, personal communication.

Water leaves Otty Lake through Jebbs Creek which also sustains healthy warm and cold water fish communities including:

- largemouth bass
- smallmouth bass
- northern pike
- rock bass
- pumpkinseed
- brown bullhead
- banded killifish
- central mud minnow
- burbot

Electro-shocking studies show high catches of young-of-year northern pike, smallmouth bass, and largemouth bass, suggesting that Jebbs Creek is an important nursery for fish from Otty Lake and the Tay River[21].

Impacts on the Otty Lake fishery over the years include shoreline development and associated loss of natural shoreline, sedimentation from erosion, changing water levels due to dams constructed by cottagers, beavers on Jebbs Creek, and cattle access to Jebbs Creek. Fishing bass out of season can also have an effect on bass populations.

Bass

Overall, the bass population in Otty Lake appears to be in excellent health. Individual fish are generally free from external parasites and abnormal skin lesions and there is an abundant supply of various year classes.

The lake sustains a variety of forage fish and other food sources for both small and largemouth bass including lake herring, black suckers, black crappie, perch, chub, rock bass, pumpkinseed and bluegills. Other non-fish food sources include crawfish, frogs, young or juvenile snakes and turtles, and both mature and nymph-form insects.

6.5.2. Habitat

Eurasian water-milfoil is an invasive aquatic plant that has exploded in volume and density in Otty Lake over the last ten years. Although these dense patches of vegetation provide feeding and resting habitat for largemouth bass and the small fish they feed on, the vegetation can also limit the movement of larger fish and result in lower oxygen levels as the plants begin to die-off. As milfoil beds appear in new locations in Otty Lake, largemouth bass disperse more widely to take advantage of the new habitat. Fish species that cannot make use of the milfoil habitat may loose habitat and as a result, overall aquatic diversity may be reduced.

Otty Lake contains a large number of off-shore structures that provide habitat for smallmouth and largemouth bass. Rock shoals, mid-lake humps and large mud flats adjacent to the main basin are prime feeding stations for bass. Individual islands and clusters of islands also provide important structural features for predatory fish.

The Otty Lake shoreline is heavily populated with cottages and permanent residences. Over the years, the shoreline has been extensively altered by the construction of docks, retaining walls and swimming rafts. A natural shoreline with overhanging vegetation shades the water and provides ideal fish habitat but when the shoreline has been altered, fish can

[21] Ontario Ministry of Natural Resources, 2001. Fish Habitat of the Tay River Watershed: Existing Conditions and Opportunities for Enhancement.

use some of the lower impact structures. Largemouth bass in particular will stay close to the shoreline in the summer months and use floating and post docks as resting and ambush points for feeding.

Bass are opportunistic spawners and while shoreline development over the years has degraded some spawning locations, a variety of suitable spawning sites remain. Mud, small rock and gravel and other hard bottom surfaces can be found along the irregular shoreline of Otty Lake that are sheltered from prevailing spring winds and receive sufficient sun to warm surface temperatures into the 13 to 18°C (56 to 65°F) range required for spawning.

The greatest impact on the survival of bass eggs and fry is from predation by other fish. Eggs will be eaten within moments of being left unprotected so male bass guard the nests 24 hours a day. Because they have little to eat while they guard the nest, male bass are easy targets for anglers. To ensure that enough eggs hatch to sustain the population, bass fishing season does not begin until the last week in June after all of the eggs have hatched. Catching bass out of season, even if they are released back into the lake, can have serious implications on egg survival and the population as a whole.

The recent arrival and proliferation of zebra mussels has increased water clarity in the last three years. Although the behaviour of largemouth bass does not appear to have changed, smallmouth bass have been observed spending more time in deeper water earlier in the year and are remaining there for extended periods of time.

Although Otty Lake has a maximum depth of 27 m (90 ft) (average = 9 m (30 ft)) there is insufficient oxygen below 30 feet to sustain fish for extended periods. That said, the deep water in Otty Lake is critical habitat for smallmouth bass during the late summer as they follow their principal food source of lake herring to these areas.

Fry, fingerling and juvenile bass are natural food sources for various predators that live in and around Otty Lake. Other fish, turtles, loons, herons, otters and mink are some of the animals that feed on fish from the lake. Once bass reach approximately 2 pounds (5-8 years of age) the number of natural predators diminishes substantially. The only remaining predators are humans.

6.5.3. Threats

Otty Lake does not experience the same volume of fishing pressure as other nearby lakes. There are a large number of other lakes in the immediate area that offer good bass fishing which relieves some of the angling pressure on Otty Lake. Since Otty Lake does not have walleye or a vibrant northern pike population, there is little to no winter or spring fishing pressure and few incidental bass catches out of season.

In addition to notifying property owners of the impacts of bass fishing out of season, the Otty Lake Association (OLA) has promoted catch-and-release and selective harvesting of fish on Otty Lake for more than 15 years. The OLA has also helped raise awareness of the Ministry of Environment's *Guide to Eating Ontario Sport Fish*, which suggests that only smaller specimens of both bass species and northern pike are recommended for human consumption.

Other threats to fish habitat and populations include nutrient loading from developed properties and alterations to the shoreline of residential lots[21].

Northern Pike

The average size of northern pike caught in Otty Lake appears to have decreased over the past 30 years according to Wally Robin's fishing record. Currently, fish in the 2-3 pound range are common. Large fish are still present in Otty Lake but, with the exception of the spawning season and occasional feeding forays into shallow water, these fish reside in the lake basin where little or no angling takes place. As a result, no conclusive evidence exists to gauge the current status of the northern pike fishery. Based on catches of 50 to 75 pike per year over the past three years however, it appears fewer pike have been impacted by serious skin disease.

Carp

The carp population in Otty Lake is already large and continues to grow with mature fish up to 40 pounds. There are few natural predators of juvenile and adult carp in Otty Lake and therefore little control over their increasing numbers. Carp do not pose a direct threat to bass as a predator however, while feeding on vegetation and minuscule underwater species, they may impact spawning locations.

6.5.4. Wildlife

Data compiled by volunteers suggest a variety of birds (Appendix 4) and other wildlife (Appendix 8) occur within the watershed. The state of individual populations is unknown.

Patches of wildlife habitat that have become isolated from other areas by development of homes and roads can prevent wildlife populations from breeding with individuals from other populations and can lead to reduced mating success and inbreeding. These populations are more susceptible to disease and are likely to decline in numbers and risk local extinction. When numbers are already low, as is the case with Species at Risk, the connectivity of habitat is particularly important to their continued survival within the landscape.

Just over half of the Otty Lake watershed is forested (Map 3) although the landscape is fragmented by roads and encroaching development. When wildlife head out in search of mates or new territory, the chance of being killed increases with the number of roads they need to cross and the farther they have to travel to find another suitable patch of habitat.

One project underway to improve habitat connectivity that includes the Otty Lake watershed is the Algonquin-to-Adirondack (A to A) initiative. The goal is to maintain and improve a functional ecological link between two of the largest and oldest protected areas in eastern North America. The corridor between the parks has significantly greater tree cover than other areas of Southern Ontario and can be maintained or improved to ensure the continued movement and exchange of wildlife. The Otty Lake watershed falls within the area proposed as a wildlife corridor between the two parks and can play an important role in maintaining healthy wildlife populations.

Nine species (Appendix 9) that are likely to be found in the watershed have experienced declines in their populations to the extent that they are currently listed as species at risk in Canada. These species are at risk primarily because of the

destruction of habitat. Genetic and reproductive isolation, environmental contamination, disease and the presence of invasive species may also have played a role.

6.6. Who Regulates the Resource?

Any project that involves work in or around Otty Lake requires a fisheries review by the RVCA under Section 35 of the *Federal Fisheries Act*. This review involves identifying potential impacts know as HADD (the Harmful Alteration, Disruption, or Destruction of fish habitat).

If an application is made and the project has the potential to result in a HADD, measures to avoid disturbing the fish habitat will be given to the landowner. In other cases, advice will be given on how to redesign the project so that the HADD can be avoided. If the project cannot be redesigned or protection measures cannot be followed, the application will be referred to the Department of Fisheries and Oceans for review.

The Ministry of Natural Resources administers the *Endangered Species Act*, *Fish and Wildlife Conservation Act*, *Lakes and Rivers Improvement Act* and the *Public Lands Act* which all govern what can and cannot be done to fish and wildlife and their habitat within the Otty Lake Watershed. Environment Canada is responsible for administering the *Migratory Birds Convention Act*.

Thanks to the following volunteers and community partners that provided information for the Fish and Wildlife Health section of this report:

- Wally Robins
- John Bufton
- Tobi Kiesewalter –Murphy's Point Provincial Park
- OLA files
- Rosemarie Hoppe-Wilhelm
- Fred Lepine
- MNR – Scott Smithers, Allan Bibby, Shaun Thompson
- MNR Lake files for Otty Lake
- Dennis Brock
- Canadian Lakes Loon Survey (Otty Lake data contributed by Dennis Brock, Wally Robins, and Christine Edmondson)

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7. Mining Rights and Claims

7.1. How does this affect you?

When you purchased your property on Otty Lake, did you purchase the mineral rights to your land or did you buy the surface rights only? If you own the mineral rights to your property you own everything in, on or under your land, including the minerals. On the other hand, if you own only the surface rights to your property, the minerals in, on or under the land you own belong to the province of Ontario.

According to the *Ontario Mining Act 1990*, a prospector can enter your land and stake a claim on mineral rights that are owned by the province. A mining operation on Otty Lake could have a significant impact on noise levels, ground and surface water quality and your property value, just to name a few.

7.2. How is the lake affected?

The mineral rights of a significant portion (25%) of the Otty Lake watershed rest with the Crown. These lands are open for staking by a licensed prospector at any time. The development of mines on these lands could have a negative impact on the health of the lake and of peoples' enjoyment of the lake and the watershed. Some of the impacts include deterioration of wetlands, ground water and private well quality and the lake itself due to both exploration and mining activity, and the lack of regulations in the current Ontario Mining Act to govern the restoration of property following both exploration and mineral extraction.

7.3. History

Settlers looking to start a new life in Upper Canada began arriving in the Otty Lake region of Lanark County in the early part of the 1800s. To encourage settlers, the Crown offered land grants in 100 to 200 acre lots which included title to both surface and mineral rights.

Some settlers cleared enough land to establish modest farms; others learned from experience that the rocky and stone-ridden land was, at best, marginal for farming and turned to mining mica and apatite to sustain their livelihood. They either mined the land personally or deeded or leased their mineral rights to others.

The early 1900s saw the government institute a new acreage tax within the Mining Tax Act of the time. This tax applied to all mineral rights and lands that had been severed from the surface rights. The provisions of this Mining Tax Act became more comprehensive through the years and in the 1950s became embedded in the Mining Act of Ontario

Some mineral rights and mineral lands holders chose not to pay their mineral taxes. Some may have assumed that the mineral rights were worthless - many mines in the area had already been abandoned since the minerals were no longer in demand. Other land owners with limited finances may have failed to pay the mineral tax since it did not mean foreclosure as did the failure to pay land property taxes.

Property owners who failed to pay their mineral rights tax for two years or more forfeited their mineral rights to the province. In the Otty Lake area, the majority of forfeitures were carried out in the 1940s, 1950s and into the early 1960s.

7.4. Trends

In late 2001, Otty Lake residents were shocked to learn that prospectors for Graphite Mountain Inc. had filed a number of mining claims in March 2001 in Tay Valley Township, two of which were in the Otty Lake watershed. One of these claims abutted the north shore of Otty Lake encompassing Lots 1 and A of Concession 8, Burgess, including over 30 lakeshore properties. The second claim was staked just north of the shoreline in the Otty Lake watershed. The mining company also

purchased a property on the Rideau Ferry Road just east of the Elmgrove Road, which they identified as a potential location for a processing plant.

After a two-year struggle by a group of Otty Lake residents supported by the Citizens Mining Advisory Group (CMAG) and the OLA, the claims at Otty were cancelled. At the same time, many of the other disputed Tay Valley Township claims were also cancelled.

7.5. Current State of the Resource

The dismissal of the claims at Otty Lake in 2003 was excellent news and there are currently no active claims within the Otty Lake watershed. All surface-rights-only land remains vulnerable however for future mining, staking and subsequent exploration and mining. In fact, 14 active claims remain in Tay Valley Township (Merkley Road area). As stated earlier, approximately 25% of Otty lakeshore and watershed properties remain “surface rights only” (SRO).

In addition to mica and apatite which were actively mined in the past, the Nepean sandstone formation along the southeast shore of the lake has potential for building stone and is a possible source of glass sand because of its high silica content. Sand and gravel deposits are scattered throughout the watershed and are generally of low to moderate potential.

Otty Lake residents remain concerned about the future potential impact of mining exploration and development in both claimed areas as well as the surrounding areas, including Otty Lake itself. Some of the concerns include:

- Noise, dust and dirt from earth moving equipment
- The increased heavy truck traffic on local roads
- The impact on wetlands, ground water and private wells, and the lake itself
- Environmental issues related to open pit mining e.g. toxic materials released into the watershed
- The negative impact of the above mining activities on property values throughout the area.
- The lack of remediation – many mining companies have a history of extracting minerals and profits and leaving communities to deal with the effects of pollution and altered landscapes.

Members of CMAG continue to push for the return of mineral rights from the crown to property owners and changes in the Mining Act to ensure increased protection for the environment and Ontario rural property owners. To find out if you own the mineral rights to your land, go to the Ministry of Northern Development and Mines website at www.mndm.gov.on.ca

7.6. Who Regulates the Resource?

The *Ontario Mining Act* confers extensive scope and powers for exploration for minerals on SRO properties (i.e. where the Crown has the mineral rights). A prospector may enter and stake a claim on SRO properties, without notification, prior or afterwards, to the surface landowner. The holder of the mining claim, after giving 24 hours notice to the surface landowner in the form of a letter mailed anywhere in the province, can then proceed to begin exploration. The exploration work can

include, tree cutting, trenching, and open pit mining with removal of up to 1000 tons (i.e. 50 truckloads) of overburden from the claimed lands without any requirement for environmental assessment, landowner, or municipal approval.

There are multiple unmapped and abandoned mines and mine hazards throughout the Otty Lake Watershed. These pose both safety and environmental concerns as does the unmonitored assessment phase of any new mining claim. Tay Valley Township, the Conservation Authorities and CMAG have been active in making these concerns known as well as to requesting comprehensive changes to the Mining Act. Currently the Ministry of Northern Development and Mines, while allocating many millions of dollars to abandoned mine clean up, has focused on large contaminated mine sites elsewhere in the province and appears to disregard the problems of areas such as ours. It should be noted that Tay Valley Township has received a letter from the Minister of Northern Development and Mines stating that his department intends to introduce legislative and regulatory changes to the Mining Act in 2006. The specifics of these changes are not known at present.

Thanks to Murray Hunt for preparing a summary of mining in the Otty Lake Watershed, with input from Maureen Towaij, Councillor for Tay Valley Township and Wendy Hassard of CMAG.

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8. Shoreline Protection and Health

8.1. How does this affect you?

The shoreline around the lake is commonly referred to as the “ribbon of life” because of the important role it plays in keeping the water clean and healthy. Unfortunately, shoreline vegetation is frequently removed and replaced with lawns and hardened (rock or concrete) shorelines. Many people have grown accustomed to the “tidy” look of urban homes and parks and don’t realize that by bringing those concepts to the lake they are putting everything they value about the lake at risk, including their privacy, the rural character of the lake, clean drinking and lake water, wildlife health as well as property values (Figure 11).

When the natural shoreline vegetation is removed, important ecosystem components including the lake’s cooling and filtration system, erosion protection, fish and wildlife habitat, as well as the lake’s rural character are also lost. The maintenance of manicured lawns and gardens often includes the use of chemical pesticides, herbicides and fertilizers that can harm fish and wildlife and increase weed and algae growth in the lake. The protection and maintenance of a healthy shoreline is important to each and every person that enjoys swimming, fishing or just spending time at Otty Lake.

8.2. How is the lake affected?

Native trees and shrubs around the shoreline of the lake prevent erosion, provide essential habitat for fish, birds and other wildlife, improve water quality and shade the lake to regulate water temperature.

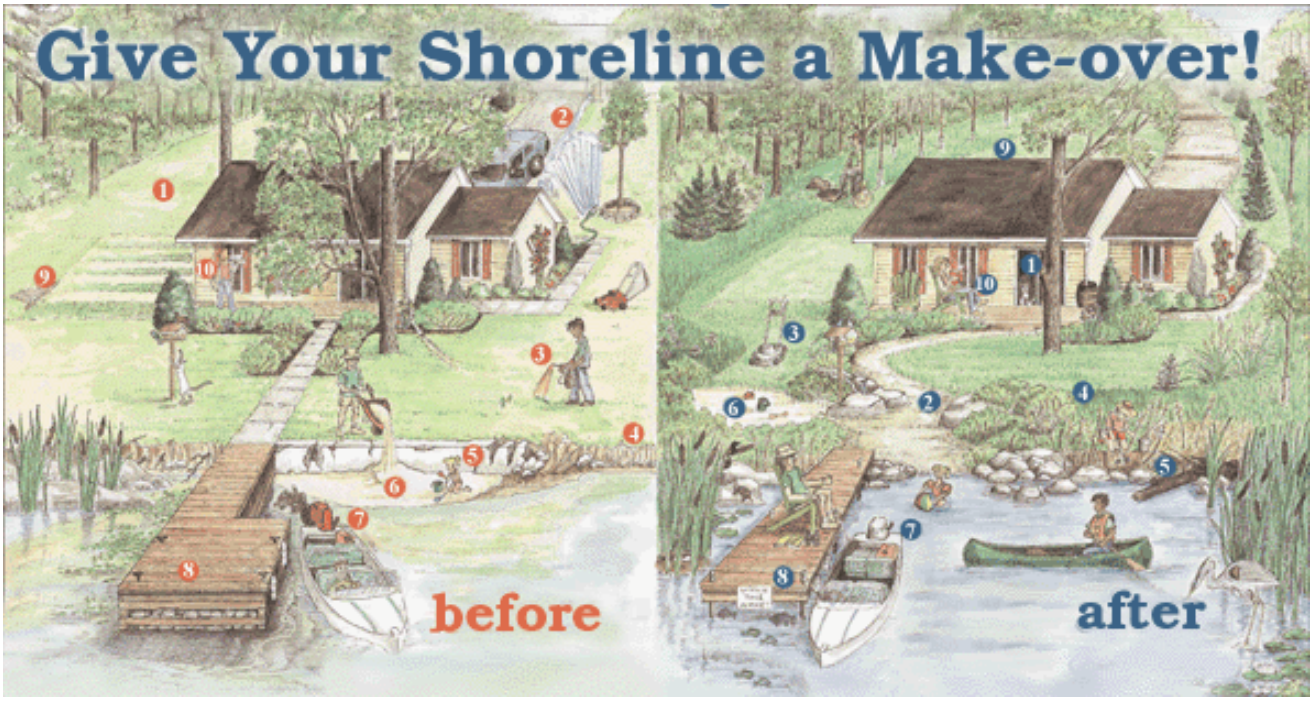

Figure 11: Illustration from the Living By Water Project[22] showing best management practices on a lakefront property

8.2.1. Erosion

The roots of trees and shrubs provide the most durable and reliable protection against erosion. In the majority of cases, erosion has become a problem only after the natural shoreline vegetation has been removed. Without adequate root structure to hold it in place, soil can be washed away at alarming rates by rain, ice and waves. Once the soil is lost, it is very difficult to replace especially when the soil layer is already thin and sparse.

Soil that enters the lake fills in the cracks and crevices that are important habitat for fish and other animals. In spring and early summer the sediment that enters the lake may smother nesting sites and reduce fish breeding success. The soil that enters the lake also carries nutrients that can result in excessive aquatic plants and algae growth (see Aquatic Vegetation, page 27).

8.2.2. Habitat

Tree and shrub roots, fallen branches and dead trees are all important habitat for the fish and wildlife in Otty Lake. A concrete wall provides as much habitat to aquatic animals as a mall parking lot does for forest animals. The more complex the shape of the lake bottom and shoreline, the more places there are for a variety of species to hide, breed and feed. Falling leaves and branches may also provide important habitat and food for the aquatic invertebrates (bugs) which are in turn food for fish.

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[22] The Living By Water Project: http://www.livingbywater.ca/main.html

8.2.3. Water Quality

Consider the many products and chemicals we use on land that can be carried by rain into the lake. Some of the more common ones might be soap, lawn fertilizer, pesticides and herbicides, car wash soap products and pet waste. How long does it take for water from a heavy rainfall to travel from your cottage or home, across your yard and into the lake?

Properties that slope towards the lake or have manicured lawns provide a direct route for contaminants and nutrients into the lake. On the other hand, a buffer of trees and shrubs between your home and the lake will filter out many of the chemicals, nutrients and sediments. The larger roots slow the water down so there is more time for it to soak into the ground where contaminants can become trapped in the smaller roots and soil particles. The plants on the shoreline can then use those nutrients for growth rather than the plants in the lake. The fewer contaminants that reach the lake, the cleaner, safer and healthier the lake is for you.

8.2.4. Temperature

Trees around the perimeter of the lake provide shade and help regulate the temperature during the hot summer months. Cool water holds more oxygen than warm water and provides a better environment for spawning and survival of fish species sensitive to water temperature. As the temperature increases, oxygen is lost from the water and plants including Eurasian water-milfoil (an invasive species that grows in thick mats in Otty Lake) will grow more vigorously[23]. The question is whether you prefer your lake warm and weedy, or cool and refreshing?

8.3. History

Prior to human settlement on Otty Lake, the 35 km of shoreline was dominated by stands of red oak and white pine. Although the watershed was substantially logged in the early 1880's it is likely that the shoreline around Otty Lake remained largely untouched until cottage development accelerated in the 1950's and 60's.

The trend during this era was towards taming nature by creating managed, park-like parcels in the wilderness. There was little understanding at the time of the role of shoreline vegetation in the health of the lake. Many people removed the trees and shrubs and replaced them with manicured lawns that do little to filter runoff, provide habitat, shade the lake or prevent erosion. To prevent erosion, many people also hardened their shorelines using concrete or rocks to create walls between their lawn and the lake. In essence, the habitat used by fish and other animals was removed and replaced with something that may not have been suitable shelter, breeding or feeding habitat.

8.4. Trends

In 1987 MNR and Mississippi Valley Conservation completed a survey of the shoreline of Otty Lake. The Mutual Association for the Protection of Lake Environment (MAPLE) protocol was used to classify segments of the shoreline as

[23] Owttrim G. W., and B. Colman, 1989. Measurement of the photorespiratory activity of the submerged aquatic plant Myriophyllum spicatum L.Plant, Cell and Environment 12: 805-811

ornamental, natural, regenerative or degraded. A second shoreline survey was conducted 18 years later (2005) by the Lanark County Stewardship Rangers and EcoScapes Consulting. Segments identified in 1987 were reassessed to identify how the condition of the shoreline had changed over time (Map 5).

Each classification was defined as follows:

Natural: no significant human disruption, shoreline in natural state, buffer of indigenous species, development generally not visible due to vegetation buffer

Regenerative: good buffer and vegetative cover, significant alteration of the land has been avoided, evidence that property has been allowed to regenerate from ornamental to naturalized shoreline, absence of manicured waterfront and no structures other than dock (less than 20-25% of shoreline developed/disturbed)

Degraded: a property that might impact lake ecology, little or no natural vegetation, active soil erosion, undercutting of shore, evidence of runoff, bare earth, slumping/ failing retaining wall; active and immediate protective /remediation work needed to stabilize shoreline

Ornamental: natural vegetation removed, replaced with turf grass and non-native vegetation, development, docks, decks, gazebos, takes up notable percentage (20-25%) of shoreline

Since 1987, 15% of the shoreline segments have changed classification. More than half (59%) of the segments that were modified showed improvement while the remainder were in worse condition. Figure 12 shows a decrease in the number of natural and degraded shoreline segments and an increase in the number that are ornamental and regenerative over the 18 years.

The majority of the shoreline (85%) retained the same classification between surveys. Close to half (46%) of the segments around the lake are ornamental, 40% are natural, 11% regenerative and 3% are degraded.

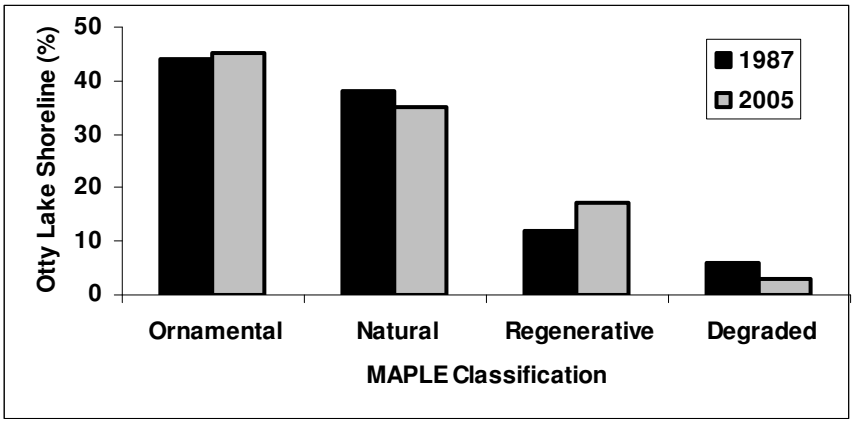

Figure 12: Change in the state of Otty Lake shoreline over 18 years, based on MAPLE surveys done in 1987 and 2005

8.5. Current State of the Resource

Close to half of the segments around Otty Lake are classified as ornamental suggesting that a large portion of the shoreline is not providing the ecological services necessary to maintain lake health (filtration of surface run-off, erosion protection, shade and wildlife habitat). In addition, it is likely that some property owners with ornamental properties continue to use chemical fertilizers, herbicides and pesticides on their lawns which mean that these chemicals continue to pollute the lake causing excessive weed growth and degrading overall water quality.

In addition to classifying each segment of the shoreline in 2005, surveyors collected information specific to each individual property, including number and type of shoreline structures, degree of erosion and the amount and type of aquatic vegetation. Using this information it was discovered that 10% or more of the waterfront was eroding on 59% of the properties around the lake. The majority of those properties (63%) were classified as ornamental while only 5% were natural. As shown in Figure 13, properties classified as ornamental seem to be almost twice as likely (36% of ornamental and only 19% of natural properties) to have erosion on greater than 25% of the shoreline. Properties with erosion on greater than 50% of the shoreline were more than twice as likely to be ornamental (23%) than natural (10%)(Figure 13).

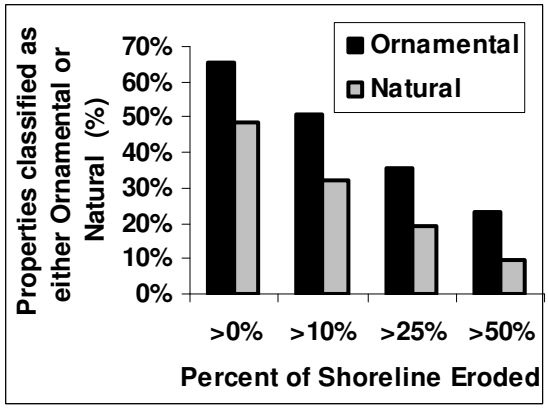

Figure 13: The amount of erosion occurring along the shoreline on properties classified as either ornamental or natural (>=greater than).

In addition to the removal of vegetation, 10% of the 35 km of Otty Lake shoreline has been altered by the addition of structures such as boat houses, docks, decks, retaining walls and boat ramps. Although some of these structures, including floating and post docks may provide shading and habitat for some fish, the maintenance of a natural shoreline is always better for the lake. More than 10% of properties with structures do not meet current regulations and have structures covering more than 25% of the properties shoreline. Almost half (49%) of the properties on Otty Lake do not have any shoreline structures.

8.6. Who Regulates the Resource?

Individual property owners are responsible for maintaining their own shoreline although the RVCA and municipalities encourage everyone to maintain or restore their shoreline to a natural state. For any work near the water, including shoreline stabilization and docks, the Ministry of Natural Resources and RVCA must both be contacted to ensure fish habitat is not altered, disrupted or destroyed (see Table 2 for more information about which agencies to contact).

Thanks to the following volunteers and community partners that provided information for the Shoreline Protection and Health section of this report:

- OLA files
- RVCA
- MVC
- CSW
- MNR
- Lanark Stewardship Council/ Stewardship Rangers
- EcoScapes
- MOE
- the many Otty Lake residents who assisted in identification of the shoreline photos

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9. Impacts of Boating

9.1. How does this affect you?

Boats and cottages have always gone hand in hand in Eastern Ontario but concern about the impacts of boating is growing. Motorized boats, including personal watercraft (PWC), can introduce invasive species, pollute the environment through emissions, irritate property owners with excessive noise and present a safety concern to swimmers and other boaters. Boat propellers can chop up invasive aquatic plants like Eurasian Water-milfoil and aid in spreading the invasion. Boat wake can accelerate shoreline erosion, impact wildlife by flooding nest sites.

Of particular concern to many property owners on Otty Lake are boat noise and safety. Noise pollution from boats is very subjective and can depend on a number of factors. Some people hardly notice the noise while others can be very sensitive to boats with large engines or boats traveling too close to shore. At some threshold point, the lake stops being a place of tranquility and escape.

9.2. How is the lake affected?

9.2.1. Invasive Species

One of the most topical issues related to boating is the spread of invasive species: species that are not naturally found in this part of the world that reproduce so aggressively that they outcompete the native species. The most common invasive species to watch for in Eastern Ontario according the Ontario Federation of Anglers and Hunters are:

Zebra mussels: a freshwater mollusk native to the Black and Caspian Sea region of Asia.

- Zebra mussels filter out large amounts of microscopic plants (phytoplankton) which are an important food source for young fish.
- The mussels remove suspended material which allows more sunlight to penetrate through the water leading to an increase in the amount of aquatic plants biomass and places where plants are able to grow.
- When zebra mussels filter the water, they also remove contaminants including heavy metals. When animals such as sport fish or ducks feed on the mussels, the contaminants become concentrated in their tissue making them harmful for humans and other animals to eat.
- Zebra mussels colonize the tops of native clams and prevent them from opening and closing and also expose the clams to predators, parasites, disease causing them to become locally extinct.
- Zebra mussels colonize boat and domestic water intake pipes, reducing and even preventing the domestic use of lake water.
- Colonies of zebra mussels on the lake bottom can cut swimmer's feet.
- The accumulation of dead zebra mussels shells on the lake bottom affects fish habitat including nesting areas.

Spiny water flea: a microscopic invertebrate (zooplankton) introduced from northern Europe and Asia by ships

- Spiny water flea can eat up to three times as much plankton as native zooplankton species and competes with native species of juvenile fish for food.
- The tail spine of the spiny water flea can get caught in the throats of smaller fish (less than 10 cm long (3.9 in)) causing the flea to be coughed out. Difficulty feeding may lead to lower survival rates and slower growth in these small fish.
- It is still too early to know if spiny water flea will change the aquatic ecosystem and harm the native fish populations.

Eurasian Water-milfoil: an aggressive submerged aquatic plant native to Europe, Asia and North Africa

- Eurasian water-milfoil produces a dense mat of vegetation and blocks sunlight from plants below the surface resulting in lower aquatic plant diversity.
- The thick mats of plants can add more phosphorus and nitrogen to the water column and change the quality of the water by raising the pH and temperature and decreasing the dissolved oxygen. Poor water quality makes poor habitat for fish, waterfowl and other species.
- Eurasian water-milfoil can interfere with boating, fishing, and swimming.

- Thick mats on the surface of the water create stagnant areas that are ideal for breeding mosquitoes.

There are a couple of ways boats and other watercraft can spread invasive species. When a boat is moved from one body of water to another there is the possibility that it is carrying an invasive species in the water droplets attached to or in the boat and motor. Any toys or equipment that may still have water droplets on or in them, including scuba or snorkeling gear, pool noodles, pumps, etc. can carry invasive species.

If an invasive plant species like Eurasian water-milfoil has already been introduced to the lake, motorized boats and PWC can inadvertently help to spread it throughout the lake. When a boat travels through a patch of Eurasian water-milfoil, the propeller either becomes clogged or it cuts the plant into smaller fragments. Each one of those fragments has the potential to spread to new locations and develop into a new plant. The area of lake affected by Eurasian water-milfoil can increase 8 to 10 times in one year through the spread of plant fragments alone[24].

9.2.2. Pollution

An older two-stroke boat engine passes up to 30% of the fuel through the combustion chamber unburned or partially unburned and releases it directly into the water and air as pollution. A new four-stroke marine engine produces only 1/10th the emissions of a fuel-injected two-stroke engine and 1/40th the emissions of a regular two-stroke marine engine[25]. New two-stroke engines are another alternative to older two-stroke models.

9.2.3. Erosion

Any motorized vehicle on the water creates a wake behind it as it moves forward and displaces water. The size of the wake created by a boat depends on the size and shape of the boat, as well as the speed at which it is traveling. The wake created by a watercraft will travel outward from the boat until it reaches shore where it is either absorbed or reflected outward again to travel towards the opposite shore. Depending on the condition of the shoreline, the impact of the wake can cause erosion.

9.2.4. Wildlife

Boats and other watercraft can have various impacts on wildlife. For example, the rotation of propellers in shallow water can stir up the sediment in shallow areas and smother fish spawning areas. Loons can also be significantly affected by boat traffic. They commonly build their nests at lake level close to the waters edge so even moderate boat wake can easily flood the nest. If the eggs hatch, excessive boat traffic can reduce the parents hunting success and ability to feed the hungry young. Both parents and young may also be continually harassed by individual boats which can also be detrimental to the young.

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[24] Western Aquatic Plant Management Society: http://www.wapms.org/plants/milfoil.html
[25] Clean Marine Partnership: http://www.ene.gov.on.ca/programs/3952e_5.htm

9.3. History

According to a survey of property owners in 1971, swimming and boating were the most important recreational activities on Otty Lake. More than three quarters (77%) of seasonal and permanent residents owned 1 or more motor boats. Of all the boats on the lake, 50% of the boats were motorized while the other 50% were primarily canoes and sail boats. The majority of residents felt that boating congestion was not a major problem on Otty Lake at that time.

9.4. Trends

The only survey of boat traffic on Otty Lake since 1971 was conducted in 2005. Because of the difference in survey methods the results cannot be compared to determine trends over time.

No surveys have been done to measure public perception of boat noise and safety issues or the use of lower emission engines. Monitoring has been done on invasive species, erosion and wildlife but it is difficult to link any but the spread of invasive species directly to boating on the lake.

9.4.1. Invasive Species

With regards to aquatic invasive species, Otty Lake has been invaded by two of the three most common in this area. Eurasian water-milfoil may have been present in Otty Lake as early as 1974. It appears that the density of Eurasian water-milfoil has increased over the years but no scientific monitoring has been done.

Zebra mussel veligers (a mobile, juvenile form of the mussel) were likely introduced to Otty Lake in 2001 although it is difficult to pinpoint exactly when and where this happened. Spiny water flea has not yet been detected in the lake and its introduction can still be prevented.

9.5. Current State of the Resource

9.5.1. Boating Activity:

Wally Robins, a Director of the Otty Lake Association (OLA), conducted a visual boating survey over 29 days between June and August 2005 to provide a snap-shot of the volume and type of boating traffic on Otty Lake. Only a portion of the lake could be observed at one time during the survey and therefore the data provides only an estimate of boat usage on the lake.

Peak volumes of traffic occurred on the opening day of bass season and on weekends. Weather had the greatest impact on boating activity as fewer boaters ventured out in wet windy conditions. Hot humid weather in July also appeared to prevent boaters from enjoying the water.

The vast majority of boating traffic on Otty Lake is motorized (Figure 14). Of the total number of boats with motors, almost one quarter had outboards smaller than 10 horsepower (hp) and greater than three quarters had engines smaller than 40 hp. Fewer than 5% of motorized vehicles sighted on the lake during this survey were personal water craft (jet-skis).

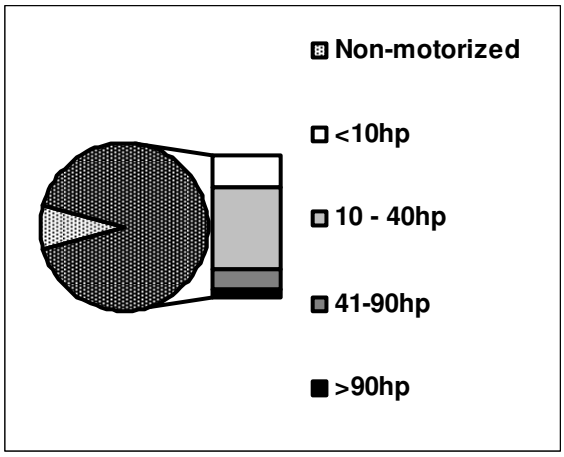

Figure 14: Boats recorded on Otty Lake in summer of 2005 showing the proportion of motorized boats with outboards of specific horsepower (hp).

9.5.2. Invasive Species

Anywhere that people are able to launch a boat that has been in contact with another body of water is a high risk point for the introduction of invasive species. Boaters should dry their boat and equipment in the sun for at least 5 days before transporting them to another body of water if boat washing facilities are not available.

Many individual property owners around Otty Lake have private boat access while Maple Glen and Burgess Wood offer communal launches for their residents. There is currently only one public boat launch on Otty Lake and it is owned and maintained by Tay Valley Township. It is used regularly by lake residents that do not have easy access to the lake on their property as well as visitors to the lake.

The parking lot area at the public boat launch is small which can serve to limit the number of boats visiting Otty Lake on any given day. Invasive species information obtained from the OFAH Invasive Species Program is posted in the parking lot and provides precautionary information to help prevent the spread of invasive species when moving boats or equipment. Loon Alert signs from Bird Studies Canada have also been posted this spring which provide loon/waterfowl friendly tips for boaters.

9.5.3. Erosion

Based on the 2005 Otty Lake shoreline survey, a sizeable proportion of properties on Otty Lake (58%) are being gradually eroded away by rain, runoff and boat wake. The extent of the damage specifically from boat wake is difficult to determine.

9.5.4. Wildlife

Without information about boating activity on Otty Lake it is impossible to make a direct link to any trends in wildlife. A decline in the average number of loon pairs on Otty Lake between 1991 and 1999 (average number of pairs per year = 4) and 2000 to 2005 (average = 3) may be due to a number of factors (see Figure 10, page 52). Boating activity may be one of them.

9.6. Who Regulates the Resource?

The following regulations fall under the *Canada Shipping Act* and are enforced by the Ontario Provincial Police (OPP) on Otty Lake:

- Aids to Navigation Protection Regulations
- Private Buoy Regulations
- Collision Regulations
- Boating Restriction Regulations
- Small Vessel Regulation
- Competency of Operators of Pleasure Craft Regulations

The *Canada Wildlife Act* also serves to protect the fish and wildlife and their habitat. More about the Acts and Regulations in effect on Otty Lake, go to http://www.tc.gc.ca/BoatingSafety/regs.htm.

Thanks to the following volunteers and community partners that provided information for the Impacts of Boating section of this report:

- Wally Robins
- RVCA
- Canadian Lakes Loon Survey data contributed by Dennis Brock, Wally Robins, and Christine Edmondson
- OLA files
- MOE
- OFAH Invasive Species Program

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10. Responsibility of Landowners in Protecting Lake Health

10.1. How does this affect you?

A survey of residents conducted in 1971 showed that the majority of residents felt that the provincial and municipal governments should take action to protect Otty Lake. At that time, 72% of the seasonal and 49% of the permanent residents were willing to pay for government action through additional taxes.

Today, in an era of government downsizing and funding cuts to departments and programs, some responsibilities that used to fall to government are now in the hands of the local community. If the local community does not take responsibility for protecting Otty Lake, who else will?

It is the people who live, work and play around the lake that have everything to lose and the most to gain. If the people who use the lake do not care enough to protect the lake, is there anyone else out there who will? It is the responsibility of the landowners within the watershed to ensure that their investment is protected, their quality of life is preserved and that the health of Otty Lake is maintained for generations to come.

10.2. How is the lake affected?

Human activities in and around the lake may seem relatively benign in and of themselves but it is the cumulative impact of these activities that causes a deterioration in the quality of the water, a reduction in the fish and wildlife, and a decline in the overall quality of life in the watershed.

When everyone does their part to protect the lake, everyone benefits:

- Algae blooms and bacterial contamination are prevented ensuring safe drinking water, safe swimming, and good boating and fishing
- Fish and wildlife have adequate healthy habitat ensuring abundant catches and wildlife sightings in addition to a healthy ecosystem

- The rural character of the lake is protected so that it still feels like you are at the cottage
- The value of your property is protected

10.3. History

There is a long history of dedicated volunteers working to protect the health of Otty Lake. Although the first Otty Lake Association formed in the 1930s appears to have been more oriented to promoting water sports and organizing the annual Regatta, a sense of community among landowners on the lake had begun.

By the 1960s a second lake association, the Otty Lake Protection and Conservation Association, was actively promoting fishing and related outdoor activities. The population of Otty Lake had increased considerably by that time and there was a growing concern for the water quality of the lake. In response to these concerns a Pollution Control Committee made up of dedicated volunteers was formed in 1971.

Under the auspices of the Pollution Control Committee, the lake was organized into nine “areas”, each with a volunteer “Counselor” to provide a communication link between the Committee and the area residents.

In 1973 a volunteer based water quality program was established at Otty Lake. This program continues today (see Surface Water Quality, page 19).

By 1976 the Otty Lake Pollution Control Committee had assumed all of the responsibilities – and more – of the former association and members decided to rename the organization. In 1978 it officially became the Otty Lake Association.

10.4. Trends

The goals of the Otty Lake Association since its early days have been:

- to provide a pollution-free lake environment
- to maintain good recreational facilities and,
- to be generally concerned with matters that affect property owners.

Through the years, members of the Otty Lake Association have encouraged municipal and provincial authorities responsible for regulating lakes, to develop sound lake management policies and principles. As well, dedicated volunteers have worked hard to educate permanent and seasonal lake residents on good environmental practices and have run programs to monitor the health of the lake.

For almost forty years, many caring volunteers have devoted their time and skills to ensure that the water quality and environment of Otty Lake is maintained and enhanced for future generations. The challenge over all of those years has been to convince property owners around the lake to take responsibility for the health of the lake they love and become part of the solution.

10.5. Current State of the Resource

The years of dedicated effort on the part of many Otty Lake volunteers provided a foundation for development of the lake management plan for Otty Lake.

In 2004, driven by development pressures on the lake and recognizing the need to protect the lake's long-term sustainability, the Otty Lake Association acknowledged the role a Lake Management Plan could play in the future health of the lake and initiated a lake management planning process[26].

In October 2005, Otty Lake was accepted as the first of three "core lakes" to receive support for their lake management planning through the Trillium-funded Lake Management Planning Program. The Otty Lake Management Plan will be completed in 2007 and implementation by the Otty Lake community will be ongoing thereafter.

In recent years, one of the greatest changes in the Otty Lake watershed area has been the increase in permanent residency "at the Lake". Otty Lake Association records for 2005 show that there are 273 seasonal and 274 permanent residences on or near the shores of Otty Lake. Approximately 60% of the 574 property owners on or around the lake are members of the lake association.

Between June 2004 and June 2005 it is estimated that more than 51 Otty Lake volunteers contributed 2421 volunteer hours on behalf of Otty Lake and its residents. Given the increase in the number of permanent residents on the lake, the OLA hopes that more people will volunteer their time to help protect the health of the lake they love.

10.6. Who Regulates the Resource?

Regulations including septic design and setback and building setback help to ensure that the lake is protected. In addition to these regulations, each individual property owner, regardless of whether they are a seasonal or permanent resident or whether they live on or near the lake, can decide to protect the lake and the characteristics that make it such a wonderful place.

Thanks to the following volunteers and community partners that provided information for the Responsibility of Landowners in Protecting Lake Health section of this report:

- Lorne Gold
- David Code

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[26] Otty Lake Association, Otty Lake Management Plan Terms of Reference

11. Partnerships in Lake Management

11.1. How does this affect you?

The Otty Lake Management Plan will reflect the values and concerns of property owners and users of the watershed. The process of developing the plan will ensure that everyone with a financial, emotional or spiritual interest in the watershed is consulted and can take ownership of the recommendations made in the plan.

A lake management plan cannot be developed by a single person, group or agency in isolation of the community at large; it cannot be imposed. For the plan to successfully protect the long term health of the lake, everyone with an emotional, financial or professional interest in the lake needs to be involved in the development of the plan. This process will ensure the plan reflects more than one agenda and that there is support from the community at large when it comes to implementing the recommendations.

As a property owner or user of Otty Lake you have a personal interest in ensuring the health of the lake is protected. If you do not perceive any problems now, are you willing to wait until a crisis occurs? Or will you become part of the solution so you can enjoy the lake each and every day?

It is easy to take the health of the lake for granted because it is a beautiful, relaxing place to be. Consider though that some activities taking place around the lake right now are not sustainable and do threaten the long term health of the lake. The lake seems ok now but what about in five, 10 or even 20 years from now?

You are one of the partners needed to help develop and implement the plan. The actions that you carry out on your property matter because the effects are cumulative; there are 546 other properties and hundreds of other people each doing things that impact the lake.

If you decide not to participate in the process then the content of the plan and the action strategies taken to resolve the issues will not reflect your concerns. Your opinion matters because you are a part of Otty Lake.

11.2. How is the lake affected?

The only way to ensure that the health of the lake is improved or maintained is to involve everyone with an interest in the lake in its protection. Working together as partners ensures that the lines of communication are open, that consensus and understanding grow and that everyone has the opportunity to learn more about how their activities can either enhance or harm the lake. As people develop a better understanding of how their actions impact the lake they become better stewards of the land and the lake. Improved land management will ultimately benefit the fish, wildlife, water quality, overall lake characteristics, and all users of the lake.

11.3. History

In the past, Canadians have relied on government to deal with issues related to the environment. If there was a concern over water quality or fish stocks, the appropriate Ministry was contacted and surveys or monitoring would be conducted. Government spending on environmental issues has decreased over the years which has led to a decrease in the monitoring required to ensure ongoing health of our lakes, forests and wetlands.

Otty Lake is fortunate to have had a dedicated association that requested numerous surveys and studies in the 1970's which today provide us with invaluable historical information. Several of these studies were developed by students or government agencies and departments and made recommendations regarding the future of Otty Lake. Because the recommendations were developed in isolation from the community they affected, they did not involve the local community nor necessarily reflect their vision for the future of the lake. The recommendations rarely gained enough support to be implemented and the documents became outdated.

11.4. Trends

The downsizing of government and downloading of responsibility to the community has led many lakeshore property owners to recognize the important role they can play in protecting the lake they love. They recognize they cannot do it on their own but they can certainly start and keep the momentum going towards a healthier lake. More and more lake communities are initiating the development of lake management plans and bringing community partners to the table themselves.

Government and non-government groups and organizations are often spread thin but are able to commit to attend meetings or provide information. The community has therefore taken the leadership role. By involving everyone with an interest in the lake and taking into account their concerns, they encourage buy-in to the plan.

11.5. Current State of the Resource

In 2002, the RVCA released the Tay River Watershed Management Plan, a community developed plan which outlined specific recommendations to ensure the health of the whole watershed. One of the many action strategies identified in the report was the development of comprehensive lake management plans. Developing plans to ensure the long-term health of the lakes would benefit the entire watershed as well as provide detailed information on smaller geographic areas.

Soon after, development pressures on the lake and costly appearances at the Ontario Municipal Board prompted the OLA to consider alternative solutions to protecting the long-term sustainability of the lake in 2004. The Otty Lake Association acknowledged that hard work and a team of dedicated volunteers would be required to develop a lake management plan but a strategy was needed to protect the lake. The process got underway to convince OLA members, other property owners, the municipalities and other partners that this strategic action plan would benefit everyone.

As part of the lake management planning process, an Otty Lake Community Partners group was formed to ensure that all of the government and non-government groups and organizations that have a stake in the health of Otty Lake were

represented during the planning process and had the opportunity to provide their input into the development of the plan. This committee includes, but is not limited to representatives from: municipalities, provincial ministries, federal departments, counties, interest groups, the conservation authority, the business community, etc.

The role of this committee is to provide advice and input into the development of the lake management plan from a technical perspective. This committee will continue to meet and provide input into the 'Vision' and 'Goals and Objectives' for Otty Lake and to review the final lake plan.

11.6. Who Regulates the Resource?

When lake management plans are developed in partnership with other stakeholders, regulations are less likely to be required to ensure the lake is protected. Communication and education through partnership are more likely to produce a successful plan and a healthy lake.

Although the lake management plan will not have legal status, it will provide comprehensive recommendations that can be incorporated in Official Plans and Zoning By-laws as well as the work plans and initiatives of other agencies.

Thanks to the following volunteers and community partners that provided information for the Partnerships in Lake Management section of this report:

- Otty Lake residents and users
- MOE
- Scouts Canada
- Township of Drummond/North Elmsley
- FoTW
- REAL and LLGreen Communities
- OLA
- RVCA
- MNR
- Lanark and District Maple Syrup Producers Association
- Community Stewardship Council of Lanark County
- Historical information from Don Oliver, Tressa Oliver and David Code
- Tay Valley Township
- CSW
- CGIS
- Leeds Grenville and Lanark Health Unit
- OPP Lanark Detachment

Next Steps

The Report on the State of Otty Lake and its Watershed is a milestone in the lake management planning process. Now that all of the available information has been compiled to determine the current state of Otty Lake, gaps in the information can be identified and strategies can be developed to address each of the issues of concern as identified by the Otty Lake community.

Keeping in mind the community's vision for the future of Otty Lake, property owners and community partners are invited to begin developing a specific, measurable and achievable strategy to protect the long-term health of the lake. The Otty Lake Association will be holding meetings and workshops to ensure everyone has the opportunity to participate in the process. The involvement of all community partners is important to ensure continued support for the plan and its implementation. For more information about the lake management planning process or to provide feedback on the Report on the State of Otty Lake and its Watershed, contact the Otty Lake Association at ottylake@sympatico.ca or Karen Hunt, Chair of the OLA Lake Management Planning Committee at mkhunt@ripnet.com.

Glossary of Terms

Anoxic: without oxygen

Aquifer: an underground layer of permeable rock, gravel, sand, silt, or clay from which groundwater can be extracted using a well

Benthic invertebrates: animals without backbones that live in association with streams and lake bottom habitats

Canadian Shield: an area of granite rock dating to the Precambrian Era with thin-soil cover found in eastern and central Canada and adjacent portions of the United States

Carrying capacity: The maximum population size that can be regularly sustained by an environment

Chlorophyll a: a pigment that makes plants and algae green and can be used to determine the quantity of algae in the water

Emergent plants: aquatic plants with floating leaves or leaves that stick out of the water

Endangered: a wildlife species that is facing imminent extirpation or extinction

Eutrophic:. waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the extinction of other organisms

Extinct: a wildlife species that no longer exists

Extirpated: a wildlife species that no longer exists in the wild in Canada, but exists elsewhere

Fecal coliform bacteria: Fecal coliform bacteria are a group of bacteria that aid in the digestion of food and are passed through the fecal excrement of humans, livestock and wildlife. E. coli are a subgroup of these bacteria

Groundwater: water from underground aquifers

Hypolimnion: the bottom and most dense layer of water in a thermally-stratified lake. It is the layer that lies below the thermocline. Typically, it is non-circulatory and remains cold throughout the year

Invertebrates: animals that do not have a backbone, including insects, worms, mollusks, etc.

Lake hydrology: the movement of water into and out of the lake

Limiting nutrient: a chemical necessary for plant growth, but naturally available in quantities smaller than needed for plants to increase in abundance

Loam soil: Soil composed of a mixture of sand, clay, silt, and organic matter

Mesotrophic: a term applied to clear water lakes and ponds with beds of submerged aquatic plants and medium levels of nutrients. These lakes are also of intermediate clarity, depth and temperature

Oligotrophic: Waters with relatively low nutrients levels which cannot support a large amount of plant life

Provincial Water Quality Objectives (PWQO): chemical and physical indicators representing a level of water quality which is protective of all forms of aquatic life and all aspects of the aquatic life cycles

Special Concern: a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats

Species diversity: the number of different species in a particular area

Stewardship action: taking responsibility for the survival and well-being of something that is valued, such as a natural resource

Submergent plants: aquatic plants which live for the most part under water

Surface water: water in streams and lakes

Temperate climate: Temperate climates are those without extremes of temperature and precipitation

Thermocline: a layer within a body of water where the temperature changes rapidly with depth

Threatened: a wildlife species likely to become an endangered species if nothing is done to reverse the factors leading to its extirpation or extinction

Total Kjeldahl Nitrogen (TKN): a measure of the organic nitrogen and ammonia resulting from wastewater and manure discharges into the lake

Total Phosphorus (TP): a measure of all the forms of phosphorus in a sample

Water clarity: measured by lowering a black and white disk (Secchi disk) into the water

Watershed: a geographic area of land that drains water to a shared destination, in this case, all of the land around the lake that drains water into Otty Lake

Watershed slope: 85/10 Average Slope Method uses the elevations at 10% of the overall length and 85% of the overall length (height of fall and rapids deducted) to estimate the representative slope (Otty Lake 85/10 Average =0.0055 m/m). Equivalent Slope Method assumes that the overall flow path is broken into equal length sections and uses a weighted average of the individual slopes of each of these sections (Otty Lake Equivalent= 0.0032 m/m)

Zebra mussel veligers: a mobile, juvenile form of the mussel

Appendices

Appendix 1: Agencies and some of the legislation that determines their responsibilities in the Otty Lake Watershed

Ministry of the Environment	• Environmental Protection Act, 1990 • Nutrient Management Act, 2002 • Ontario Water Resources Act, 1990 • Environmental Assessment Act, 1992 • Safe Drinking Water Act, 2002 • Clean Water Act, 2005
Ministry of Natural Resources	• Lakes and Rivers Improvement Act, 1990 • Fish and Wildlife Conservation Act, 1997 • Public Lands Act, 1990 • Endangered Species Act, 1990
Department of Fisheries and Oceans	• Fisheries Act, 1985 • Canada Shipping Act, 1985
Rideau Valley Conservation Authority	• Conservation Authorities Act, 1990 • Section 35, Fisheries Act, 1985 • Planning Act, 1990
Ministry of Municipal Affairs and Housing	• Planning Act, 1990
Environment Canada	• Migratory Birds Convention Act, 1994 • Canada Wildlife Act, 1985
Ministry of Northern Development and Mines	• Ontario Mining Act, 1990

Appendix 2: The terrestrial plant lists were compiled by Diana Nuttall who has been on Otty Lake (seasonal and now permanent) all her life and are based on her own observations of plants seen within the Otty Lake Watershed area and on observations of others as reported to Diana.

Bushes and Shrubs	Native	Blue beech	*Carpinus carolina*
		Blackberry	*Rubus allegheniensis*
		American bladdernut	*Staphylea trifolia*
		High bush blueberry	*Vaccinium corymbosum*
		Low bush blueberry	*Vaccinium angustifolium*
		Bunchberry	*Cornus canadensis*
		Choke cherry	*Prunus virginiana*
		High bush cranberry	*Viburnum trilobum*
		Wild black currant	*Ribes americanum*
		Spreading dogbane	*Apocynum androsaemifolium*
		Alternate-leaf dogwood	*Cornus alternifolia*
		Gray dogwood	*Cornus racemosa*
		Red osier dogwood	*Cornus stolonifera*
		Prickly gooseberry	*Ribes cynosbati*
		Fanleaf hawthorn	*Crataegus flabellate*
		Fireberry hawthorn	*Crataegus chrysocarpa*
		Fly honeysuckle	*Lonicera Canadensis*
		Juneberry	*Amelanchier arborea*
		Common juniper	*Juniperus communis*
		Eastern red cedar juniper	*Juniperus virginiana*
		Nannyberry	*Viburnum lentago*
		Purple-flowering raspberry	*Rubus odoratus*
		Red raspberry	*Rubus idaeus*
		Steeplebush	*spirea tomentosa*
		Staghorn sumacc	*Rhus typhina*
		Thimbleberry	*Rubus occidentalis*
		Bebb's willow	*Salix bebbiana*
		Heartleaf willow	*Salix eriocephala*
		Pussy willow	*Salix discolor*
		Yellow willow	*Salix lucida*
	Exotic	Common lilac	*Syringa vulgaris*
		Meadowsweet	*Spirea latifolia*
		Basket willow	*Salix viminalis*
		Purple-osier willow	*Salix purpurea*
Coniferous Trees	Native	Balsam fir	*Abies balsamea*
		Eastern white cedar	*Thuja occidentalis*
		Eastern hemlock	*Tsuga Canadensis*
		Black spruce	*Picea mariana*
		Red spruce	*Picea rubens*
		White spruce	*Picea glauca*
		Eastern white pine	*Pinus Strobus*
		Jack pine	*Pinus banksiana*
		Red pine	*Pinus resinosa*
	Exotic	Scots Pine	*Pinus sylvestris*
		Norway Spruce	*Picca abies*

Deciduous Trees	Native	Speckled alder	*Alnus incana ssp. rugosa*
		Black ash	*Fraxinus nigra*
		Red ash	*Fraxinus pennsylvanica*
		White ash	*Fraxinus americana*
		Large-toothed aspen	*Populus grandidentata*
		Trembling aspen	*Populus tremuloides*
		American basswood	*Tilia americana*
		American beech	*Fagus grandifolia*
		Grey birch	*Betula populifolia*
		Paper (White) birch	*Betula papyrifera*
		Yellow birch	*Betula alleghiensis*
		Butternut	*Juglans cinerea*
		Black cherry	*Prunus serotina*
		Pin cherry	*Prunus pensylvanica*
		Wild crabapple	*Malus coronaria*
		Slippery elm	*Ulmus rubra*
		White elm	*Ulmus Americana*
		Dotted hawthorn	*Crataegus punctata*
		Bitternut hickory	*Carya cordiformis*
		Eastern hophornbean	*Ostrya virginiana*
		Ironwood	*Ostrya virginiana*
		Mountain maple	*Acer spicatum*
		Red maple	*Acer rubrum*
		Silver maple	*Acer sacharinum*
		Striped maple	*Acer pensylvanicum*
		Sugar maple	*Acer saccharum*
		American mountain ash	*Sorbus Americana*
		Showy mountain ash	*Sorbus decora*
		Bur oak	*Quercus macrocarpa*
		Red oak	*Quercus Rubra*
		White oak	*Quercus alba*
		Canada plum	*Prunus nigra*
		Balsam poplar	*Populus balsamifera*
		Downy serviceberry	*Amelanchier arborea*
		Smooth serviceberry	*Amelanchier laevis*
		Black willow	*Salix nigra*
		Peachleaf willow	Salix amygdaloides
	Exotic	European alder	*Alnus glutinosa*
		Common apple	*Malus pumila*
		European mountain ash	*Sorbus aucuparia*
		European weeping birch	*Betula pendula*
		European buckthorn	*Rhamnus cathartica*
		Oneseed hawthorn	Crataegus monogyna
		Black locust	*Robinia pseudoacacia*
		Amur maple	*Acer ginnala*
		White mulberry	*Morus alba*
		English oak	*Quercus robur*
		Lombardy poplar	*Populus nigra*
		White poplar	*Populus alba*
		White willow	*Salix alba*

Understory Plants	Native	Canada anemone	*Anemone Canadensis*
		Wood anemone	*Anemone quinquefolia*
		Large-leaved aster	*Aster macrophyllus*
		New England aster	*Aster novae-angliae*
		Small White aster	*Aster vimineus*
		White avens	*Geum canadense*
		Yellow avens	*Geum aleppicum var. strictum*
		Red baneberry	*Actaea rubra*
		White baneberry	*Actaea pachypoda*
		Fragrant bedstraw	*Gaultheria procumbus*
		Beggar-tick	*Bidens frondosa*
		Hedge bindweed	*Convolvulus sepium*
		Black-eyed susan	*Rudbeckia hirta*
		Greater bladderwort	*Utricularia vulgaris*
		Bugbane	*Cimicifuga racemosa*
		Cardinal flower	*Lobelia cardinalis*
		Clammy ground cherry	*Physalis heterophylla*
		Sweet cicely	*Osmorhiza claytoni*
		Rough cinquefoil	*Potentilla norvegica*
		Rough- fruited cinquefoil	*Potentilla canadensis*
		Ground pine club moss	*Lycopodium dendroideum*
		Southern ground cedar club moss	*Diphasiastrum digitatum*
		Blue cohosh	*Caulophyllum thalictroides*
		Columbine	*Aquilegia Canadensis*
		Corn-lily	*Clintonia borealis*
		Golden corydalis	*Corydalis aurea*
		Pale corydalis	*Corydalis sempervirens*
		Wild cucumber	*Medeola virginiana*
		Intermediate dogbane	*Apocynum medium*
		Dutchman's breeches	*Dicentra cucullaria*
		Pearly everlasting	*Anaphalis margaritacea*
		Common fleabane	*Erigeron philadelphicu*
		Daisy fleabane	*Erigeron annus*
		Gaywings	*Polygala paucifolia*
		Ginseng	*Panax quinquefolius*
		Broad-leaved goldenrod	*Solidago flexicaulis*
		Canada goldenrod	*Solidago canadensis*
		Tall goldenrod	*Salidago altissima*
		Maple-leaved goosefoot	*Chenopodium hybridum*
		Canada hawkweed	*Hieracium canadense*
		Indian hemp	*Apocynum cannabinum*
		Round-lobed hepatica	*Hepatica americana*
		Herb robert	*Geranium robertianum*
		Honewort	*Cryptotaenia canadensis*
		Field horsetail	*Equisetum arvense*
		Meadow horsetail	*Equisetum pratense*
		Horseweed	*Erogeron canadensis*
		Jack-in-the-pulpit	*Arisaema triphyllum*
		Jerusalem artichoke	*Helianthus tuberosus*
		Jewelweed (Touch-me-not)	*Impatiens capensis*
		Spotted joe-pye-weed	*Eupatorium maculatum*
		Knotweed	*Polygonum achoreum*
		Showy lady's slipper	*Cypripedium reginae*
		Wild lily-of-the-valley	*Marianthemum canadensis*
		Trout lily (Adder's tongue)	*Prythronium americanum*
		Fringed loosestrife	*Lysimachia ciliata*

	Yellow loosestrife	*Lysimachia terrestris*
	Early meadow-rue	*Thalictrum dioicum*
	Tall meadow-rue	*Thalictrum polygamum*
	Common milkweed	*Asclepias syriaca*
	Miterwort	*Mitella nuda*
	Tower mustard	*Arabis glabra*
	Enchanter's nightshade	*Circaea quadrisulcata*
	Wild oats	*Uvularia sessilifolia*
	Partidgeberry	*Mitchella repens*
	Periwinkle	*Vinca minor*
	Pickerel weed	*Pontederia cordata*
	Common evening primrose	*Oenothera biennis*
	Milk purslane	*Euphorbia supine*
	Field pussytoes	*Antennaria neglecta*
	Common ragweed	*Ambrosia artemisiifolia*
	Pasture rose	*Rosa carolina*
	Bristly sarsaparilla	*Aralia hispida*
	Wild sarsaparilla	*Aralia nudicaulis*
	Silver-rod	*Solidago bicolour*
	White snakeroot	*Eupatorium rugosum*
	Solomon's seal	*Polygonatum biflorum*
	False solomon's seal	*Smilacina racemosa*
	Spikenard	*Aralia racemosa*
	Starflower	*Trientalis borealis*
	Barren strawberry	*Waldsteinia fragarioides*
	Common strawberry	*Fragaria virginiana*
	Woodland strawberry	*Fragaria vesca*
	Strawberry blite	*Chenopodium capitatum*
	Woodland sunflower	*Helianthus divaricatus*
	Showy tick-trefoil	*Desmodium canadense*
	Painted trillium	*Trillium undulatum*
	Red trillium (Wake robin)	*Trillium erectum*
	White trillium	*Trillium grandiflora*
	Twinflower	*Linnaea borealis*
	Blue vervain	*Verbena hastate*
	Milk vetch	*Astragalus canadensis*
	Purple vetch	*Vicia americana*
	Canada violet	*Viola canadensis*
	Common blue violet	*Viola papilonacea*
	Dog violet	*Viola conspersa*
	Round-leafed yellow violet	*Viola rotundifolia*
	Smooth yellow violet	*Viola pensylvanica*
	Sweet white violet	*Viola blanda*
	Wintergreen	*Gaultheria procumbens*
	Yellow wood-sorrel	*Oxalis stricta*
Exotic	Alfalfa	*Medicago sativa*
	Green amaranth	*Amaranthus retroflexus*
	Buckwheat	*Polygonum convolvulus*
	Bugle (Bugleweed)	*Ajuga reptans*
	Viper's bugloss	*Echium vulgare*
	Common burdock	*Arctium minus*
	Butter and eggs	*Linaria vulgaris*
	Common buttercup	*Ranunculus aeris*
	Bladder campion	*Silene cucubalus*
	Wild carrot (Queen Anne's lace)	*Daucus carota*

Catnip	*Nepata cataria*
Chicory	*Chicorium intybus*
Rough-fruited cinquefoil	*Potentilla recta*
Shrubby cinquefoil	*Potentilla fruticosa*
Silvery cinquefoil	*Potentilla argentea*
Alsike clover	*Trifolium hybridum*
Hop clover	*Trifolium agrarium*
Red clover	*Trifolium pratense*
White clover	*Trifolium repens*
White Sweet clover	*Melilotus alba*
Yellow sweet clover	*Melilotus officinalis*
Coltsfoot	*Tussilago farfara*
Winter cress	*Barbarea vulgaris*
Ox-eye daisy	*Chrysanthemum leucanthemum*
Dandelion	*Taraxacum officinale*
King devil	*Hieracum pratense*
Devil's paintbrush	*Hieracum aurantiacum*
Curled dock	*Rumex crispus*
Yellow goat's beard	*Tragopogo pratensis*
Poison hemlock	*Conim maculatum*
Yellow iris	*Iris pseudoacorus*
Lamb's quarters	*Chenopodium album*
Purple loosestrife	*Lythrum salicaria*
Common mallow	*Malva neglecta*
Black medic	*Medicago lupilina*
Clasping-leaved mullein	*Verbascum phlomoides*
Common mullein	*Verbascum thapsus*
Black mustard	*Brassica nigra*
Field mustard (Rape)	*Brassica rapa*
Stinging nettle	*Urtica dioica*
Common nightshade	*Solanim nigrum*
Wild parsnip	*Pastinaca saliva*
Everlasting pea	*Lathyrus latifolius*
Field pennycress	*Thlaspi arvense*
Common plantain	*Plantago major*
English plantain	*Plantago lanceolata*
Shepherd's purse	*Capsella bursa-pastoris*
Dame's rocket	*Hesperis matronalis*
Sheep sorrel	*Rumex acetosella*
Common sow-thistle	*Sonchus oleraceus*
Spiny-leaved sow-thistle	*Sonchus oleraceus*
Cypress spurge	*Euphorbia cyparissias*
Leafy spurge	*Euphorbia esula*
Common St. Johnswort	*Hypericum pyramidatum*
Common tansy	*Tantacetum vulgar*
Canada thistle	*Cirsium arvense*
Bull thistle	*Cirsium vulgare*
Scotch thistle	*Onopordum acanthium*
Lady's thumb	*Polygonum persicaia*
Birdfoot trefoil	*Lotus corniculatus*
Crown vetch	*Coronilla varia*
Yarrow	*Achillea millefolium*

Parasitic Plants		Beechdrops	*Epifagus virginiana*
		Indian pipe	*Monotropa uniflora*
		Pine sap	*Monotropa hypopithys*
Vines	Native	Allegheny vine	*Adlumia fungosa*
		Bittersweet	*Celastrus scandens*
		Grape	*Vitis riparia*
		Hairy Honeysuckle	*Lonicera hisuta*
		Climbing nightshade	*Solanum dulcomara*
		Hog-peanut	*Amphicarpa bracteata*
		Poison ivy	*Rhus radicans*
		Inserted virginia creeper	*Parthencosis inserta*
		Virgin's bower (Old man's beard)	*Clematis virginiana*
	Exotic	Trumpet honeysuckle	*Lonicera sempervirens*
		Morning-glory	*Ipomoea purpurea*
Wetland Plants	Indigenous	Water avens	*Geum rivale*
		Slender blue flag	*Iris prismatica*
		American great bulrush	*Scirpus valius*
		Black-sheathed bulrush	*Scirpus cyperinus*
		Eastern buttonbush	*Cephalanthus occidentalis*
		Bur-reed	*Spaganium americanum*
		Spotted cowbane	*Cicuta maculata*
		Small cranberry	*Vaccinium oxycoccos*
		Water dock	*Rumex orbiculatus*
		Swamp loosestrife	*Decodon verticullatus*
		Yellow loosestrife	*Lysimachia terrestris*
		Marsh marigold	*Caltha palustris*
		Swamp milkweed	*Asclepias incarnata*
		Pitcher plant	*Sarracenia purpurea*
		Swamp rose	*Rosa palustris*
		Marsh skullcap	*Scutellaria epilobiifolia*
		Skunk cabbage	*Symplocarpus foetidus*
		Swamp smartweed	*Polygonum coccineum*
		Tickseed sunflower	*Bidens coronata*
		Turtlehead	*Cheloneglabra*
		Marsh blue violet	*Viola cucullata*
		Purple-leaved willow-herb	*Epilobium coloratum Biehler*
	Exotic	Winter cress	*Barbarea vulgaris*

Appendix 3: Submergent and emergent vegetation recorded in Otty Lake in summer, 1974

Submergent vegetation	Canada waterweed	*Anacharis canadensis*	very abundant
	Coontail	*Ceratophyllum demersum*	common
	Stonewort	*Chara (algae)*	very abundant
	Watermoss	*Fontinalis*	rare
	Water milfoil	*Myriophyllum*	very abundant
	Bushy pondweed	*Najas flexilis*	very abundant
	Bassweed/Large leaf pondweed	*Potomogeton amplifolius*	very abundant
	Variable pondweed	*Potomogeton gramineus*	
	Floating leaf pondweed	*Potomogeton natans*	rare
	Sago pondweed	*Potomogeton pectinatus*	rare
	Tape grass, wild celery	*Vallisneria americana*	very abundant
	Canada waterweed	*Anacharis canadensis*	very abundant
Emergent vegetation	Horsetail	*Egisetum fluviatile*	rare
	Yellow waterlily	*Nuphar variegatum*	common
	White waterlily	*Numphaea ordorata*	very abundant
	Pickerelweed	*Pontederia cordata*	common
	Arrowhead	*Sagittaria spp.*	rare
	Cattail	*Scirpus spp.*	rare
	Bulrush	*Typha latifolia*	rare
	Water speedwell	*Veronica catenata*	rare

Other Aquatic Plants documented in Otty Lake (by Diana Nuttall, volunteer on Otty Lake)

Broad-leaved Arrowhead	*Sagittaria tatifolia*
Flat-leaved Bladderwort	*Urticularia intermedia*
Large-fruited Burreed	*Sparganium eurycarpum*
Common Cattail	*Typha latifolia*
Coontail	*Ceratophyllum demersum*
Lesser Duckweed	*Lemna minor*
Bullhead Lily	*Nuphar variegatum*
Yellow Pond Lily	*Nupharvariegatum*
Water Marigold	*Megalodonta beckii*
Milfoil	*Myriophyllum sibircum*
Pickerelweed	*Pontederia cordata*
Water Smartweed	*Polygonum amphibium*
Fragrant White Water-lily	*Nymphaea odorata Aiton*
Eurasian water-milfoil (invasive species)	*Myriophyllum spicatum*

Appendix 4: Inventory of birds that have been seen or heard in the Otty Lake watershed over the years based on observations of several volunteers and prepared by Rosemarie Hoppe-Wilhelm, February 2006. "Time of Year" indicates when the birds have been seen or are most likely to be seen or heard; "Breeding" indicates that they are known to have bred or are presently breeding in the watershed.

Species	Time of Year	Comments
American Black Duck	Spring	
American Redstart	Spring/Summer	Breeding
American Tree Sparrow	Winter	Wintering
Bald Eagle	Summer	Rare
Baltimore Oriole	Spring/Summer	Breeding
Barn Swallow	Spring/Summer	Breeding
Barred Owl	Year round	
Black-and-White Warbler	Spring/Summer	Breeding
Blackburnian Warbler	Spring/Summer	Breeding
Black-throated Blue Warbler	Fall	
Black-throated Green Warbler	Spring/Summer	Breeding
Blue Jay	Year round	Breeding
Bluebird, Eastern	Spring/Summer	Breeding; casual
Bobolink	Spring/Summer	Breeding
Brant	Spring/Fall	In migration
Broad-winged Hawk	Spring/Summer	
Brown Creeper	Year round	Breeding
Brown Thrasher	Spring/Summer	Breeding
Brown-headed Cowbird	Spring/Summer	Breeding
Bufflehead	Spring/Fall	In migration
Canada Goose	Spring/Summer	Breeding
Chestnut-sided Warbler	Spring/Summer	Breeding
Chickadee, Black-capped	Year round	Breeding
Chipping Sparrow	Spring/Summer	Breeding
Common Grackle	Spring/Summer	Breeding
Common Loon	Spring/Summer	Breeding
Common Nighthawk		
Common Redpoll	Winter	May winter here in large flocks
Common Tern		
Common Yellowthroat	Spring/Summer	Breeding
Cooper's Hawk	Spring/Summer	
Crow, American	Year round	Breeding
Cuckoo, Black-billed	Spring/Summer	Breeding
Dark-eyed Junco, Slate-colored	Fall/Winter/	
Double-crested Cormorant	Summer	Visitor
Downy Woodpecker	Year round	Breeding
Evening Grosbeak	Winter/Spring	Casual visitor
Flycatcher, Great Crested	Spring/Summer	Breeding
Flycatcher, Yellow-bellied	Spring/Summer	
Fox Sparrow	Spring	In migration
Glaucous Gull		In migration
Golden Eagle		Visitor
Golden-crowned Kinglet	Spring/Fall	In migration
Species	**Time of Year**	**Comments**

Goldeneye, Common	Spring/Fall	In migration
Goldfinch, American	Year round	Breeding
Great Blue Heron	Spring/Summer	Breeding in wider area
Great Egret		Accidental visitor
Great Grey Owl	Winter	Occasional visitor
Great Horned Owl	Year round	
Greater Black-backed Gull		Rare
Green Heron	Spring/Summer	Breeding; casual
Grey Catbird	Spring/Summer	Breeding
Hairy Woodpecker	Year round	Breeding
Hermit Thrush	Spring/Summer	Breeding
Herring Gull		
Hoary Redpoll	Winter	Less common; with Common Redpoll flocks
House Finch	Year round	
House Wren	Spring/Summer	Breeding
Hummingbird, Ruby-throat.	Spring/Summer	Breeding
Indigo Bunting	Spring	
Kestrel, American	Spring/Summer	
Killdeer	Spring/Summer	Breeding
Kingbird, Eastern	Spring/Summer	Breeding
Kingfisher, Belted	Spring/Summer	Breeding
Magnolia Warbler	Spring/Summer	Breeding
Mallard	Spring/Summer	Breeding
Merganser, Common	Spring	
Merganser, Hooded	Spring/Summer	Visitor; casual breeding
Merlin	Spring/Summer	Breeding; casual in winter
Mourning Dove	Year round	
Nashville Warbler	Spring/Summer	Breeding
Northern Bobwhite		
Northern Cardinal	Year round	Breeding
Northern Flicker, Yellow-shafted	Spring/Summer	Breeding
Northern Goshawk		Casual visitor
Northern Shrike	Winter	Occasional visitor
Northern Waterthrush	Summer	
Osprey	Spring/Summer	
Ovenbird	Spring/Summer	Breeding
Phoebe, Eastern	Spring/Summer	Breeding
Pied-billed Grebe	Spring	Visitor
Pileated Woodpecker	Year round	Breeding
Pine Grosbeak	Year round	
Pine Siskin	Winter/Spring	
Pine Warbler	Spring/Summer	Breeding
Purple Finch	Year round	Breeding
Raven, Common	Year round	
Red-breasted Nuthatch	Year round	Breeding
Red-shouldered Hawk	Spring/Summer	
Red-tailed Hawk	Spring/Summer	
Red-winged Blackbird	Spring/Summer	Breeding
Ring-billed Gull	Spring/Summer	Breeding
Species	**Time of Year**	**Comments**

Ring-necked Duck	Spring	In migration
Ring-necked Pheasant		
Robin, American	Year round	Breeding; locally migrant
Rock Dove	Year round	
Rose-breasted Grosbeak	Spring/Summer	Breeding
Ruby-crowned Kinglet	Spring/Fall	In migration
Ruffed Grouse	Year round	Breeding
Rusty Blackbird	Fall	In migration
Sapsucker, Yellow-bellied	Spring/Summer	Breeding
Savannah Sparrow	Spring/Summer	
Saw-whet Owl, Northern	Year round	
Scarlet Tanager	Spring/Summer	
Screech Owl, Eastern	Year round	
Sharp-shinned Hawk	Spring/Summer	
Snow Bunting	Winter	Visitor, casual
Song Sparrow	Spring/Summer	Breeding
Spotted Sandpiper	Spring	
Starling,European	Spring/Summer	Breeding; rare in winter
Swainson's Thrush	Fall	In migration
Swamp Sparrow	Spring/Summer	Breeding
Tree Swallow	Spring/Summer	Breeding
Turkey Vulture	Spring/Summer	
Veery	Spring/Summer	Breeding
Vireo, Blue-headed	Fall	
Vireo, Philadelphia	Fall	
Vireo, Red-eyed	Spring/Summer	Breeding
Vireo, Warbling	Spring/Summer	
Waxwing, Bohemian	Winter	Visitor
Waxwing, Cedar	Spring/Summer	Breeding; casual in winter
Whip-poor will	Spring/Summer	Breeding
White-breasted Nuthatch	Year round	Breeding
White-crowned Sparrow	Spring/Fall	In migration
White-throated Sparrow	Spring/Fall	In migration
Wild Turkey	Year round	Breeding
Winter Wren	Summer	
Wood Duck	Spring/Summer	Breeding
Wood Thrush	Spring/Summer	
Woodcock, American	Spring/Summer	Breeding
Wood-Pewee, Eastern	Spring/Summer	Breeding
Yellow Warbler	Spring/Summer	Breeding
Yellow-rumped Warbler	Spring/Summer	Breeding
Yellow-throated Warbler		Occasional visitor

Appendix 5: Bird species that may be increasing in number in the Otty Lake watershed (sightings of these bird species in Murphy's Point Provincial Park appear to have become more frequent since 1970)

Bald Eagle	*Haliaeetus leucocephalus*
Barred Owl	*Strix varia*
Black/Yellow-billed Cuckoo	*Coccyzus americanus*
Blackburnian Warbler	*Dendroica fusca*
Brown Creeper	*Certhia americana*
Canada Goose	*Branta canadensis*
Canada Warbler	*Wilsonia canadensis*
Cerulean Warbler	*Dendroica cerulea*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Common Raven	*Corvus corax*
Common Snipe	*Gallinago gallinago*
Dark-eyed Junco	*Junco hyemalis*
Eastern Phoebe	*Sayornis phoebe*
Golden-crowned Kinglet	*Regulus satrapa*
Hooded Merganser	*Lophodytes cucullatus*
Killdeer	*Charadrius vociferus*
Nashville Warbler	*Vermivora ruficapilla*
Northern Cardinal	*Cardinalis cardinalis*
Northern Goshawk	*Accipiter gentilis*
Ring-billed Gull	*Larus delawarensis*
Ruby-crowned Kinglet	*Regulus calendula*
Spotted Sandpiper	*Actitis macularia*
Swamp Sparrow	*Melospiza geor*
Yellow-throated Vireo	*Vireo flavifrons*

Appendix 6: All bird species found during the Ontario Breeding Bird Atlas Surveys (1st atlas: 1981-1985, 2nd atlas: 2001-2005) in region #25 (Perth), Square 18VQ06.

Breeding evidence and estimates of abundance are available online at http://www.birdsontario.org/atlas/atlasmain.html

- Alder Flycatcher
- Am. Three-toed Woodpecker
- American Bittern
- American Black Duck
- American Crow
- American Goldfinch
- American Kestrel
- American Redstart
- American Robin
- American Wigeon
- American Woodcock
- Baltimore Oriole
- Bank Swallow
- Barn Swallow
- Barred Owl
- Bay-breasted Warbler
- Belted Kingfisher
- Black Tern
- Black/Yell-billed Cuckoo
- Black-back Woodpecker
- Black-billed Cuckoo
- Blackburnian Warbler
- Black-capped Chickadee
- Black-crown N.-Heron
- Black-throated Blue Warbler
- Black-throated Green Warbler
- Black-white Warbler
- Blue Jay
- Blue/Gold-wing Warbler
- Blue-gr Gnatcatcher
- Blue-headed Vireo
- Blue-winged Teal
- Bobolink
- Boreal Owl
- Broad-winged Hawk
- Brown Creeper
- Brown Thrasher
- Brown-head Cowbird
- Canada Goose
- Canada Warbler
- Carolina Wren
- Caspian Tern
- Cedar Waxwing
- Cerulean Warbler
- Chestnut-sided Warbler
- Chimney Swift
- Chipping Sparrow
- Clay-colored Sparrow
- Cliff Swallow
- Common Grackle
- Common Loon
- Common Merganser
- Common Moorhen
- Common Nighthawk
- Common Raven
- Common Snipe
- Common Tern
- Common Yellowthroat
- Cooper's Hawk
- Coot/Moorhen
- Dark-eyed Junco
- Double-crest Cormorant
- Downy Woodpecker
- Eastern Bluebird
- Eastern Kingbird
- Eastern Meadowlark
- Eastern Phoebe
- Eastern Screech-Owl
- Eastern Towhee
- Eastern Wood-Pewee
- European Starling
- Evening Grosbeak
- Field Sparrow
- Gadwall
- Golden-crown Kinglet
- Golden-winged Warbler
- Gr Crested Flycatcher
- Gray Catbird
- Gray Jay
- Great Blue Heron
- Great Horned Owl
- Green Heron
- Green-winged Teal
- Hairy Woodpecker
- Hermit Thrush
- Herring Gull
- Hooded Merganser
- Horned Lark
- House Finch
- House Sparrow
- House Wren
- Indigo Bunting
- Killdeer
- Least Bittern
- Least Flycatcher
- Lincoln's Sparrow
- Loggerhead Shrike
- Long-eared Owl
- Magnolia Warbler
- Mallard
- Marsh Wren
- Merlin
- Mourning Dove
- Mourning Warbler
- Nashville Warbler
- North Rough-wing Swallow
- North Saw-whet Owl
- North Waterthrush
- Northern Cardinal
- Northern Flicker
- Northern Goshawk
- Northern Harrier
- Northern Mockingbird
- Northern Parula
- Olive-sided Flycatcher
- Osprey
- Ovenbird
- Philadelphia Vireo
- Pied-billed Grebe
- Pileated Woodpecker
- Pine Siskin
- Pine Warbler
- Prairie Warbler
- Purple Finch
- Purple Martin
- Red Crossbill
- Red-breast Nuthatch
- Red-eyed Vireo
- Red-head Woodpecker
- Red-should Hawk
- Red-tailed Hawk
- Red-wing Blackbird
- Ring-billed Gull
- Ring-necked Duck
- Rock Dove
- Rose-breast Grosbeak
- Ruby-crown Kinglet
- Ruby-throated Hummingbird
- Ruddy Duck
- Ruffed Grouse
- Savannah Sparrow
- Scarlet Tanager
- Sedge Wren
- Sharp-shinned Hawk
- Song Sparrow
- Sora
- Spotted Sandpiper
- Spruce Grouse
- Swainson's Thrush
- Swamp Sparrow
- Tennessee Warbler
- Tree Swallow
- Trumpeter Swan
- Turkey Vulture
- Upland Sandpiper
- Veery
- Vesper Sparrow
- Virginia Rail
- Warbling Vireo
- Whip-poor-will
- White-breast Nuthatch
- White-crown Sparrow
- White-throat Sparrow
- White-winged Crossbill
- Wild Turkey
- Willow Flycatcher
- Winter Wren
- Wood Duck
- Wood Thrush
- Yellow Warbler
- Yellow-bellied Flycatcher
- Yellow-bellied Sapsucker
- Yellow-billed Cuckoo
- Yellow-rumped Warbler
- Yellow-throated Vireo

Appendix 7: Fish Species in Otty Lake and estimated status of each population based on volunteer observation.

			Status
Sport Fish	smallmouth bass	*Micropterus dolomieu*	abundant
	largemouth bass	*Micropterus salmoides*	abundant
	northern pike	*Esox lucius*	average
	walleye	*Sander vitreus*	Extremely rare; possibly extinct
Panfish	yellow perch	*Perca flavescens*	abundant
	rock bass	*Ambloplites rupestris*	abundant
	pumpkinseed (sunfish)	*Lepomis gibbosus*	abundant
	bluegill	*Lepomis macrochirus*	abundant
	black crappie	*Pomoxis nigromaculatus*	average
Coarse Fish	carp	*Cyprinus carpio*	Average/increasing
	Brown bullhead (catfish)	*Ameiurus nebulosus*	below average
	ling	*Lota lota*	rare
Forage Species	lake herring (shad)	*Coregonus artedi*	abundant
	black sucker	*Moxostoma duquesnei*	average/above average
	golden shiner	*Notemigonus crysoleucas*	average
	chub	*Couesius plumbeus*	poor/declining
	red fin sucker	*Moxostoma macrolepidotum*	rare

Appendix 8: Mammals, reptiles and amphibians of the Otty Lake Watershed.

The following list was compiled by Fred Lepine, a resident of BurgessWood and president of the Rideau Valley Field Naturalists Club with input from John Bufton, also a BurgessWood resident and past president of the Friends of Murphy's Point Provincial Park. The list was reviewed and added to by Tobi Kiesewalter, park naturalist and warden at Murphy's Point Provincial Park. Information about provincially significant species was provided by Shaun Thompson, MNR, District Ecologist and Chair of Recovery Team for the Frontenac Axis Region.(* Species of special concern; [t] Threatened; [N] Not confirmed)

Mammals

Beaver	*Castor canadensis*	Muskrat	*Ondatra zibethicus*
Black bear	*Ursus americanus*	Northern long-eared bat	*Myotis septentrionalis*
Coyote	*Canis latrans*	Northern flying squirrel	*Glaucomys sabrinus*
Deer mouse	*Peromyscus maniculatus*	Northern river otter	*Lontra canadensis*
Eastern chipmunk	*Tamias striatus*	Porcupine	*Erethizon dorsatum*
Eastern cottontail	*Sylvilagus floridanus*	Raccoon	*Procyon lotor*
Eastern grey/black squirrel	*Sciurus carolinensis*	Red fox	*Vulpes vulpes*
Eastern pipistrelle bat	*Pipistrellus subflavus*	Red squirrel	*Sciurus hudsonicus*
Fisher	*Martes pennanti*	Short-tailed weasel	*Mustela erminea*
Grey wolf	*Canis lupus*	Snowshoe hare	*Lepus americanus*
House mouse	*Mus musculus*	Star-nosed mole	*Condylura cristata*
Least weasel	*Mustela nivalis*	Striped skunk	*Mephitis mephitis*
Little brown bat	*Myotis lucifugus*	White-footed mouse	*Peromyscus leucopus*
Masked shrew	*Sorex cinereus*	White-tailed deer	*Odocoileus virginianus*
Meadow vole	*Microtus pennsylvanicus*	Woodchuck (groundhog)	*Marmota monax*
Mink	*Mustela vison*		

Reptiles and Amphibians

Snakes	Eastern ratsnake[t]	*Elaphe obsoleta*
	Eastern milksnake*	*Lampropeltis triangulum*
	Eastern garter snake	*Thamnophis sirtalis sirtalis*
	Eastern ribbonsnake*	*Thamnophis sauritus*
	Northern water snake	*Nerodia sipedon*
	Northern red-bellied snake	*Storeria occipitomaculata occipitomaculata*
Frogs	Spring peeper	*Pseudacris crucifer*
	Chorus frog	*Pseudacris triseriata*
	Gray tree frog	*Hyla versicolor*
	Green frog	*Rana clamitans*
	Leopard frog	*Rana pipiens*
	Wood frog	*Rana sylvatica*
	Bull frog	*Rana catesbeiana*
	American toad	*Bufo americanus*
Salamanders	Spotted salamander	*Ambystoma maculatum*
	Blue-spotted salamander	*Ambystoma laterale*
	Eastern red back salamander	*Plethodon cinereus*
	Four-toed salamander[N]	*Hemidactylium scutatum*
Turtles	Snapping turtle	*Chelydra serpentina*
	Northern map turtle[N] *	*Graptemys goegraphica*
	Blanding's turtle*	*Emydoidea blandingii*
	Painted turtle	*Chrysemys picta*
	Musk (Stinkpot) turtle[t]	*Sternotherus odoratus*

Appendix 9: Species at Risk that have been recorded or are very likely to occur within the Otty Lake watershed. (SC= Special Concern, THR= Threatened, NAR= Not at Risk, END= Endangered)

		COSEWIC	MNR	Ontario General Status
Red-shouldered Hawk	*Buteo lineatus*	SC	SC	Sensitive
Cerulean warbler	*Dendroica cerulea*	SC	SC	Sensitive
Blanding's Turtle	*Emydoidea blandingii*	THR	THR	Secure
Musk (Stinkpot) Turtle	*Sternotherus odoratus*	THR	THR	Secure
Black (Eastern) Ratsnake	*Elaphe obsoleta*	THR	THR	At risk
Milksnake	*Lampropeltis triangulum*	SC	SC	Secure
Eastern Ribbonsnake	*Thamnophis sauritus*	SC	SC	Secure
Eastern Pipistrelle (bat)	*Pipistrellus subflavus*			Sensitive
Black tern	*Childonias niger*	NAR	SC	Sensitive
Northern Map Turtle	*Graptemys goegraphica*	SC	SC	Secure
Butternut (tree).	*Juglans cinerea*	END	END	Secure

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