



East Lake State of the Lake

2012 / 2013



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Executive Summary

The East Lake State of the Lake report documents current and relevant information on East Lake (to January 2013), for use in the development of the East Lake Watershed plan. The report provides an overview of the history of the area, and summarizes information on land use, development, water quality, water levels, natural habitats and features. This includes endangered species, invasive species, forest cover, wetlands, and fish and wildlife.

East Lake was initially created following the retreat of the last glaciers; about 12,000 years ago. Wave and wind action along the early Lake Ontario shoreline caused sand to accumulate and create baymouth sandbars that separated both East and West Lakes from Lake Ontario. East Lake is connected to Lake Ontario via the Outlet River. Under normal conditions, the Outlet River is open to Lake Ontario during the summer months and the water level in East Lake corresponds very closely to that of Lake Ontario. However, at certain times of the year the outlet of the river becomes plugged.

Following the glaciers, the first inhabitants arrived in the area. They were Paleo-Indians, a nomadic people who practiced hunting and gathering. They were followed by the Mound Builders; around 1500 BC. The Iroquois, who settled around 1500 years ago, were the first to build villages and they farmed the area for corn, tobacco, beans and squash. Soon after 1550, due to inter-tribal wars, the Iroquois in the area moved northwest to form the Huron Confederacy. The Massassauga members of the Cree linguistic group settled this area soon after; they were hunter-gatherers unlike the agricultural Iroquois.

The first European settlers were United Empire Loyalists, arriving in the late 1700s. The land was cleared beyond that done by First Nations, and developed for agricultural use. Agriculture dominated through the 19th and 20th centuries, including beef and dairy cattle, field crops, vegetables, and fruit. Canning was a thriving industry around East Lake from the 1940's up until the 1960's.

Agriculture remains a dominant land use today, notably along the north shore of East Lake where there is production of fresh peas, market garden vegetables, cereal grains, sweet corn, maple syrup, beef cattle, and dairy cattle. This agricultural landscape is mixed with a different set of uses around the lake. The south shore is well developed, with cottages, full-time houses, and tourism establishments; cottage rentals, cabins, and trailer parks. At the west end of the lake (and shared with Lake Ontario) is Sandbanks Provincial Park, a busy camping and day use recreation destination. A commercial and a vibrant recreational fishery continue on East Lake, attesting to the good health of the lake's fishery.

Based on sampling over the past 25 years, the water quality of East Lake can generally be considered good. Quinte Conservation, as well as the Friends of East Lake, have been collecting water samples and the results indicate that East lake is a "mesotrophic" lake, or a lake with higher productivity; i.e., more nutrients (phosphorous

and nitrogen), more vegetation, and higher fish populations than the “oligotrophic” lakes typical of northern Ontario. The higher nutrient levels are to be expected in this part of the province, but can also be associated with increased runoff from the surrounding landscape, lawns, roads, and poorly-maintained septic systems.

Approximately 20% of the East Lake watershed is covered with forest, which reflects a long-term presence of cleared land for agriculture and development on the shoreline areas. Nonetheless, there remain important natural features and habitats, notably marshes at the east and west ends of the lake, significant habitat types in Sandbanks Park (a forest patch of Sugar and Black Maple trees mixed with White Cedar and the dune ridges); and the mature Maple-Beech forest of the Cove Beach Sugar Bush. The area supports a number of important species at risk; turtles, frogs, birds, and plants, and one fish species at risk, the Spotted Gar. The lake has been noted for its healthy fish populations; spawning and nursery areas for Walleye and Northern Pike and nursing grounds for small and Largemouth Bass, Pumpkinseeds, Bluegills, Crappies, Rock Bass, Brown Bullheads, Yellow Perch, White Perch and White Bass.

A full understanding of the presence of invasive species is not well known because inventories have not been conducted, but there are known terrestrial and aquatic species in and around East Lake, and more that threaten to arrive from Lake Ontario and elsewhere.

Prince Edward County regulates the development of the area through its Official Plan and associated zoning bylaws. The Official Plan contains a number of statements supporting protection of the environment and specific statements endorsing development of Shoreland Management Plans. The zoning around East Lake is reflective of the current land uses; predominantly rural on the north shore and predominantly residential and commercial around the southern and western shores.

Through a community engagement process during the summer of 2013 the State of the Lake report will be reviewed. Stewardship and land use actions will be identified to be included in the plan. The draft plan will then be prepared and presented to all stakeholders in 2014, and will contain information and advice for property owners and lake users on how to best protect, preserve and enhance the environmental and social features of the lake.



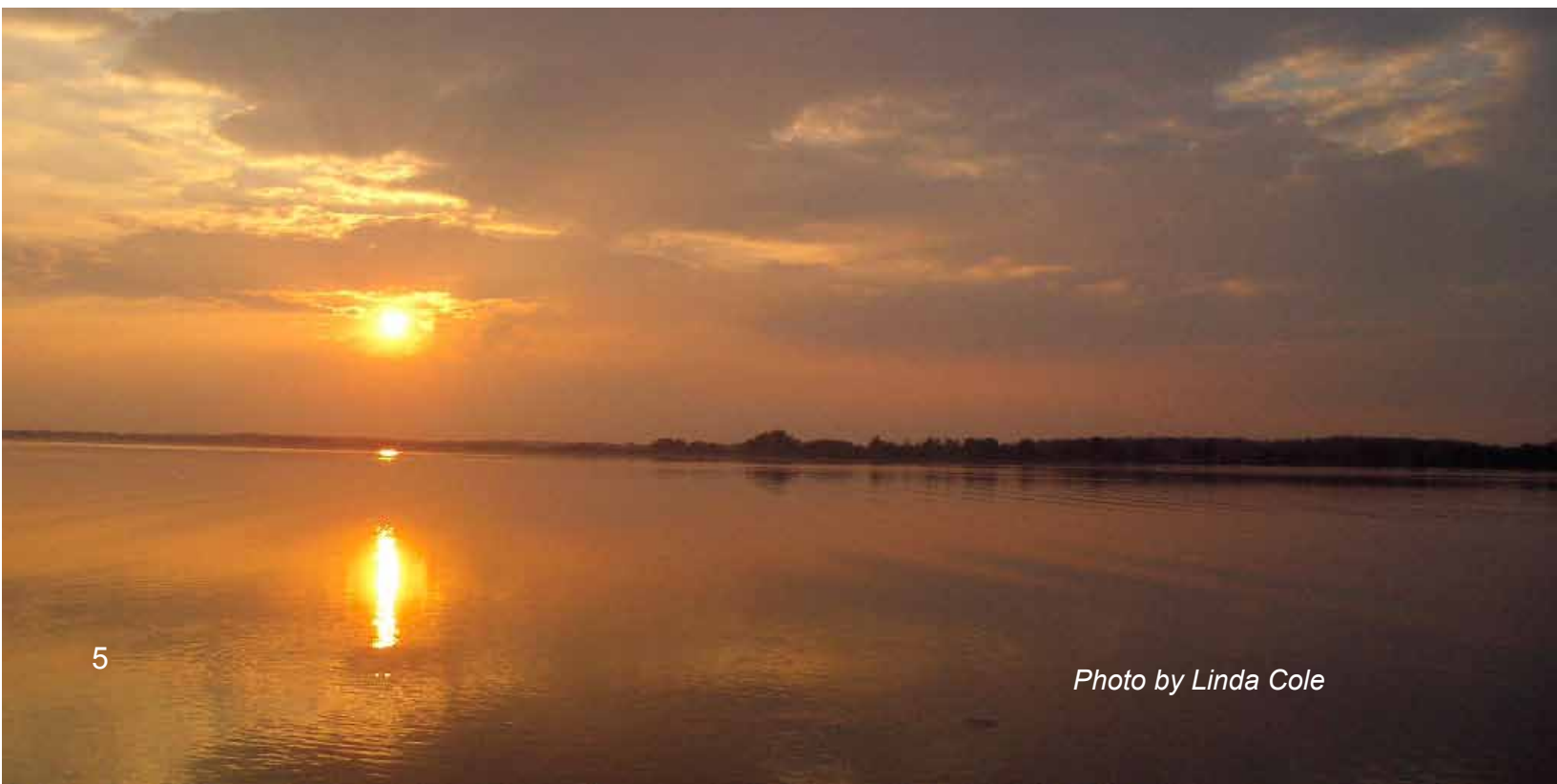
2. Introduction to East Lake & Watershed State of the Lake

This State of the Lake report is one step in the process of creating a stewardship plan for East Lake and its watershed. This report documents the relevant data and information that is available for East Lake, and provides background information to be used in the development of the East Lake Watershed plan.

The report summarizes and synthesizes the information that is current to 2013, including information collected on land use, development, environmentally sensitive areas, water quality, water quantity, endangered species, fish and wildlife.

Through a community engagement process during the summer of 2013 a committee will review this information and identify stewardship and land use actions to be incorporated in to the plan. The draft plan will then be prepared and presented to all stakeholders in 2014 and will contain information and advice for property owners and lake users on how to best protect, preserve, and enhance the environmental and social features of the lake.

The East Lake Watershed Plan is a community-based process that considers the interests of all stakeholders on East Lake and within the watershed including permanent and seasonal residents, commercial operators and their guests, farmers, recreationalists (e.g. anglers, boaters, waterfowl hunters), and all other interested parties. The purpose of the process is to identify and protect the unique characteristics of the East Lake watershed and to recommend land-use policy and stewardship approaches to ensure long-term protection, maintenance, and restoration of natural, social, and physical features.



The planning process and final products will help the East Lake community to develop a greater appreciation and protection of the natural heritage features of our area and will include actions and recommendations that:

- ensure a healthy lake for people, fish, wildlife and plants;
- protect wetlands and other environmentally sensitive areas;
- promote fish and wildlife populations and protect their sensitive habitats;
- promote awareness about endangered and rare species;
- empowering community members to have a say and play a role in the East Lake's future;
- the East Lake Watershed Plan is unique in Prince Edward County and may provide an approach to be considered for other inland lakes or shoreline reaches in Prince Edward County.

The State of the Lake Report and the East Lake Watershed Plan will provide valuable insight into East Lake and its watershed which will allow for more effective measures and stewardship programs.



Photo by Peggy deWitt

3. East Lake and Watershed Cultural History

a) The First Peoples

As the last of the glaciers retreated and the land became exposed, plants emerged and animals migrated to Prince Edward County. Alongside the animals came the first peoples.

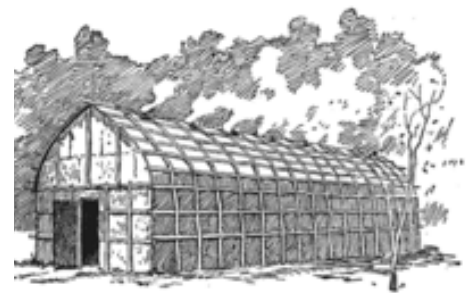
Around 12,000 years ago (10,000 BC) the first inhabitants in southern Ontario arrived; a nomadic hunter and gatherer group known as Paleo-Indians. They did not settle in villages but moved where the food would take them. Caribou meat would have been a main source of food for these nomadic hunters. Paleo-Indian presence in the East Lake region has been shown by the fluted chert spear points found in the area that were dated back to 12,000 years ago.

The Mound Builders, archaic hunters, arrived next in 1500 BC. They were the first peoples to settle in Prince Edward County. The Mound Builders were prehistoric inhabitants of North America who were named for the mounds they built for ceremonial and burial purposes. Local sources indicate that signs of them have been discovered between Rednersville and Massassauga and deposits of tools were found at Green Point.

Around 500 AD the Early Iroquois, also known as the Haudenosaunee or the “People of the Longhouse”, settled in the area and remained for the next thousand years, until about 1550 AD. Their presence is indicated by pottery made by paddle and anvil and with the remains of cultivated corn and tobacco. The Early Iroquois settled into small villages of around 150 people and they farmed. When beans and squash crops were introduced they grew into larger villages. Several longhouses of 70 feet by 26 feet were built. According to local legend, soon after 1550, due to inter-tribal wars, the Iroquois in the area moved



Above: image depicting Paleo-Indians hunting and images of a fluted chert spear point made to be used as a hunting tool



Above: Iroquois longhouse

northwest to form the Huron Confederacy, leaving Prince Edward a no man's land and buffer between the Hurons in Ontario and the Five Nation Iroquois in New York state. The Massassauga members of the Cree linguistic group settled this area soon after. They were hunter-gatherers; unlike the agricultural Iroquois.

b) First Explorations and First European Settlement

Local legend states that in 1615 Samuel de Champlain sailed to what is now Picton. On foot, he left from Glenwood cemetery portaging to the foot of Markland Hill on the East Lake Road. He paddled the stream that passes through the back of Beaver Meadow into the head of East Lake. With him were 200 Huron warriors. They paddled into East Lake, down the outlet river onto Lake Ontario and followed the eastern shore of Prince Edward County back to the mainland. Samuel de Champlain reported no aboriginal villages in the area at that time.

A story said to be history, but perhaps legend, states that during the Seven Years' War (1756-1763) a French naval captain was carrying a barrel of gold to be delivered to the French Fort Frontenac (now Kingston). The vessel was being pursued by a British vessel and was chased thirty miles. To escape captivity the Captain ran the ship into Little Sandy Bay and Outlet Beach and then burned the ship. He had instructed his crew to carry and bury a barrel of gold to prevent it from falling into the hands of the British. It was said that the gold was buried halfway between the bay and East Lake on the shore of the Outlet River, but it was never found. Legend has it that eighty years later a man by the name of M. de Pontleroy, a descendent of the French Captain, rounded Salmon Point with documents indicating the location of the gold. As he was making preparations to dig the gold he fell in love with a woman who was engaged to another young man. Pontleroy made a deal with the young man; the woman in exchange for the gold. The gold was never found. Some are convinced that the gold is still buried and yet to be found under the ever-changing sands of the outlet. (Dodds, 1979)

In 1783, Colonel Henry Young, the very first United Empire Loyalist, settled in the County. Young, born in 1737, was from Nottingham England, and came to America at an early age. He joined the British army and served for six years. He retired from the army at half-pay with a grant of 3,000 acres of land. In 1783 it is said he and one other went out in a canoe, entered Picton Bay, then left their canoes and crossed Hallowel and Athol townships exploring East and West Lakes. That year he claimed the north shore of East Lake and around the lake head down to what is now known as lots 4, 5 and 6 on the south side of East Lake. He left his two sons on East Lake late that year and returned with four of his daughters the following spring. At this time the land was densely forested

and water was the highway. Land was slowly being cleared to create fields for farming. Trees were cut and the stumps were burned and in some cases removed and used to create fences. As the fields were created wheat was then planted. Flour mills sprang up on the fast flowing streams as the wheat market grew in demand.

By 1800 East Lake was settled by 34 families; 19 on the south side and 15 on the north side.

In 1812 Cherry Valley was given its name by Alva Stephens who came from a village of the same name in New York State. There were a large number of wild cherry trees in the vicinity of East Lake at that time.

There were a number of blacksmith shops. Several were at Salmon Point and the last of the shops was Fred Smith's in Cherry Valley (Athol, 1979). It was a place to get horses shod and logging chains repaired; buggies, wagons and sleighs repaired, and even to make and repair tools. If it could be made or repaired with iron, the blacksmith shops could do it.

Woodrows (also spelled Woodrous) Corners was once a little village with its own post office, shoe shop, a school (used as a church on Sundays), saw and flour mill, blacksmith shop, and a saw and feed mill. Woodrows Corners was named after John Woodrow who received some of the land from the original purchaser, Wymot Williams.

There were a number of shoemakers who thrived during this time. Tanneries were also abundant. Hides were purchased, scraped, and placed in vats. Leather from the tannery was used in making harness, shoes, and boots.



Above: Fence line of stumps. Photo Courtesy of "The Settlement of Prince Edward County", 1984



Above: Early farming in Athol County. Photos Courtesy of "Athol", 1979, pg 163



Above: Cherry Valley, a post card view, 1900. c. Terry Ellsworth. Photo courtesy of "The Settlers Dream", pg 95.

c) Early Agriculture and Industry

"Barley Days" brought prosperity to Athol County between 1860 and 1890. Much of the land that is used today for pasture was once used for growing barley. 816,432 bushels of barley were shipped in 1881 to the United States, where much of it was used in breweries.

A Prince Edward County Directory, dated 1865, stated that the county exported immense numbers of cattle, horses and sheep and these were recognized for their superior condition and breed. The waterways were used for transporting.

Since the early 1900's, several canning factories existed in Cherry Valley. Foods processed included green beans, tomatoes, peas, pumpkin, pork and beans, strawberries, raspberries, pears, plums, huckleberries, peaches, and cherries.

Prince Edward County was well fitted for growing canning crops like tomatoes, peas, and corn due to several factors:

- gentle rolling lands, making use of practical machine labour;
- varied soils; crops are planted in both sandy to clay soils ensuring success of crop despite extremes in summer weather ;
- and climate; lakeshore locations report higher humidity, longer growing seasons, smaller annual range in temperature and decreased danger of early or late frost.



Above: Hyatt Canning Co. built in in Cherry Valley in 1937, handled tomatoes, peas, pumpkin, pork and beans, and italian beans.
Photo Courtesy of "Athol", 1979, pg 284

The 1865 directory of Athol Township stated that the total acreage was 39,913 and of that 26,027 were under cultivation.

10 lots being under 6 acres

5 were 10-20 acres

45 were 25-50 acres

136 were 50-100 acres

105 were 100-200 acres

33 were upwards of 200 acres

18, 753 acres were utilized for crops

6, 758 for pasture

526 for orchard and garden

13,876 were wood and wild land

Land held by townspeople, not being farmers, was 25 acres

Between East Lake and West Lake there were large acreages of canning crops. Canning crops were often grown with dairying, poultry raising, and general farming operations.

in 1946, four canneries were in operation; three in Cherry Valley (Colliver and Leavens, Benson Canning Co., and W.H. Johnson (1930's-1950's)), and one at the northwest corner of the lake; East Lake Cannery Limited (closed in 1978).

The Hyatt family bought up several of the canneries including Colliver and Leavens, and Benson Canning Company which became Hyatt Canning Ltd.

In October of 1985, after 65 years of continuous operation, the Hyatt Canning company closed due largely to changing markets and fluctuating prices. Farmers supplying vegetables were guaranteed a price for their crop but canners were subject to price variations depending on the canning market.

After closure the Hyatt factory building was sold to a company that made batteries.

In Cherry Valley both local and imported fruit was canned including strawberries, raspberries, cherries, pumpkins, and tomatoes from Prince Edward County; huckleberries from Nova Scotia; and peaches and plums from Niagara. East Lake Cannery canned tomatoes and fruit. The factory opened in 1930 and was in operation under many owners until 1976, when it closed.

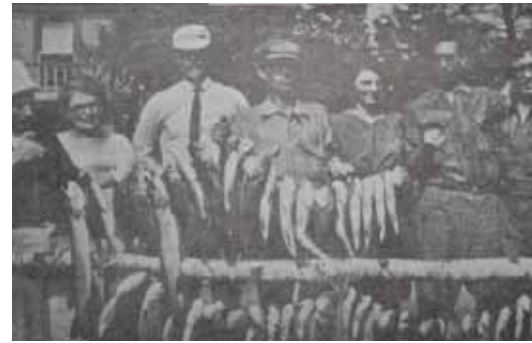
Eight chicken canning facilities existed on East Lake Road. They were opened in the 1940's and all closed by the late 1950's, except for one near Sandbanks that primarily sold their products to tourists. It closed in the 1970's. Closures were due to increased cost of cans, a great amount of work for a small return, and continuous upgrading of regulations by the Department of Health that required costly stainless steel equipment.

Early Fishing Industry

East Lake has always been known for its good fishing. The southern shores of Prince Edward County and East Lake have always been known for the great quantities of Salmon caught off its shores. Row boats were mostly used for catching fish at this time. Fish caught were Whitefish and Salmon, Round-casks (now extinct) and a fish called "Bloats"(Athol, 1979). Salmon Point fisheries boomed in the 1920s. For the next five years catches were large. One boat recorded bringing in a half a ton of Trout at one lifting. Fish were shipped daily to Picton for shipment by rail or water (Dodds, 1979).

Early fishermen talk of great quantities of fish pulled in with seine nets from Sandy Beach, fronting Outlet Provincial Park, now Sandbanks Provincial Park (Athol, 1979). Atlantic Salmon were plentiful and of great size in earlier years. In the 1970s there were reports of Yellow Perch, Eel, and the odd Herring (Athol, 1979). Whitefish were few and Smelt were taken in season (Dodds, 1979).

A commercial fishery has been active on East Lake from the late 19th century, and it remains in place today.



Above: East Lake has always been known for good fishing. This photo was taken in 1936.



Above: Two whitefish caught in 1923. Photo courtesy of Athol, 1979, pg 85

David Baverstock's family has been fishing on East Lake since 1898. Mr. Baverstock says he has observed some changes on the lake but that the fish populations continue to remain strong with good numbers of pike, pickerel, bass, and sunfish.

The Outlet and the Park

The Outlet Road, previously called "The Cedars" was once a narrow and winding road, with tall cedars close on both sides, that made for slow travelling. Later this road was widened and paved to carry heavy traffic.

The Outlet, always a busy place, was purchased by the provincial government in 1967. In 1969 it was opened as a Provincial Park. Before that, the Outlet Road did not exist and cars drove directly on the beach amongst the sunbathers. This was always a popular spot, long before it was a provincial park.

Today Cherry Valley and the surrounding area is driven by tourism in addition to agriculture. There are many beef and dairy farms surrounding the hamlet and several wineries. Tourist establishments such as campgrounds, cabins, trailer parks, and rental cottages) have developed along the south and west shores of East Lake over the past century.



Above: The Outlet River during early settlement. Photo by P. Dodds courtesy of "The Settlement of Prince Edward County", 1984, pg 144



Above: Outlet Beach before it became a Provincial Park. Photo courtesy of "Athol", 1979, pg 113.



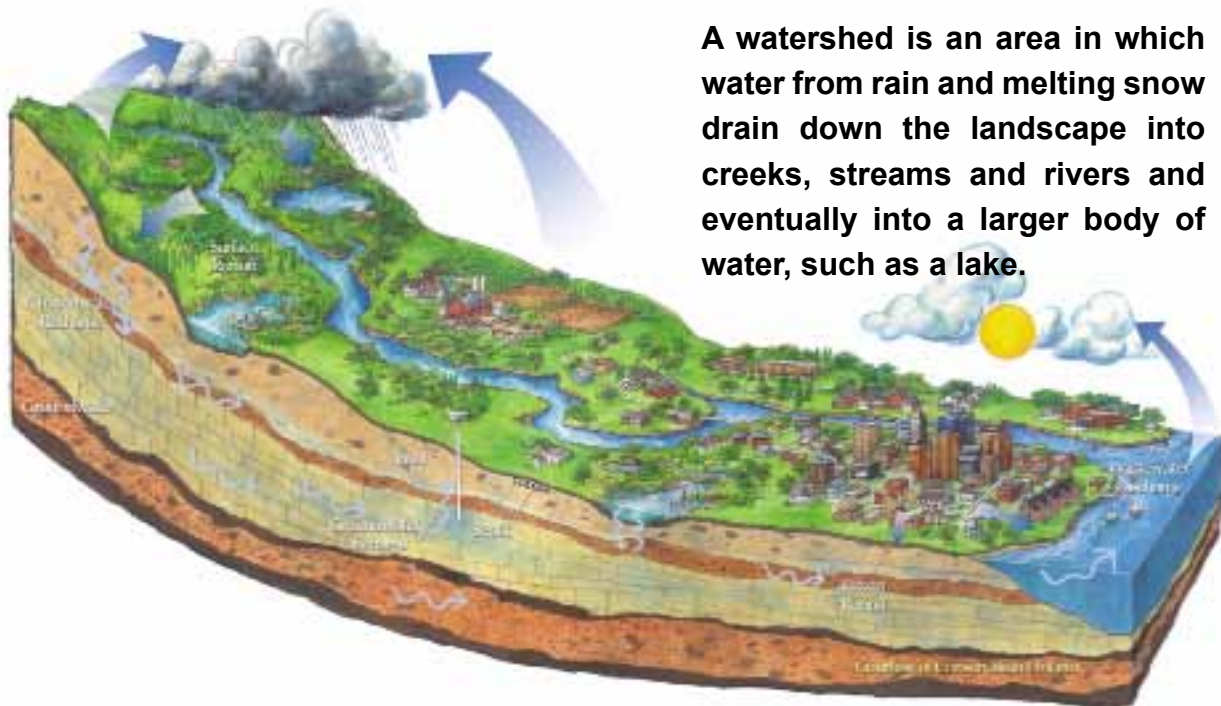
Above: Remnants early settlements and pioneer life can still be seen today.

4. East Lake and Watershed Characteristics:

East Lake, historically called Spence Lake, is located southwest of Picton in the Athol Geographic Township of Prince Edward County. East Lake is a large lagoon that is connected to Lake Ontario by the Outlet River.

The East Lake watershed is approximately 68 square kilometres in area and East Lake itself includes almost 20% of that area, or 12 square kilometres.

East Lake has a number of tributaries (creeks and streams) that collect water through rain and snowmelt and then carry that water down into East Lake. The location of six key streams are shown on the following page. There are numerous other intermittent watercourses.



A watershed is an area in which water from rain and melting snow drain down the landscape into creeks, streams and rivers and eventually into a larger body of water, such as a lake.

East Lake was once named Spence Lake. In 1815 Captain Will Fitz William Owen, a Royal Navy Hydrographer, drew a chart of Prince Edward County. He noted a lake that found an outlet through the sand beach to Athol Bay and named it Spence Lake after Lieut. Henry F. Spence.

East Lake consists of many year-round residents who work and live permanently in the area. The south shore of East Lake is generally limestone bedrock; the 'tail end' of an escarpment which runs from Picton to Salmon Point, and holds the majority of development such as cottages, homes and resorts. The north shore is level prime agricultural lands and home to a number of farms. The eastern edge is bordered by cattail dominated wetlands and at the most eastern tip lies the hamlet of Cherry Valley, associated with a historic mill dam on Woodrous Creek.

The western shore is comprised of barrier beach sand dunes and consists of the Sandanks Provincial Park, many residential buildings and two operating resorts.

Below is an aerial photo of Prince Edward County showing East Lake and the watershed boundary (yellow line) highlighting East Lake streams.



Stream #1



Stream #2



Stream #3



Stream #4



Stream #5



Stream #6

Hydrogeology of East Lake Area

The hydrogeology of the East Lake area is controlled by the underlying geology and the shallow soil over limestone bedrock. The exception being an area of greater soil depth associated with the Picton Esker, extending through Cherry Valley along the south shore of East Lake and the bay mouth sandbar at Sandbanks Provincial Park. These formations are comprised of sandy soils with some deposits of gravel also associated with the esker. The depth of soil associated with these deposits is up to 30 metres above limestone bedrock. The limestone of this area has been mapped as comprising the Lindsay Formation which is the youngest bedrock unit found in the region at an estimated thickness of 60 metres. Structurally this limestone is essentially flat lying, however a normal fault has been mapped as extending along the south side of East Lake from Picton to Lake Ontario.

Groundwater of the area is typically found in the limestone bedrock at depths of less than 30

metres, average in the order of 20 metres. This groundwater flows through the fractures in the limestone bedrock. Due to the variable nature of the bedrock, the yield and quality is highly variable. Flow rates are typically low, less than 5 gallons per minute, however in some instances wells with high flow rates can be encountered. Conversely, in some cases dry wells can occur when a well does not intersect a water bearing fracture. Water quality in the limestone is typically good, however the water is hard and problems associated with sulphur and salt can occur with wells that are drilled too deep. In addition to the bedrock, a small percentage of wells encounter water in the overburden deposits associated with the esker and the sand bar at Sandbanks Provincial Park.

The direction of groundwater flow is typically similar to topography with flow from areas of high ground to low. As such, the water table is at a higher elevation than East Lake with flow towards the Lake. Based on the soil conditions of the area and the nature of the fractured limestone bedrock the aquifers of this area are considered to be highly vulnerable to contamination. More information about groundwater in this area can be found in the *Quinte Regional Groundwater Study* (October, 2004).

a. The Formation of the Landscape

Glaciers, large ice sheets over a kilometre thick, once covered 80% of Canada and all of Ontario. About 12,500 years ago the last of the glaciers, the Wisconsin Glacier, began to retreat, moving east, at a rate of only a few centimetres per day. The tremendous weight of the moving ice sheet caused large basins to be carved into the relatively soft limestone bedrock; creating depressions and rugged shorelines with the many bays and points we see today. Glacial meltwaters formed glacial rivers that filled the newly carved basins forming lakes, like Lake Iroquois, now known as Lake Ontario, seen in the picture above.



Above: Glacial Lake Iroquois

As the ice sheet moved and carved the land it also scraped, pushed and carried sediments; rocks and sand. This sediment was released as the glaciers moved over the landscape. Some sediment was moved great distances. Sand sediments were easily carried great distances by the glacial rivers and were deposited near the shorelines and shallow areas of the newly filled depressions; now forming lakes.

As the glacier retreated north, glacial water in Lake Iroquois drained out toward the ocean along the St Lawrence River. Water continued to drain until the levels stabilized to create what we now know as Lake Ontario.

As the Lake Iroquois water levels dropped, sand and gravel that had been deposited by the glacial rivers became exposed. The exposed sand, when in contact with the westerly winds, was blown and pushed to the east.

Through wave and wind action so much sand accumulated to the east that the sand rose above the waters and the baymouth sandbars were created. This is what now separates both East Lake and West Lake from Lake Ontario.

A baymouth barrier, or sandbar, is defined as a bank that extends entirely across a bay linking two headlands. Such a barrier created East Lake. Plants then moved in and today the sandbar is heavily vegetated, aiding in stabilizing this sandbar from any further movement from water and wind.

The Outlet River formed between East Lake and Lake Ontario to drain water out of East Lake when East Lake levels were higher than Lake Ontario. When the water levels of Lake Ontario and East Lake are the same the Outlet River can naturally close off as the water flow from East Lake is significantly reduced, causing the longshore transport of sediment along Lake Ontario to fill in the outlet of the river. It is also possible that some back flushing may occur when Lake Ontario is at the same level, or higher, than East Lake.

The Cherry Valley Esker formed on the southeast side of the Lake, part of which can be seen in the aerial photograph to the right. An esker is a long, narrow, winding ridge composed of stratified sand and gravel. It is formed by glacial meltwater that formed rivers that flowed within and under the ice. Eskers are often quarried for sand and gravel as the material is readily accessible. The photo to the right shows the sand and gravel from the Cherry Valley Esker that is being quarried today (Water & Earth Science Associates Ltd. 1985).



Above: West Lake and East Lake Sandbars



Above: Outlet River on East Lake Sandbar

Photo by Linda Cole



Above: The Cherry Valley Esker, where today a gravel pit exists.

b. Climate

Since Prince Edward County is located on a peninsula surrounded on three sides by water, Lake Ontario has a significant influence on both local temperature and moisture regimes. Prince Edward County has an average annual 143 days free of frost (Richards & Morwick, 1948), and an average of 920 millimetres of precipitation per year (Quinte Conservation, 2008b). With an average of 540 mm being lost to evapotranspiration (Quinte Conservation, 2008b), Prince Edward County is one of the driest areas of the province (Richards & Morwick, 1948).

Understanding the impacts of climate change on our environment is crucial. Understanding and predicting the impacts allows planning for adaptation to changes that will occur. Climate change is predicted to;

- contribute to more frequent severe weather events, higher intensity/duration rainfall, and at the same time, lead to more frequent and prolonged droughts;
- contribute to longer ice free periods on lakes;
- increase lake effect snow, but less reliable snow and ice cover and earlier spring melts;
- increase in average temperature which leads to changes to biological communities including increased weed growth and longer growing season;
- contribute to changes in the distribution of flows in surface water courses, with reduce flow and levels in rivers, lakes, streams, and groundwater;
- lessen groundwater recharge, lower the water table and lower discharge (base flow);
- diminish cold water fisheries, wetland and marsh habitats;
- contribute to poorer water quality and increase costs required to treat water and associated increased competition for water supplies.

Quinte Conservation has launched a Climate Change Monitoring Program in order to develop a stronger understanding of the local impacts of Climate Change to aid in the development of strategies to adapt.

C. Geology and Soils

The bedrock geology dates back to the Ordovician period, about 450 million years ago, when the entire area was a warm marine environment covered by a vast sea of water. Shells, coral, algal and fecal debris settled to the bottom and due to pressure and time it formed into a rock formation, termed sedimentary limestone. This limestone bedrock underlay much of Prince Edward County and is a relatively soft rock composed of primarily calcium carbonate. The limestone under the East Lake watershed is of the Lindsay Formation (lower member), described as being a crystalline limestone with shaly partings. In addition, an east to west trending fault in bedrock follows the southern shoreline of East Lake (Quinte Conservation, 2008b).

The quaternary geology of the watershed area is Paleozoic rock, rock that is 280 to 570 million years old. It is covered by less than one metre of soil and other material on top of the bedrock with the exception of glaciofluvial ice-contact deposits; gravel, cobbles and sand deposited by the retreating glacier and near shore sand and silt in and around the hamlet of Cherry Valley and the north-western and north-eastern corners of the lake. The Outlet Beach consists of an eolian (wind eroded and deposited) sand and silt deposit reported to be up to 40 metres deep (Quinte Conservation, 2008b). The source material for the sand of the barrier beach bar is the relic sand from glacial Lake Iroquois (J. D. Paine Engineering, 1989).

Map 1. Watershed Bedrock Geology

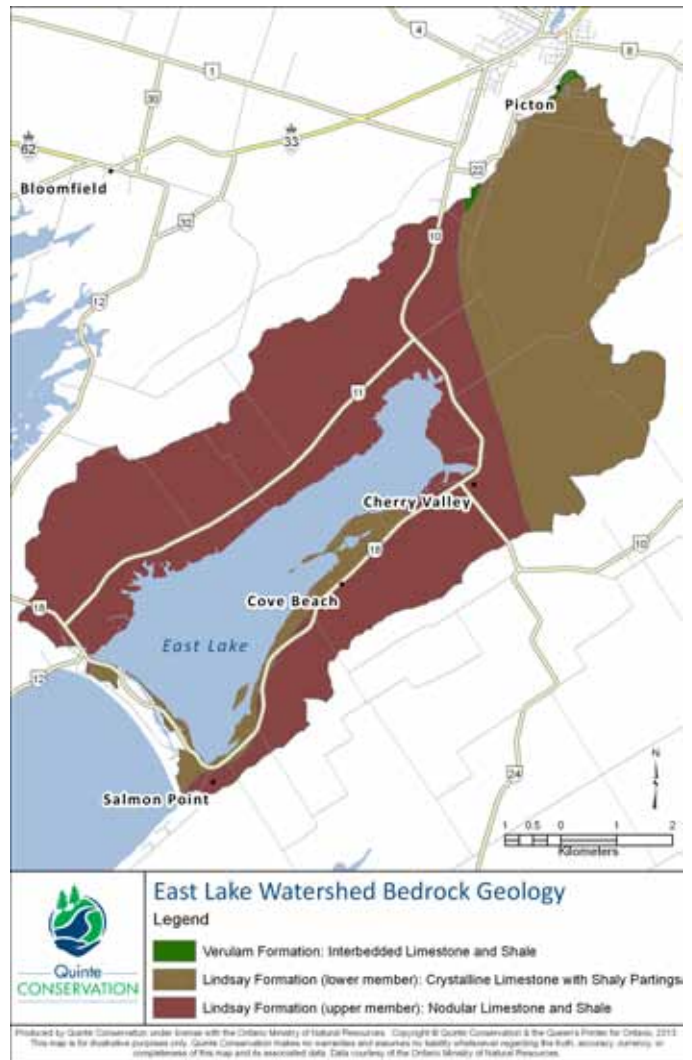


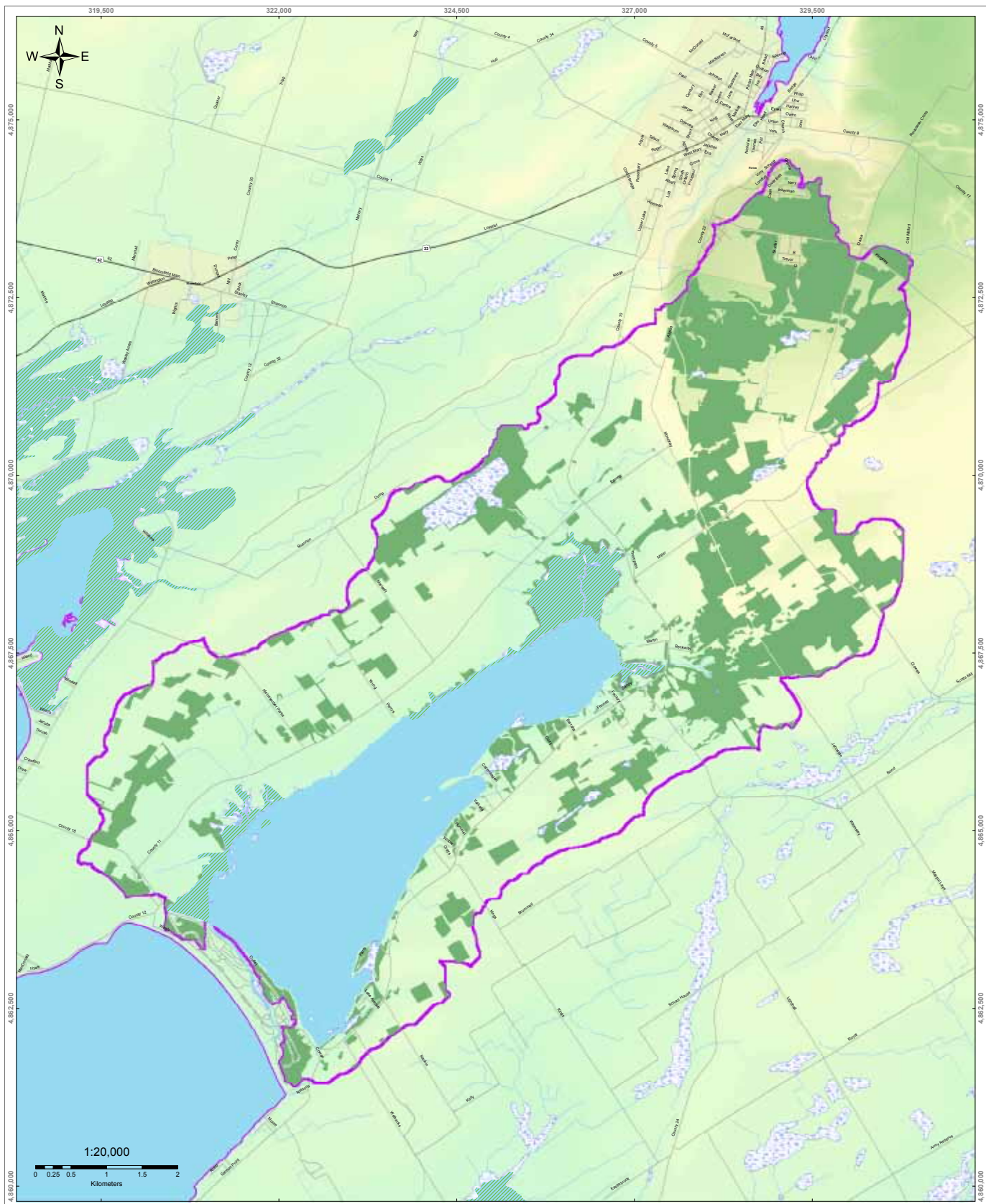
Photo by Fred Lester



Photo by Fred Lester

Examples of exposed sedimentary limestone can be seen in these photos, and found along the south shore of East Lake.

Map 2. East Lake Watershed Natural Features



Quinte
CONSERVATION

Legend

- Highways
- Lakes
- PSW Wetlands
- Roads
- East Lake Watershed
- Wetlands
- Watercourse
- Populated Areas
- Wooded Areas

d. Land Use
i. Past Land Uses

in 1967, the *Prince Edward Region Conservation Report*, prepared by the Department of Energy and Resources Management, stated that land use in rural areas of Prince Edward County was considered primarily to be agricultural. As well, the report provided the following reference to the use of the shoreline areas:

“The use of shoreline areas for the creation of private tourist enterprises has grown somewhat. There is a growing local inclination and desire to increase this trend and thereby diversify the economic base of the region. There is still ample room to continue this form of development and alternative land use.”

In 1970, the *Prince Edward Region Conservation Report – Recreation* made the following reference about cottage developments in the region:

“The present cottage situation in the Prince Edward Region is in an early stage of development compared to the westerly shores of Lake Ontario and inland areas such as Lake Simcoe. Nonetheless, many of the problems are common to both. Overall, the cottager is not aware of the results of his [or her] presence in the region. Neither is the local municipality cognizant of the potential spending power of the cottager nor of the costs incurred by his [or her] demand for services.”

By 1970, the East Lake shoreline had three private campgrounds which primarily catered to American visitors – said to be primarily for fishing expeditions (PERCA, 1970). Today, there are 20 commercially zoned properties and at least 13 tourist commercial campgrounds, trailer or cottage resorts operating along the lakeshore.

Mapping included within the *Prince Edward Region Conservation Report* indicates that several orchards existed on the northwestern portion of the shoreline of the Lake. In addition, the map indicates that the majority of the southwestern portion of the lake is scrublands, wooded pastures, and invaded lands; ie. not active agricultural lands. The remainder of the shoreline is either dunes (Outlet Beach) or active agricultural lands. The dunes and beaches of the Outlet sector have been used for recreation since the 1800s, and parking lots and campsites have been present since 1959. The mapping also indicates a small gravel pit at the south corner of the Outlet Beach dunes, another in the Cove Beach area, and lastly an excavation just to the southwest of the hamlet of Cherry Valley. Two closed waste disposal sites appear on County Official Plan mapping within close proximity of the Lake at the Cove Beach area and Outlet River area (Prince Edward County Official Plan, 1993).

ii. Agriculture

According to Richards and Morwick (1948), the farms of Prince Edward County historically progressed through four eras:

1. the clearing of land and subsistence farming
2. the production of barley and hops for export to the United States and overseas
3. the production of 'seed peas' for export to the United States
4. the production of field crops for canning (peas, tomatoes, corn, and squash)

There are 7 classes used to rate land capability to support agricultural land use.

*Class 1 = highest capability
Class 7 = lowest capability*

The northern shoreline of East Lake constitutes 'Class 1' and 'Class 2' agricultural land that is limited by depth to rock according to the Canada Land inventory mapping (ARDA, 1966), and continues to be dominated by an agricultural land use. The Richards and Morwick (1948) report also indicates that a cheese factory was erected at Cherry Valley in 1867, and that the early stages of the Holstein breed of dairy cattle had beginnings in this area.

During the canning era, cold storage for dairy, poultry and fruit products played a secondary role to the burgeoning canning industry. A large portion of apples, canning crops, and cheese from Prince Edward County and the East Lake shoreline agricultural lands were noted to be marketed in Montreal and Toronto (Richards and Morwick, 1948).

Today, fresh peas, market garden vegetables, cereal grains, sweet corn, maple syrup, beef cattle, and dairy cattle are produced on the northern shores of the lake (Margetson, 2012).

Agricultural Land Stewardship

Regional farmers have implemented many practices to optimize on-farm efficiency, minimize costs and protect and preserve surface and ground water and soils through:

- improved manure storage and land application techniques
- improved storage and handling of on farm fruit and vegetable processing water
- improved on-farm fuel and pesticide storage
- improved on farm silage storage
- sealing and capping of abandoned wells to avoid groundwater contamination
- fencing livestock to stop them from accessing streams and lake water directly
- the creation of natural buffers at the shorelines to protect lake and stream water from runoff contamination
- wetland restoration work
- improved erosion control along shorelines
- equipment modifications for more optimal application of fertilizers
- equipment modifications to improve water efficiency during irrigation
- nutrient management planning and alternative livestock watering systems

iii. East Lake Shoreline Reaches

Seven shoreline reaches have been identified along the shoreline of East Lake. During the summer months of 1992, the former Prince Edward Region Conservation Authority employed two students to conduct a relatively intense shoreline inventory and water sampling testing of *E. Coli* bacteria on East Lake. Using the same shoreline inventory areas, historic information, current internet searching, and 2008 digital air photography imagery the following shoreline reach descriptions have been developed.

1. North Shore of East Lake Reach

This reach includes the area from Outlet River eastward to Martin Street in Cherry Valley, and is characterized largely by its predominantly agricultural land use. Since 1992 there have been stewardship projects in place to restrict cattle access to shoreline and to reduce erosion. There are a total of 38 properties, of which there are 31 larger parcels of land zoned for agricultural purposes (RU), 2 permanent residential lots (RR1/2), 4 limited services lots (LSR) and 1 mobile home park with 11 mobile homes. There are no commercial zones properties. Provincially significant wetland exists along the entire north shore with large marshes at opposite ends of the lake.



2. Cherry Valley Reach - South Shore

This portion of the south shore stretches from Martin Street westward to Curry Lane and is a shoreline area that has been largely developed for residential, cottage, resort and recreational uses. It includes the Hamlet of Cherry Valley, permanent and seasonal residences, and three commercially zoned properties; Cherry Lane Campground and Cottages, Shore Club, and Sandbanks Summer Village.

The shoreline has varied slopes with few shorewalls and active erosion was noted in a 1992 report. There is a public boat launch in the marsh found below the Hamlet of Cherry Valley



Above: Currie Point



Above: Aerial view of Cherry Valley.
Photo credit Linda Cole



3. Job's Island Reach

This reach includes the area from Curry Lane westward to Willow Lane. This reach contains many residential and residential and seasonal cottages, and resorts including: Sandbanks Summer Village, Cherry Beach Resort, Echo Bay, Sandbanks Cottages and Campsites, Bluejay Cottages, and East Lynn cottages.

It is a littoral zone (lands under water) with a steeper gradient from shallow to deeper waters, and little weed growth (1992 report). Job's Island has one seasonal residence and is only accessible by water.



Photos by Linda Cole



4. Parr Island Reach

Parr Island Reach includes the area from Willow Lane to the east side of Lake Avenue Resort property. Parr Island is joined to the mainland by a causeway through a wetland area to allow access to several homes and cottages. The shoreline is limestone bedrock with very steep gradient to deeper water.

This section of shore has many residential homes, seasonal cottages, several commercially zoned properties; and two tourist establishments, The Four Winds and Sunset Shores Trailer Park.



5. Salmon Point Basin Reach

The Salmon Point Basin Reach is located in the southwestern end of the lake, from the Lake Avenue Park property, west to the Provincial Park boundary. This reach consists of the basin at the southwest corner of lake and part of the sand formation that has created East Lake.

Permanent residences, cottages, and one trailer park, Lake Avenue Park, can be found along this section of the lake as well as two highway commercial properties that are not currently operating.

This is a very shallow area of the lake with many submerged and/or emergent aquatic plants.



6. Sandbanks Provincial Park - East Lake Sector (Outlet Beach) Reach

This reach encompasses the Provincial Park lands that are located to the south of the Outlet River Reach and includes; a long stretch of naturally vegetated shoreline, very shallow, sparse weed beds due to sandy substrate, a water current and a portion of the baymouth sandbar barrier.



Above: View looking south on the Outlet River on Provincial Park lands in January 2013.



Above: Lake Ontario side of the Outlet beach.



Above: Outlet Shore on the East Lake side showing long stretch of natural vegetation



7. Outlet River Reach

The Outlet River Reach is located on the west shore of East Lake. This reach includes the shoreline of the Outlet River on the east side of the County Road 18 and encompasses the baymouth sandbar barrier that formed the lake. This reach includes Sandbanks Provincial Park, permanent residences, cottages and two commercially zoned properties, Log Cabin Point and Martins River Country. This region of the lake has many shorewalls, little vegetation and numerous docks, sheds and garages.



Above: View looking northwest of the Outlet River in January 2013

Left: Aerial photo of the Outlet River. Photo credit Linda Cole



iv. Description of Land Use Around East Lake

There are four distinct categories of land uses that abut the East Lake shoreline:

- Agriculture/Rural (north shore from the Sandbanks Provincial Park in the northwest corner of the lake to the Hamlet of Cherry Valley);
- Hamlet (southeast shore);
- Shore Land Residential and Commercial (south shore); and
- Provincial Park and Outlet River (west shore).

While these land use categories have uncommon and sometimes incompatible activities, their juxtaposition on the lake provides for the uniqueness of the lake's character. The northern and southern sides of the lake have two very different and distinctive characters and land use. The northern shoreline (North Shore Reach from the Sandbanks Provincial Park to the Hamlet of Cherry Valley) is characterized by agricultural and rural development, and the southern shoreline (encompassing the other six reaches described in the previous section) is characterized by permanent and seasonal residential development, and resort and trailer park commercial operations.

In total, there are 186 shoreline lots that are adjacent to East Lake. Figure 1 provides information on the number of shoreline lots by land use zoning category (in accordance with By-law 1816).

Figure 1 - Number of Shoreline Lots by Location and Zoning Category - East Lake (2012)

Zone	Northside of East Lake	Southside of East Lake	Total Lots
Rural			
RU1	18	9	27
RU2	11	1	12
RU3	2	-	2
Rural Lots TOTAL	31	10	41
Residential			
HR - Hamlet	-	6	6
RR1 - Rural	1	62	63
RR2 - Rural	1	11	12
LSR - Limited Services	4	38	42
MHR - Mobile Home	1	-	1
Residential Lots TOTAL	7	117	124
Commercial			
TC - Tourist	-	10	10
TPC - Trailer Park	-	8	8
HC - Highway	-	2	2
Commercial Lots TOTAL	-	20	20
Industrial			
MR - Industrial	-	1	1
Industrial Lots TOTAL	-	1	1
TOTAL	38	148	186

Source - Prince Edward County

http://www.pecounty.on.ca/county_overview/location_maps.php

Along the north shoreline there are in total 38 properties, of which there are 31 larger parcels of land zoned for agricultural purposes (RU), two permanent residential lots (RR1/2), four limited

services lots (LSR) and one mobile home park with 11 mobile homes. Each of these properties may have one residential dwelling, and the 38 properties zoned Rural (RU) may have additional dwellings when they are associated with the agricultural operations.

The southern shoreline has 3.5 times more shoreline lots and associated development than the northern shoreline. In total, there are 148 shoreline lots along the southern shoreline, including 10 rural (RU) properties, 79 permanent residential (HR, RR1, RR2), 38 limited services (LSR) and 20 commercial and one industrial zoned properties. Most of the southern shoreline is developed and there are only a few lots that have the potential to be subdivided or may have additional development capacity.

There are 20 commercially zoned properties along the southern shoreline; including 10 zoned for tourist commercial (TC) purposes, eight Trailer Parks (TCP) and two highway commercial (CH). The two highway commercial properties are located in the Salmon Point Reach do not appear to be operating. Figure 2 provides a list of the commercially zoned properties and the number of accommodation units (trailer park sites, tourist cottages and dwellings).

and the following is based on the draft numbers.

Figure 2 - Total Commercial Accommodation Units - East Lake - 2013

Commercially Zoned Properties	Zoning	Trailer Park Sites			Tourist Cottages (Cabins)	Dwelling ¹	TOTAL
		Full Service	Partial Service	No Service			
1. Log Cabin Point	TPC-5	32 ¹			6 ¹	1	39
2. Martins River Country	TPC	151 ²			-	1	152
3. Unknown (not operating)	CH-37	-			-	1	1
4. Willow Camp Store (not operating)	CH-38	-			-	1	1
5. Lake Avenue Park	TPC-9	106 ¹	30 ¹	20 ¹	3 ¹	1	160
6. Sunset Shores Trailer Park	TPC-2	15 ¹			3 ¹	1	19
7. Unidentified Name	TPC	? ³			? ³	1	1
8. Unidentified Name	TC-37	0 ¹			2 ¹	1	3
9. Unidentified Name	TPC-4	16 ¹			-	1	17
10. The Four Winds	TC-19	-			10 ¹	1	11
11. Unidentified Name	TC	? ³			? ³	1	1
12. East Lynn Cottages	TC	-			5 ⁴	1	6
13. Bluejay Cottages	TC-34	4 ¹			5 ¹	1	10
14. Sandbanks Cottages and Campsites	TC		75 ⁵	45 ⁵	9 ⁵	1	130
15. Echo Bay	TC-44	-			3 ¹	1	4
16. Cherry Beach Resort	TPC	20	-	100 [?]	?	1	121
17. Sandbanks Summer Village	TC-50	-			237 ¹	1	238
18. Shore Club	TC-47	-			5 ¹	-	5
19. Unidentified Name	TC	? ³			? ³	1	1
20. Cherry Lane Campgrounds	TPC-10	? ³			3 ¹	1	4 [?]
TOTAL		614			291	19	924

Footnote:

1. Number of Units permitted by By-law
2. Source - <http://www.woodalls.com/campground/campgrounddetails.aspx?campgroundid=45102300>
3. Property zoned for commercial purposes, current number of accommodation units is unknown.
4. Source - <http://eastlynncottages.com/>
5. Source - <http://www.sandbankscottagesandsites.com/>

The total number of trailer park sites is estimated to be 614 and the total number of tourist cottages/ cabins is 291 of which 237 cottages (about 80%) are located in Sandbanks Summer Village.

In accordance with the County Zoning By-law 1816-2006, 13 commercial properties have specific zoning amendments (indicated in column 2 of Figure 2 by the hyphenated number) which provides the total number of accommodation units, such as cabins and trailers, that are permitted. Seven commercial properties have general commercial zoning (TC and TPC) and the total number of allowable accommodation units are determined by design criteria and the size of the property.

5. East Lake Water Levels and The Outlet River

Under normal conditions, the Outlet River is open to Lake Ontario during the summer months and the water level in East Lake corresponds very closely to that of Lake Ontario. During the late summer and early fall the flow of water in the river decreases and the water level of Lake Ontario also drops; exposing a larger expanse of sand beach. Currents along the shoreline of Lake Ontario, also known as littoral drift, with wind and wave action gradually redistributes the sand along the shore and this action can block the mouth of Outlet River. When the river is blocked, water levels on East Lake have risen by as much as 0.6 metres during the late fall and winter. With the spring melt and additional runoff into East Lake, the sand plug at the river mouth breaches and a channel is scoured through the sand beach returning the East Lake water level to the same as that of Lake Ontario.

In the past years when Lake Ontario levels were higher the outlet sand plug would release naturally. However, in recent years when Lake Ontario has been at lower levels the natural breaching does not always occur and the sand plug appears to be breached when water levels rise on the Outlet River and East Lake due to the sand plug.

During the summer months, it is noted that virtually no flushing of the lake occurs; water which is lost by evaporation is balanced with surface runoff or precipitation falling directly on the lake. Discharge at the mouth of the Outlet River is noted to peak during the spring thaw, mid-March to mid-April, when snow and ice are melting at approximately 24.5 cubic metres per second.

When the Outlet River is open, some flushing of the river would occur during the summer months when Lake Ontario water levels are high, however insufficient volumes of water could be exchanged to have any measureable effect on the quality of water in East Lake during the summer months.

In 1986 when water levels on Lake Ontario were at record highs abnormally high levels on East Lake lead to significant erosion damage during the late fall of the year. The former Prince Edward Region Conservation Authority (now Quinte Conservation) subsequently assisted landowners in protecting their shorelines through the planting of trees and shrubs, the installation of livestock fencing along the north shoreline, and installation of rubble rip rap or gabion baskets along the southern shore (J. D. Paine Engineering, 1989).



Above: Eroded Shoreline



Above: High water and low water both shown in 2012

Photo Credit Fred Lester



Photo by Peggy deWitt

6. Water Quality

The water quality of East Lake is in relatively good condition and the lake is considered to be in a mesotrophic state, defined as a clear water lake with beds of submerged aquatic plants and medium levels of nutrients. In 2007 sampling showed some elevated concentrations of Dissolved Organic Carbon (DOC), Total Phosphorous, and some metals that are thought to be mainly from natural sources, but land use activities have not been ruled out. More sampling is required for all parameters.

There is no single measure that constitutes good water quality. For instance, water suitable for drinking can be used for irrigation, but water used for irrigation may not meet drinking water guidelines.

In 1992 and 2007 Prince Edward Region Conservation Authority (now Quinte Conservation) staff, with the assistance of the Friends of East Lake, undertook detailed water quality monitoring.

During the 1992 sampling, the shoreline was classified into reaches and notes and videos were taken to document existing shoreline types and uses and relate them to bacteria levels in the near shore waters.

The 2007 sampling regime consisted of collecting samples covering five watercourses which contribute drainage to the lake, a mid-lake deep water sample, and a sample at the lake outlet. The Ministry of Environment analyzed the water samples in their laboratory for general chemistry, metals, and *E.Coli* for seven repetitions, one sample per month at each station from May to November. In 2013 Quinte Conservation performed another round of sampling. See map 3 for locations of all samples sites. The sites from 2007 were repeated and additional sampling sites were added, including an additional lake ontario open water sampling site, ground water sampling sites, and wetland sites, The results from the 1992, 2007, and 2013 sampling that took place are summarized in the following sections under phosphorus, *E. Coli*, dissolved oxygen, and metals.

During the spring, summer and fall of 2013 the following sampling was conducted.

Tributary Sampling

Six sampling locations were sampled once a month for four months from May to August. Benthic sampling was completed on two of the tributaries.

Open Water Sampling

Two sampling locations in East Lake were sampled once a month for four months from May to August at the same time as the tributary samples. One sampling location in Lake Ontario (Athol Bay) was sampled once a month for four months from May to August, at the same time as the tributary and East Lake samples.

General chemistry parameters were tested; including chloride, total suspended solids, total solids, total dissolved solids, conductivity, pH, alkalinity, nitrogen, nitrate + nitrite, ammonia, phosphate, total phosphorus, total kjeldahl nitrogen, dissolved organic carbon, dissolved inorganic carbon, and silicon.

Metal parameters were tested; including aluminum, barium, beryllium, calcium, cadmium, cobalt, chromium, copper, iron, magnesium, manganese, molybdenum, nickel, lead, strontium, titanium, vanadium, and zinc.

Groundwater Sampling

Water level and water temperature were monitored hourly at three groundwater wells. These wells were sampled once over the four sampling months.

Wetland Surveys

The wetland surveys were conducted following the Durham Region Coastal Wetland Monitoring Protocol which is used across the Great Lakes which is useful for comparing wetland health with other areas of Lake Ontario. It included electrofishing (2 days), wetland plants (40 plots), breeding bird survey (5 surveys) benthic invertebrate (6 sites), breeding amphibian survey (3 surveys), and general chemistry measurements. Phosphorus, nitrates and ammonia were sampled.

Map 3 2013 Sampling Sites in the East Lake Watershed



Summary of 2013 Sampling Results by Quinte Conservation

The 2013 sampling was a 'snap shot' during the growing season. Further sampling would allow for seeing trends over time. No parameters from the 2013 sampling triggered a major concern for Quinte Conservation staff.

Species abundance for wetland plants, marsh indicator amphibians, fish and birds were all very good. There were some slight exceedences in surface sampling for a few parameters but nothing of concern to Quinte Conservation staff. Exceedences tended to coincide with natural causes, ie. pH due to limestone weathering, manganese and iron from soil leaching and dissolved organic carbon from the wetlands.

The benthic sampling was as expected for the watercourse conditions. Many of the tributaries in the summer months are low flow and historic sedimentation makes for difficult living conditions for benthics.

Ground water monitoring showed water table fluctuations of up to 3 metres over a relatively short monitoring period. in the shallow wells water fluctuations were in direct response to precipitation. A deep well in Cherry Valley did not fluctuate in response to precipitation. Lake levels were noted to fluctuate (approximately 0.3 metres) in response to precipitation and exhibited similar patterns to groundwater levels.

a. Phosphorus Observations

Phosphorus is a common indicator of water quality. Small amounts of phosphorus are required for plant growth but an excess of phosphorus can cause increased plant growth sometimes seen in the form of algae and algal blooms. A source for excess phosphorus in lakes is human waste from leaky septic tanks as well nutrients, such as fertilizers, that run off the land and into the lake with rain waters and the spring melt. Phosphorus also builds up on the bottom of lakes from decaying plant and animal matter. This phosphorus can be released with the turnover of the lake water in the spring and fall.

The current Provincial Water Quality Objective (MOEE, 1994) does not have a firm water quality objective for phosphorus; however the guideline gives the following advice:

“To avoid nuisance concentrations of algae in lakes, average total phosphorus concentrations for the ice-free period should not exceed 20 grams per litre.”

Historically, water quality data was collected by the Ministry of Environment – Recreational Lakes Water Quality Survey Program.

Information was collected for East Lake at a single station during 1980 and 1985 which revealed a high eutrophic status (high nutrient levels) - total phosphorus of 23 micrograms per litre in 1980, and 34 micrograms per litre in 1985 (J.D. Paine Engineering, 1989).

Total phosphorus water quality data has also been collected through the Ministry of Environment Lake Partner Program. This program assists in analyzing the lake health as available phosphorus is a determining factor in algae growth.



Blue Green Algae (Cyanobacteria)

Blue-green algae are primitive microscopic plants that live in fresh water. During warm weather, populations rapidly increase to form a large mass called a bloom, often occurring in late summer and early fall.

Blue-green algae often thrive in areas where the water is shallow, slow moving and warm, but can be present in deeper and cooler water. High levels of nutrients, such as phosphorus and nitrogen, can contribute to blooms.

Some forms can produce toxins that can be harmful to human health. Symptoms can include itchy, irritates eyes and skin. If swallowed symptoms can include headaches, fever, diarrhea, abdominal pain, nausea and vomiting.

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



Above: A Blue Green Algae warning sign on East Lake in 2012 and an example of an algal bloom.

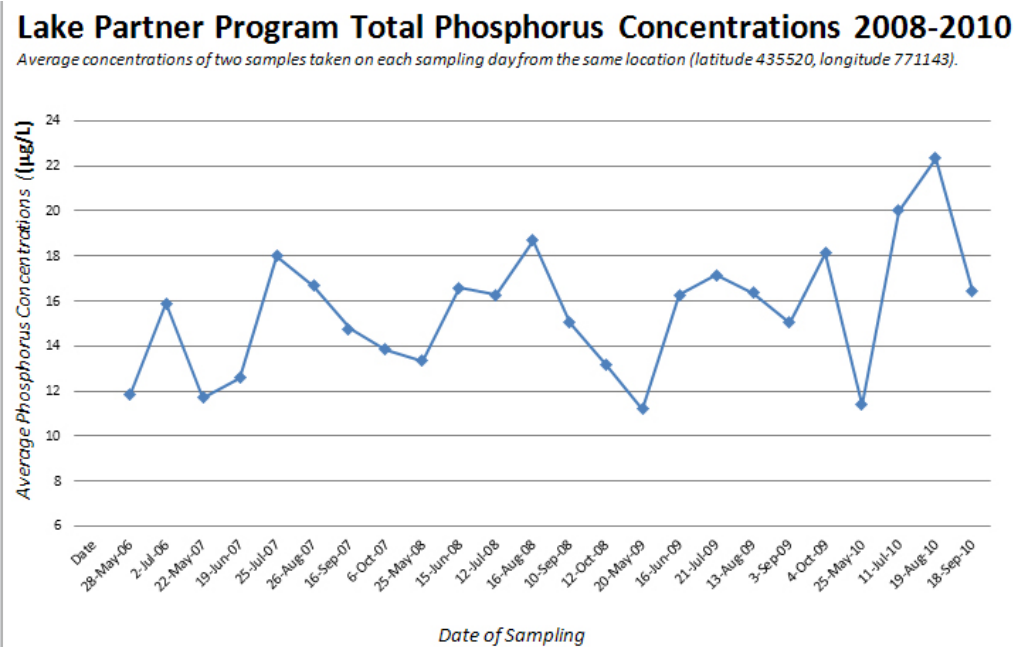
Based on 32 samples collected from 2006 to 2011, the average total phosphorus was 15.71 micrograms per litre, which is markedly down from the 34 micrograms per litre sample from 1985. The lake is now considered to have a "mesotrophic" status, a lake with higher productivity; more nutrients, vegetation and fish populations than an "oligotrophic" lake (Lake Partner Program, 2012). Likely the decrease in total phosphorus can be attributed to not only decreased numbers of livestock within the watershed but also stewardship practices implemented by farmers such as the planting of trees and shrubs along shorelines for erosion protection and minimizing surface runoff and restricting cattle from going into the water. Some of the total phosphorous concentrations could also be explained due to numerous wetlands within the lake that naturally release nutrients from decaying vegetation (Quinte Conservation, 2007).

Foaming Waters

The foam that collects in heaps along the shores of East Lake in the fall is a harmless by-product of the lake. It is natural process involving the decomposition of aquatic plants, algae, and leaves. During the decomposition process cellular products are released into the water producing a surface agent known as surfactant. A surfactant lessens the surface tension of the water making it more susceptible to foaming. When agitated by wind and waves, foam begins to build up on the shore. When small organic matter gets mixed in with the foam, it gives the foam stability.

The chemical make-up of this foam is 1% surfactant, with the remainder being air and moisture.

Figure 3- Lake Partner Program Total Phosphorus Concentrations 2008-2010



Above: A stream sampled in 2007



Above: A cottage shoreline planted with native flowering plants and shrubs aids in; shoreline stabilization, limiting soil erosion, purifying land runoff before it enters the lake water, and creating a beautiful shoreline that attract birds, butterflies, dragonflies and small animals by providing food and shelter.

Watercourses draining into East Lake were sampled by Quinte Conservation staff in 2007 for various parameters, including phosphorus. The samples indicated that total phosphorous concentrations were found to occasionally be greater than the Provincial Water Quality Objectives (PWQO) downstream from Beaver Meadows watercourse station, and in every sample taken from the Cherry Valley watercourse station. The increased nutrient levels could be from adjacent land uses, such as agricultural lands at the Beaver Meadow site and stormwater and sewage effluent from the Cherry Valley site. Phosphorus results from the 2013 sampling were highly variable with minor exceedences. Additional stream studies will help in understanding the ongoing trends.

b. *E. Coli* Bacteria

E. Coli is naturally occurring bacteria found in the intestinal tracts of animals, including humans. High *E. Coli* counts indicate contamination by human or other animal waste. In some cases high *E. Coli* counts are a sign of faulty septic systems. In other cases high *E. Coli* counts can be attributed to geese grazing and defecating at shorelines. Only a few strains of *E. Coli* can cause illness in humans.

Water quality parameters were collected during the summer months of 1992 by the former Prince Edward Region Conservation Authority, which employed two students to conduct a shoreline inventory and water sampling testing of *E. Coli* bacteria on East Lake. During the study, the bacteria levels were noted to elevate in the near shore area following rain events in July and August. Water temperatures averaged at 15 degrees Celsius across the shoreline areas and throughout the same months (Prince Edward Region Conservation Authority, 1992). During the 2007 study, only the East Lake Outlet, Cherry Valley, and the mid-lake stations could be interpreted for the presence of *E. Coli*, but none of the three stations had a count that was more than the Provincial Water Quality Objective (PWQO) of 100 counts/100 ml (Quinte Conservation, 2008). *E. Coli* data was also obtained from the Sandbanks Provincial Park for the Outlet Beach swimming area. In 2012, the highest average *E. Coli* count was 71 counts/100ml – below the PWQO during a very dry year (Reilly, 2012).

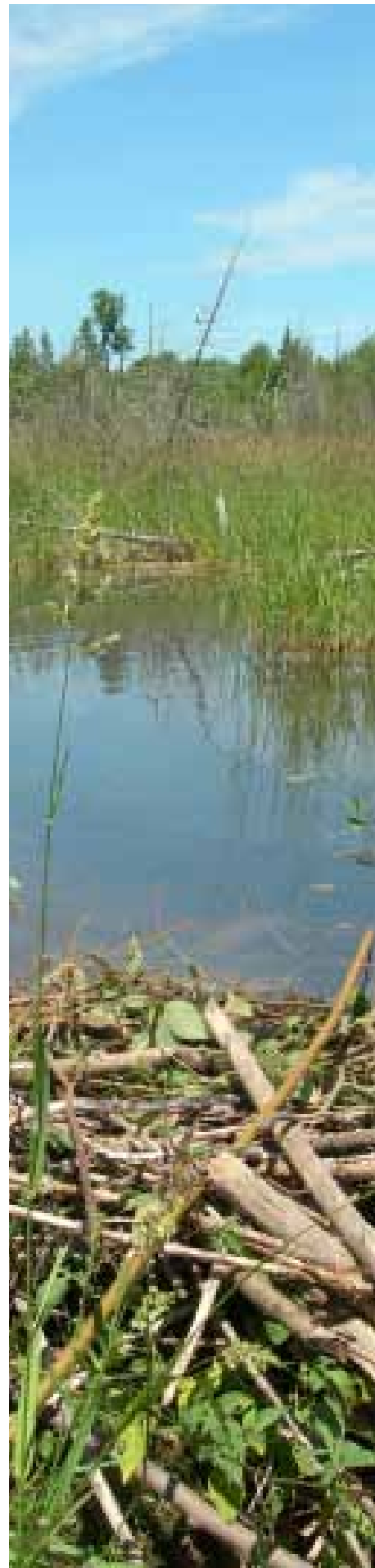
c. Other

Dissolved Organic Carbon

In 2007, East Lake sampling stations were alkaline with pH values ranging from 7.8 to 8.7 on the pH scale. Dissolved Organic Carbon (DOC) is formed through the process of plant and animal decay in the water and is often an indication that wetlands, beaver or muskrat are present. Occasionally in 2007, for stations located downstream of Beaver Meadows, East Lake Outlet, and Cherry Valley, where there are wetlands, the samples had concentrations of DOC greater than the Ontario Drinking Water Standards (Quinte Conservation, 2007).

Metals

Metals, such as aluminum, cadmium, cobalt, iron, lead, and silver had at least one sample with concentrations greater than their Provincial Water Quality Objectives (PWQO). Aluminum concentrations were



greater than the objective only once and it was from the station downstream from Beaver Meadows.

in 2007 Cadmium concentrations were greater than the PWQO for most samples at all stations, but never above the Ontario Drinking Water Standard of 5.0 µg/L. In 2013 Cadmium was not exceeded in any samples. The East Lake Outlet, County Road 10 at Eames Road, and mid-lake sample stations had cobalt concentrations greater than the PWQO once each.

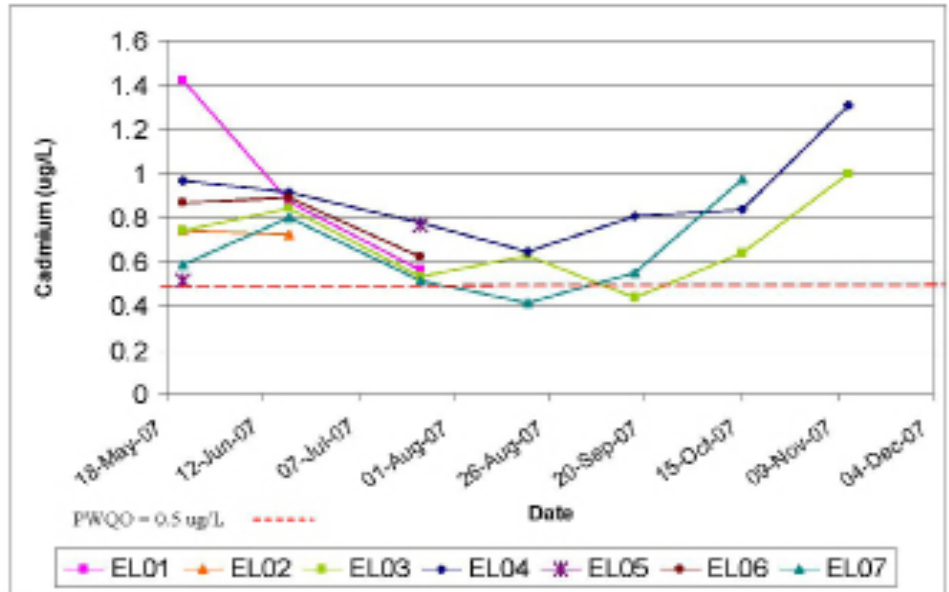


Figure 4 Cadmium concentrations in 2007 samples at seven East Lake stations. See map 3 on page 34 for sampling locations.

Iron concentrations were consistently greater than the PWQO at one station only, the Cherry Valley station from June to November. County Rd 11 west of Kleinstuber Parks Road, Cherry Valley and Thompson Rd stations had lead concentrations greater than the PWQO one time at each. Silver was only tested on one occasion; three of the sample locations had concentrations greater than the PWQO. The source of these metals is believed to come from natural sources of weathering rock and till because in 2007 cadmium, iron, lead, and silver concentrations were also found to occasionally be above the PWQO in the neighboring Black River watershed with similar bedrock geology.

Water quality data was also collected in support of a cottage development on East Lake in May of 2008 (Michalski Nielsen, 2008). The report indicates a uniform water temperature (15.5 to 16 degrees Celsius) in the centre of the lake to a depth of over 6 metres, thus reporting that the lake does not stratify and thus could not support cold water fish species. Further, the dissolved oxygen was reported to be between 10.9 mg/L and 11.0 mg/L which is close to saturation (the Provincial Water Quality Objective is only 5 mg/L). The temperature and dissolved oxygen readings were consistent through the water column indicating mixing through currents and prevalent westerly winds. The turbidity of the lake water was reported to be of generally low levels.

Field Parameters

Water quality data has also been collected by Department of Fisheries and Oceans during surveys for fish species at risk (Mandrak, 2012). During these surveys, water quality data was collected in 21 locations around the shoreline of the Lake, in an average of less than one metre of water and at an average of 60 metres from the shoreline. The average temperature was recorded at 21.74 degrees celcius in mid-June, the average pH was 8.7, and average dissolved oxygen was 142.94 % (both within the PWQO parameters).

7. Natural Habitats and Features

The watershed lies within the Huron-Ontario section of the Great Lakes-St. Lawrence Forest Region (Rowe, 1972). This forest zone consists of a rich mixture of coniferous and deciduous tree species, a broad transition life zone, where many typically southern species reach their northern limit and many northern species reach their southern limits within North America.

Of special note are birds like the King Rail, Blue-Winged Warbler, Cerulean Warbler, Yellow-breasted Chat, Orchard Oriole, and Yellow-billed Cuckoo. In addition, the presence of Juniper trees, Musk Turtle, Blanding's Turtle, Map Turtle, and the Tree Frog are highlighted as disjunct from their typical distribution (Department of Energy and Resources Management, 1968). As is common within southern Ontario, extensive forest tracts of original forest cover are relatively uncommon in the watershed, with the exception of the Beaver Meadow Wildlife Management Area. Several large blocks of poor agricultural lands have been abandoned and are reverting to secondary forest cover, such as Red Cedar dominated forests. Map 4 on page 41 illustrates natural heritage features found in the East Lake watershed.

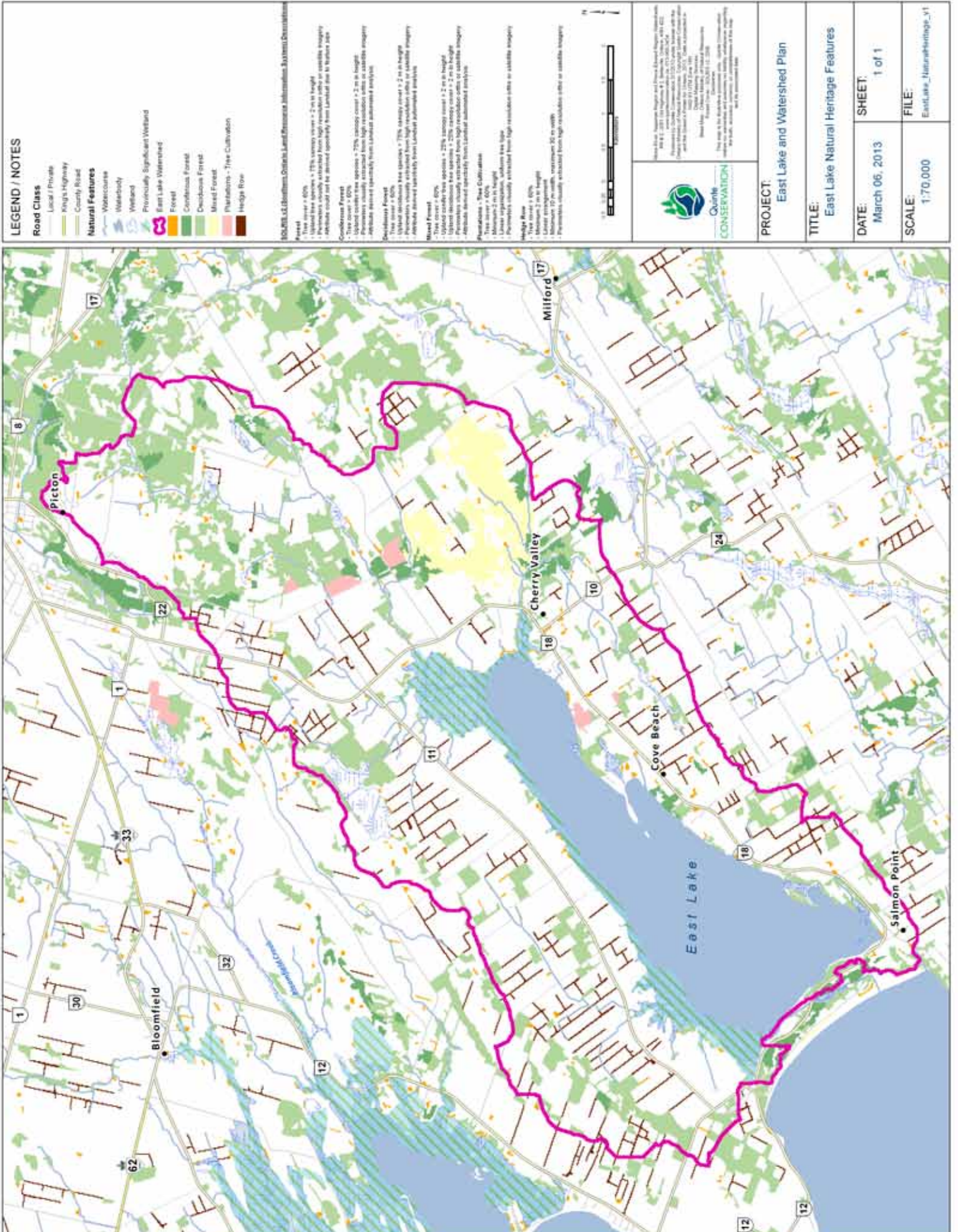




East Lake aerial photos by Peggy deWitt (left and above)

Photo Credit Fred Lester

Map 4. Natural Heritage Features



a. Forest Cover

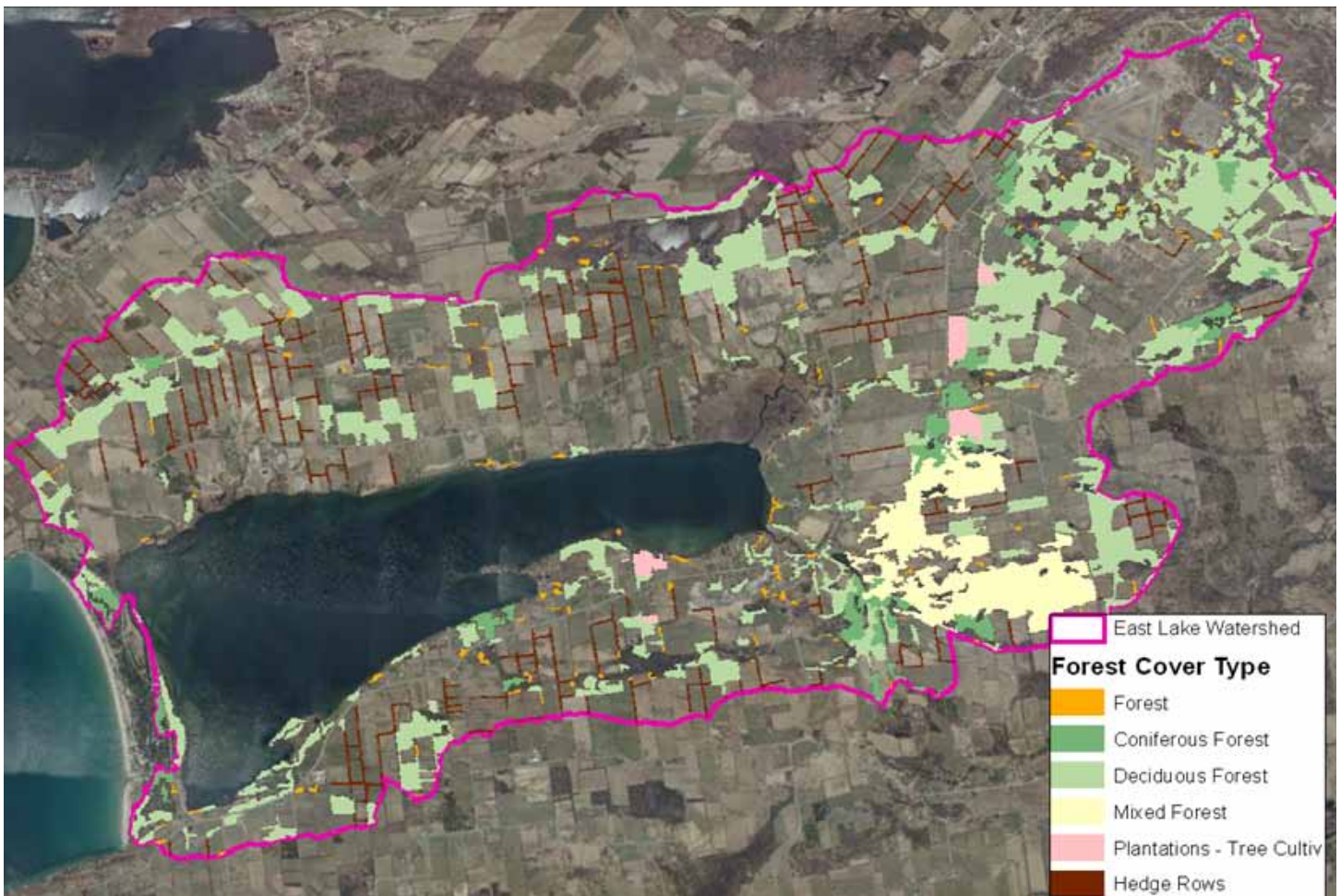
The East Lake Watershed is 6,694 hectares (ha), and has about 20% forest cover (1,363 hectares). Prince Edward County has approximately 19.3% forest cover.

Forest is defined as tree cover greater than 60% with upland tree species greater than 75% and canopy cover greater than 2 metres in height.

Deciduous forest comprises approximately 12% (838 ha) of the landbase in the East Lake watershed, mixed forest at 3% (206 ha), hedge rows at 2% (136 ha) coniferous forest at 1.7% (113 ha), and plantations (trees cultivated) at 0.5% (31 ha).

The map below shows forest cover types within East Lake Watershed.

Map 5. Forest Cover



Data Source: SOLRIS Version 1.2, April 2008

b. Cove Beach Sugar Bush

The Cove Beach Sugar Bush is included in the International Biological Program site inventories, which is a predecessor of the Areas of Natural Scientific Interest (ANSI) inventories. The sugar bush lies on a ridge of coarse, gravelly loam along the southern edge of East Lake on a sand plain overlying a limestone bedrock plain. The area is noted for being a mature but small representative of the Sugar Maple and Beech Deciduous forest type despite the forest being managed for syrup production (NHIC, 2012).



Above: Location of Cove Beach Sugar Bush



A typical sap house on a farm on East Lake Road. Photo Courtesy of "Athol", 1979, pg 422



c. East Lake Marshes

Extensive beds of submerged aquatic plants exist in both the eastern and western ends of the lake. Wild Rice is reported to exist on the western end of the lake, but not the eastern end which is dominated by Cattail. The wetland evaluation report for the East Lake Marsh notes a colonial nest of Black Terns, local significance for waterfowl nesting and staging, and significance for Large Mouth Bass and Northern Pike spawning and rearing habitat (NHIC, 2012). Sampling performed by Quinte Conservation in 2013 concluded a high abundance of wetland plant species (28 species) and a very high percentage of native plant species and specifically species requiring clean and undisturbed waters, turbidity-intolerant species, indicating that disturbance is not a factor.



Black Terns are noted to nest in the East Lake marshes each spring and summer and are a species at risk. Their nests are at the water surface and can be swamped by recreational boaters.

Northern Wild Rice (Zizania palustris) is an annual plant native to the Great Lakes region of North America. Wild Rice grows in shallow water; only the flowering head of wild rice rises above the water. The grain is eaten by ducks and other aquatic wildlife, as well as humans.



*Above: Largemouth Bass
Left: Northern Pike
Right: Cattails*



d. Beaver Meadow Wildlife Management Area

Beaver Meadow, located a few kilometres from Woodrour Corners to the north of the Lake, was at one time a forest. A large portion of the land now covered by water and marsh was cleared of trees in the early days by settlers. This clearing along with the work of beavers and their dams is what created the wetland. As water accumulated over the years, the land became water covered and the forests decreased, creating what is seen today. Beaver Meadow is part of several properties that were purchased by the Prince Edward Conservation Authority (now Quinte Conservation) and is managed as a Wildlife Management Area.

In the early 1900s the land was purchased by G.W. McMullen of Picton and for a short, but intense period, existed as an experimental farm complex. Initially forty men were brought from Deseronto to clear and cultivate the land and erect buildings for both employees and livestock. McMullen was involved in growing celery, mushrooms, ginseng, condensing milk, harvesting sugar turnips, producing maple syrup, selling wood, and raising chickens.

Quinte Conservation acquired the 89 hectare (220 acre) property in 1970 to be managed for wildlife. Further to this purpose, in 1980, Quinte Conservation and Ducks Unlimited constructed a concrete dam on this site to regulate flooding of the wetlands on the property. During the summer of 2009, the stop logs were removed to allow for oxygenation of the organic substrate over fall and winter period. The accumulated debris was removed from the upstream side of the dam and new stop logs were installed to capture the spring freshet in 2010.

This Wildlife Management Area is open to the public and features a large wetland that harbours wood ducks, osprey and herons among other wetland dependent species. As well, deciduous woods and a large plantation of wildlife shrubs on the property provide excellent habitat for songbirds. Two short hiking trails branch off from the parking lot, each ending at a scenic observation platform overlooking the wetland. Wild Ginger, Trilliums, Baneberry, Jack-in-the-Pulpit and Indian-pipe are some of the wildflowers that may be found here, along with a mix of deciduous trees including White Birch, American Beech, Black Walnut, Butternut, Shagbark Hickory and six species of Maple (Quinte Conservation, 2012).



Wetland at Beaver Meadow WMA



Trilliums in bloom at Beaver Meadow WMA



Wetland at Beaver Meadow WMA

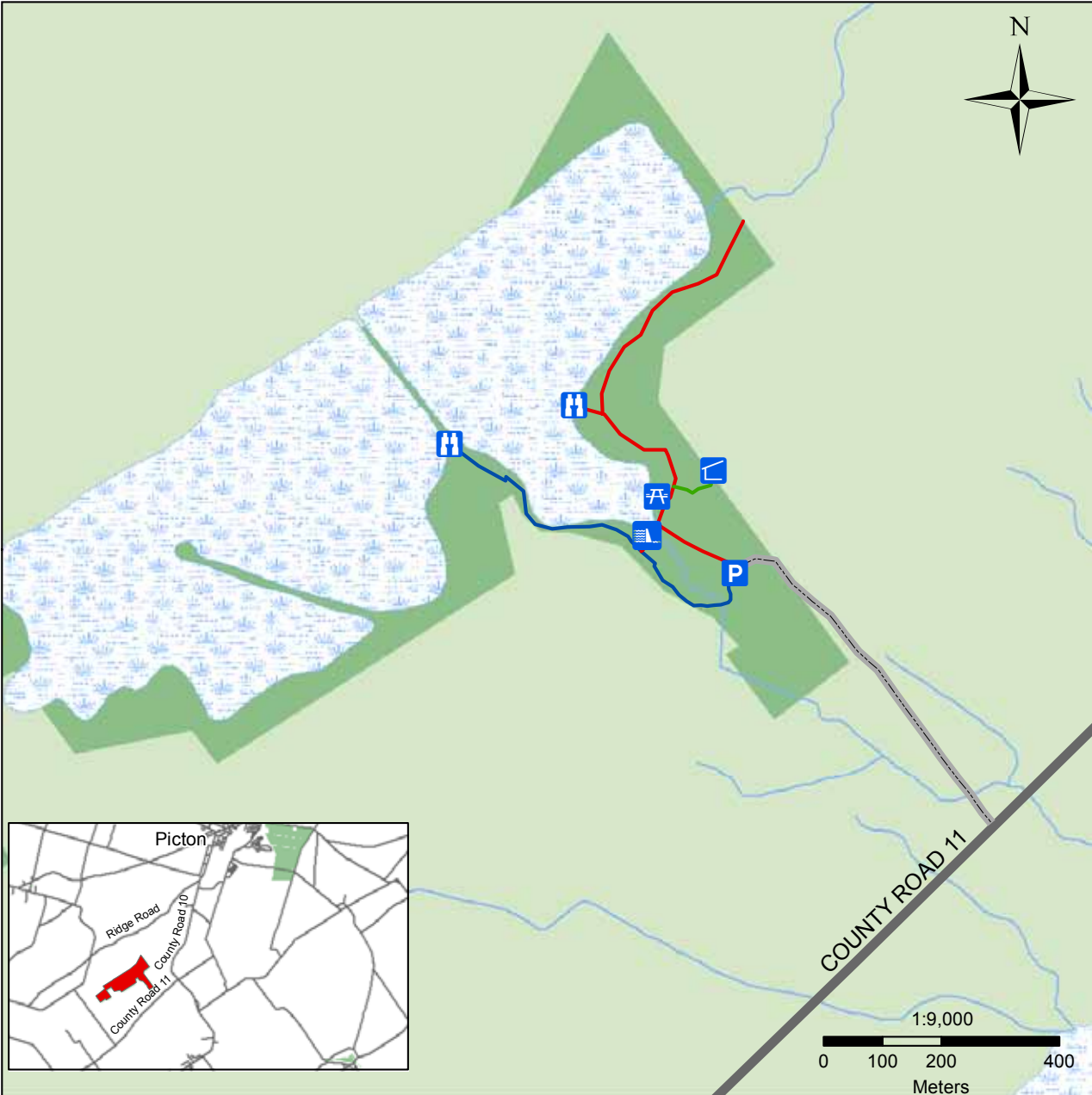



Canada Geese at Beaver Meadow WMA



Wetland at Beaver Meadow WMA

Beaver Meadow Conservation Area Trail Map





Moira River, Napanee Region and Prince Edward Region Watersheds, RR # 2, 2061, Old Highway # 2, Belleville, Ontario, K8N 4Z2, www.quintaconservation.ca, 613-988-3434

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Legend

Entrance Road ~ 0.7 km	Greenhouse Ruins	Quinte Conservation Property
Greenhouse Ruins Trail ~ 0.1 km	Parking Lot	Watercourse
East Lookout Trail ~ 1 km	Picnic Table	Waterbody
West Lookout Trail ~ 0.7 km	Lookout	Wetland Area, Permanent
Road	Dam	



A flora and fauna inventory for Beaver Meadows Wildlife Management Area can be found in Appendix 1.

e. Sandbanks Provincial Park

Sandbanks Provincial Park was formed from the joining of the previous smaller Sandbanks Park (1962) and the Outlet Park (1959) with an intervening land purchase. The combined park is 1,509 hectares (ha). The park is intensively developed as a campground for the visiting public.

The park is noted as a very well developed bay mouth barrier spit and bar on the Lake Ontario north coast, with well-developed rolling dune ridges, slack depressions, and an incised meandering stream. The park also includes sections of East Lake shoreline.

The area of the park around the Outlet River contains coniferous, mixed, and deciduous groves, thickets, meadows, and aquatics. The park contains animal and plant species of the Great Lakes area including regionally significant plant species like the Hoary Puccoon (*Lithospermum canescens*), Fringed Gentian (*Gentiana crinita*), Marram Grass (*Ammophila breviligata*), Starry False Solomon Seal, and rare prairie grasses.



Left: Fringed Gentian Centre: Marram Grass Right: Hoary Puccoon

A forest patch of Sugar and Black Maple trees mixed with White Cedar is found within the park; a stand type that is not known elsewhere within Eastern Ontario. The pannes between the stable dune ridges are noted to be unique and floristically diverse, having a number of prairie and boreal elements (NHIC, 2012).



Left and Above: Outlet Beach

The beach, bar, and dune ecosites found on the Lake Ontario side are subjected to active shoreline processes; periodic high water levels storm events, wave action, erosion, deposition, ice scour, and extremes in moisture and temperature. As a result of these harsher conditions vegetation is quite sparse and limited mainly to Marram Grass, Wormwood, Eastern Cottonwood, Canada Wild Rye, Wild Grape, Starry False Solomon's Seal, and various beach associated willows, poplars, dogwoods, and cedars (OMNR, 2009).



Above: Sandbanks P.P. highlighted in green

In addition to the beach, bar, and dune ecosites, the park contains meadow marshes (pannes) between the beachfront and the forested backdunes. They were formerly found in the area where the parking lots were constructed in the Outlet sector.



Pannes are flat depressions, primarily dominated by grasses, between sand dunes that have fluctuating water levels; they are arguably the park's most ecologically unique vegetation features. These ecosites support concentrations of rare plant species and because they are fishless ponds, they provide the only natural breeding habitat for many species of dragonflies, including some provincially rare species. (OMNR, 2009).

Sandbanks Provincial Park operates one group campground area on East Lake with two sites; one site accommodating up to 50 people, and the other 30.



Above left: Today the diverse plant community that aids in stabilizing the dunes



Above right: Big Bluestem

f. Fisheries

East Lake is noted to support both warm water and cool water fish species. A Quinte Conservation survey of fish species in 2013 through the use of electrofishing showed a high richness of native fish species, 21 species in total. A high abundance of wetland dependent fish were noted including sunfish (Crappie, Bluegill, Pumpkinseed), piscivores (Northern Pike, Large Mouth Bass, Rock Bass) and perch (Yellow and Log Perch). Data supplied by the Ministry of Natural Resources (Pitt, 2012) indicates that the following species have been found in East Lake; Northern Pike, Smallmouth Bass, Largemouth Bass, Walleye, Lake Herring, White Sucker, Brown Bullhead, American Eel, Pumpkinseed, Bowfin, Bluegill, Rock Bass, Yellow Perch, Longnose Gar, White Perch, Carp, Rosyface Shiner, Pumpkinseed, Yellow Perch, Logperch, Rock Bass, Bluegill, Bluntnose Minnow, and Spottail Shiner.

In 2008 it was confirmed that “an unusual fish” caught by a commercial fisherman in the Fairfields Cove (Cove Beach) area of East Lake was a Spotted Gar. This fish is designated as a threatened species both federally and provincially. The fish was brought to Glenora Fisheries where it was photographed and a tissue sample taken. Subsequently the fish was returned to East Lake.

The Spotted Gar is a provincially and federally threatened species. It is protected under *Ontario’s Endangered Species Act, 2007*, from any harmful actions. The species also has the general protection given by habitat sections of the Fisheries Act. In Ontario, this species of gar has been found at three sites in Lake Erie with one record from the Lake Ontario, Bay of Quinte region, East Lake.

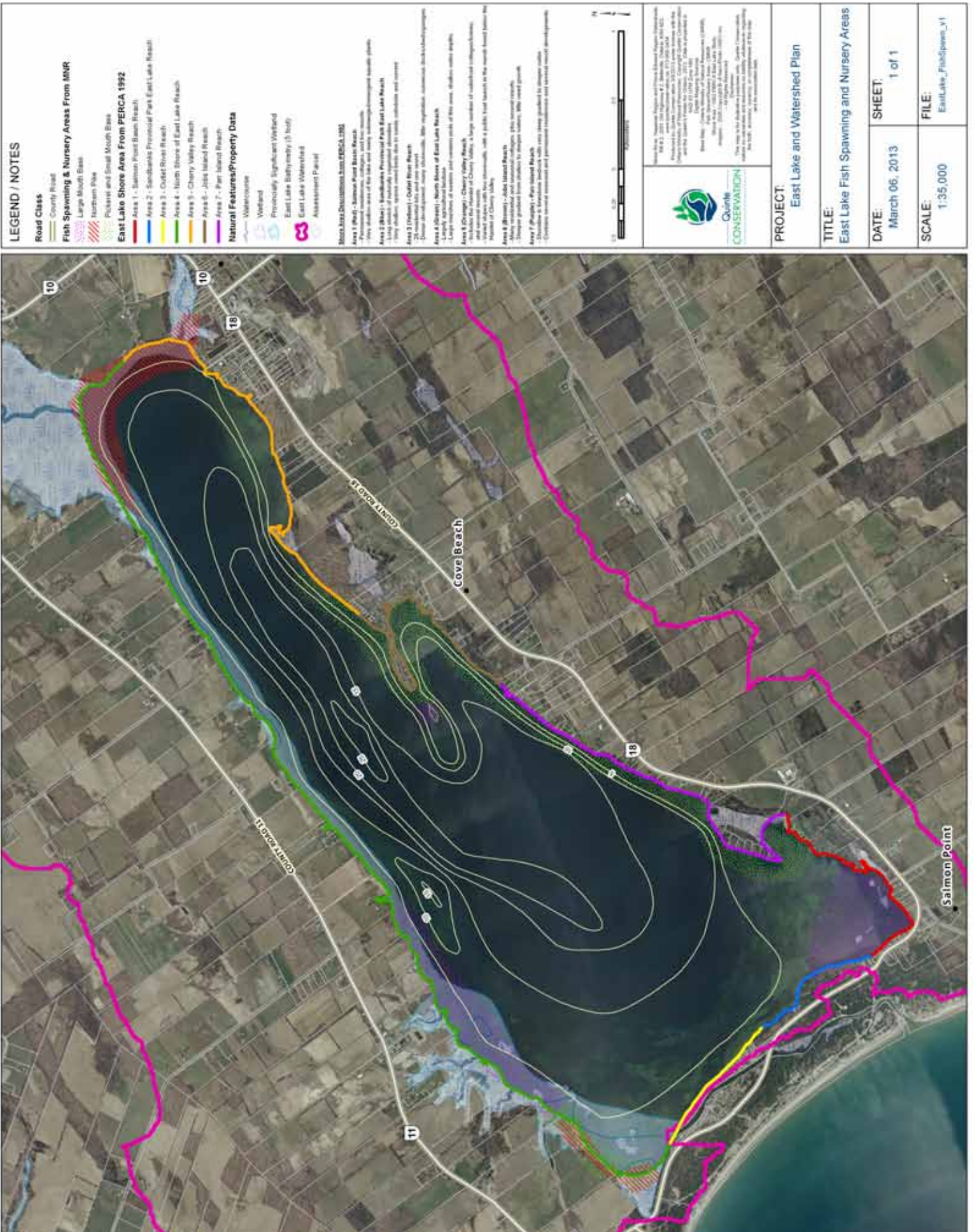


Spotted Gar (Lepisosteus oculatus)
The average length is 2 feet and it is found in shallow, weedy waters with a shorter "beak" than the longnose gar and has black spots on top of the head and beak.

The Spotted Gar is a southern species from Gulf of Mexico and Northern Florida to New Mexico with its most northerly range being the lower Great Lakes. It is a predatory fish that feeds on small fish, such as minnows and yellow perch. This species of fish can grow to over a metre long. Spotted Gar live in quiet waters and backwaters of creeks, rivers and lakes with abundant aquatic vegetation. In the spring, adults move to shallow, heavily vegetated waters to breed.

The fish spawning map on the following page shows spawning and nursery areas for resident and Lake Ontario Walleye and Northern Pike by the Ministry of Natural Resources, in addition to nursing grounds for Small Mouth and Large Mouth Bass, Pumpkinseeds, Bluegills, Crappies, Rock Bass, Brown Bullheads, Yellow Perch, White Perch, and White Bass sport fish (J. D. Paine Engineering, 1989). In particular, spawning of pike, bass and walleye have been noted around Woodrows Creek, Cherry Valley Creek, Outlet Beach Creek, and the south shore of the lake. The lake continues to support local angling pressure and a local commercial fishery (Lands and Forests, 1974).

Map 6. Fish Spawning and Nursery Areas



Common East Lake Fish Species



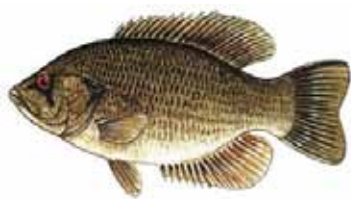
Bluegill (*Lepomis macrochirus*)
 15-22.5 cm long (6-9 inches)
 0.2 kg (0.4 lb)
 Found in warm vegetated waters.



Largemouth Bass
 (*Micropterus salmoides*)
 25-55 cm long (10-22 inches)
 0.68 - 1.8 kg (1.5-4 lb)
 Found in warmer, weedier waters and clear, rocky lakes to shallow, muddy ponds and slow-moving .



Pumpkinseed (*Lepomis gibbosus*)
 18-23 cm long (7-9 inches)
 0.2 kg (0.4 lb)
 Found in cool to warm waters with aquatic vegetation.



Rock Bass (*Ambloplites rupestris*)
 15-20 cm long (6-8 inches)
 0.2 kg (0.4 lb)
 Found in clear and rocky shallows of lakes, preferring cool waters.



American Eel (*Anguilla rostrata*)
 The American Eel spends part of its life in the Great Lakes and the other part in the ocean; a round trip lasting several decades and thousands of kilometres, via the St Lawrence river. The populations have been in decline since the mid 1990s due to human activity. The American Eel is protected under the *Ontario Endangered Species Act*.



Smallmouth Bass
 (*Micropterus dolomieu*)
 25-50 cm long (10-20 inches)
 0.45 -1.58 kg (1.5-4 lb)



Spottail Shiner
 (*Notropis hudsonius*)



Lake Herring (*Clupea*)
 20-30 cm (8-12 inches)
 Found in cold waters from great Lakes to Hudson Bay



Rosyface Shiner
 (*Notropis rubellus*)



Carp (*Cyprinus carpio*)
 30-75 cm long (12-30 inches), 0.2-3.5 kg (0.5-7 lb)
 Introduced from Europe and found in warm, shallow waters that contain an abundance of aquatic vegetation and can tolerate all types of lake bottoms and clear to murky water.



Walleye (*Stizostedion vitreum*)
 35.5-58.4 cm long (14-23 inches)
 0.68 -1.36 kg (1.5 - 3 lb)
 Found in a range of river and lake conditions from cold, clear water to warm and weedy.



Yellow Perch
(Perca flavescens)
 15-30 cm long (6-12 inches)
 0.34 kg (0.75 lb)
 Found in a variety of temperatures and habitats and most numerous in areas with open water and moderate vegetation.



White Perch
(Morone americana)
 15-25 cm long (6-10 inches)



Brown Bullhead
(Ameiurus nebulosus)
 20-36 cm long (8-14 inches)
 Found in warmer, slow moving waters.



Logperch (*Percina caprodes*)
 Average length of 3.5 inches
 Found in gravelly or sandy shallow waters.



Bluntnose Minnow
(Pimephales notatus)



Northern Pike (*Esox lucius*)
 45-75 cm long (18-30 inches), 0.9-4.3 kg (2-9.5 lb)
 Found in weedy, shallow waters ideal for ambushing prey and moves to deeper waters to avoid higher water temperatures in the summer.



Longnose Gar (*Lepisosteus osseus*)
 Commonly grows to a length of 3 feet and occasionally 4 feet.
 Found in shallow, weedy bays often laying just below the surface motionless waiting for prey.



Bowfin (*Amia calva amiidae*)
 46-61 cm long (18-24 inches)
 Found in shallow and warm weedy bays, inlets and lagoons.



White Sucker (*Catostomus commersonii*)
 30-50 cm (12-20 inches)
 Found in warm, shallow waters and tributary rivers.

g. Species at Risk

Based on information available from the Ministry of Natural Resources (Pitt, 2012; Brdar, 2012; and Bree, 2012), the following species at risk are known to occur within the East Lake watershed: Blanding's Turtle, Eastern Musk Turtle, Northern Map Turtle, Snapping Turtle, Eastern Hog-nosed Snake, Milksnake, Western Chorus Frog, Least Bittern, Barn Swallow, Black Tern, Red-Headed Wood Pecker, Bobolink, Little Brown Bat, Pugnose Shiner, Lake Sturgeon, Pugnose Shiner, Bridle Shiner, Spotted Gar and Monarch Butterfly.

In addition, the following rare plants have been noted in the area; Swamp Rose Mallow, Narrow Leaved Water-plantain, Marram Grass, Long-leaved Reed Canary Grass, Bugseed, Ram's Head Lady Slipper, Plains Puccoon, Low Nutrush, Big Bluestem, Little Bluestem, and Gray-stemmed Goldenrod (OMNR, 2009).



Photo by Jeremy Patenaude **Black Tern** - Special Concern due to wetland drainage and alteration, water pollution and human disturbance of nesting colonies (boat traffic swamping their floating nests).



Photo by Paul O'Toole
Least Bittern - Threatened due to habitat loss as wetlands decrease in size due to development, farmland expansion and human recreation.



Lake Sturgeon - Special Concern due to overexploitation in the later half of the 19th century. Overharvesting for meat and caviar, construction of dams which disrupt habitat and interrupt spawning movements and timing, habitat degradation due to human activities, pollution and exotic invasives impact this species.



Milksnake - Special Concern primarily due to human persecution.

What are Species at Risk?

The populations of more than 190 species in Ontario are in decline. These are species that are at risk of disappearing from the province. Their populations are in decline due to a number of reasons including habitat loss, pollution, land use, and resource management activities, as well as the spread of invasive species.

Ontario Ministry of Natural Resources Species at Risk Status

Extirpated A species that no longer exists in the wild in Ontario but still occurs elsewhere.

Endangered A species facing imminent extinction or extirpation in Ontario.

Threatened A species that is at risk of becoming endangered in Ontario if limiting factors are not reversed.

Special Concern A species with characteristics that make it sensitive to human activities or natural events.



Northern Map Turtle - *Special Concern due to habitat degradation (increased shoreline development and decline in habitat quality), increased human disturbance, and invasion of zebra mussels causing declines in their food sources.*



Eastern Musk Turtle - *Special Concern due to mortality of adults and young from recreational boaters and habitat loss due to development and shoreline degradation.*



Blanding's Turtle - *Endangered due to habitat loss, road mortality (often egg laying females), and predation of eggs.*



Western Chorus Frog - *Threatened due to loss of habitat.*



Eastern Hog-nose Snake - *Threatened due to habitat loss, road mortality, persecution by humans, and poaching.*



Monarch - *Special Concern due to habitat loss.*

h. Invasive Species

Invasive species, also called "exotics", are species from other areas of the world that move outside of their native habitat. Not all exotic species are harmful but when they threaten the natural environment, economy or society they become known as invasive species.

Invasive species are not naturally occurring in local ecosystems and therefore they can have drastic effects on ecosystem balance and local biodiversity (the variety of plant and animal species) when introduced. Invasive species may disrupt food webs, alter and degrade habitat, introduce parasites and disease, and lead to species at risk by pushing out native species of which share the same habitat. Invasive species are the second biggest threat to biodiversity with habitat loss being the first.

In 2013 Quinte Conservation noted a number of invasive species while surveying the lake, species included Common Reed (*Phragmites*), *Decodon verticillatus*, Dodder, Purple Loosestrife, European Frogbit, Curly Pondweed, Eurasian watermilfoil, and Mute Swan. Invasive species have also been documented within the Sandbanks Provincial Park, including the Outlet Beach portion and thus would likely be found in pockets of the entire watershed. Dog Strangling Vine, Himalayan Balsam, European Buckthorn, Scots Pine, Mute Swan, and Round Goby have all been documented within Sandbanks Provincial Park (Brdar, 2012).

In addition, invasive plant species identified in Ontario, not specifically East Lake, may also reside in the East Lake watershed (Ontario Invasive Plant Council).

Terrestrial:

Garlic Mustard (*Alliaria petiolata*)
Manitoba Maple (*Acer negundo*)
Norway Maple (*Acer plantanoides*)
European or Black Alder (*Alnus glutinosa*)
European Spindletree (*Euonymus europaeus*)
Non-native bush honeysuckles (*Lonicers spp.*)
Goutweed (*Aegopodium podagraria*)
Periwinkle (*Vinca minor*)
Giant Hogweed (*Heracleum mantegazzianum*)
English Ivy (*Hedera helix*)
Japanese Knotweed (*Polygonum cuspidatum*)
Reed or Giant Manna Grass (*Glyceria maxima*)
Common Reed (*Phragmites australis*) *



Purple Loosestrife



European Buckthorn

Aquatic:

Purple Loosestrife (*Lythrum salicaria*) *
Eurasian Water Milfoil (*Myriophyllum spicatum*) *
European Frog-bit (*Hydrocharis morus-ranae*) *
Yellow Iris (*Iris pseudacorus*)
Flowering Rush (*Butomus umbellatus*)
Phragmites (*Phragmites australis*)
Brazilian Waterweed (*Egeria densa*)
Curly-Leaved Pondweed (*Potamogeton crispus*) *
European Lake Sedge (*Carex acutiformis*)
European Water Chestnut (*Trapa natans*)
Fanwort (*Cabomba caroliniana*)
Hydrilla (*Hydrilla verticillata*)
Parrotfeather (*Myriophyllum aquaticum*)
Water Hyacinth (*Eichhornia crassipes*)
Water Lettuce (*Pistia stratiotes*)
Watermoss-Salvinia species (*Salvinia molesta*, *S. auriculata*, *S. minima*, *S. natans*)
Water Soldier (*Stratiotes aloides*)

* identified in East Lake during 2013 lake surveys

Potential Threats

According to the Ontario Ministry of Natural Resources, as of 2009, 186 non-native species were present in the Great Lake Basin. The following species are some that have been identified by the Ontario Invading Species Awareness Program as threats in Ontario, and therefore potential threats to East Lake Watershed.

Fish

Asian Carp
Goldfish
Northern Snakehead
Rainbow Smelt
Round Goby
Rudd
Sea Lamprey
Tench
Tubenose Goby

Fish Parasites and Disease

Asian fish tapeworm parasite
Koi herpesvirus

Invertebrates

Bloody Red Shrimp
Spiny and Fish Hook Water Flea
Rusty Crayfish
Zebra and Quagga Mussels

Forest Pests

Asian Long-horned Beetle
Emerald Ash Borer
Gypsy Moth
Invasive Earthworms
Mountain Pine Beetle

Pathogens

Beech Bark Disease
Butternut Canker
Dutch Elm Disease
Oak Witt
Sudden Oak Death



Above: Garlic Mustard

Right: Phragmites is causing damage to Ontario's biodiversity, wetlands and beaches. It is a perennial grass native to Eurasia. It spreads quickly and out-competes native species for water and nutrients. It grows in extremely dense stands and can reach heights of five metres. Toxins released from its roots hinder growth of surrounding vegetation. It is often found growing in areas of standing water but can survive in relatively dry areas. It provides poor food supply and habitat for wildlife. It also increases fire hazards, can affect agriculture and impact recreational activities such as swimming, boating and angling.



You can help stop the spread of invasive species.

Around Your Home:

- Garden with native plants. Many invasive species have been introduced as ornamental flowers in gardens.
- Learn, identify, and manage invasive plants on your property.
- Don't release pets (fish, amphibians, and reptiles) into the wild.



Above: A naturalized shoreline garden

When Going Camping:

- Don't transport firewood.
- Always buy firewood locally and leave behind what you don't use.

When Going Fishing:

- Don't empty your bait bucket in or near water.

When Going Boating:

- Wash your boat before you move to another lake or river.

When Going Hiking:

- Clean visible mud, plants, and seeds from your boots and other equipment.

For More Information on Invasive Species

- Ontario Invasive Species Council www.ontarioinvasiveplants.ca
- Ontario Federation of Anglers and Hunters www.mnr.gov.on.ca
- The Invading Species Hotline 1-800-563-7711



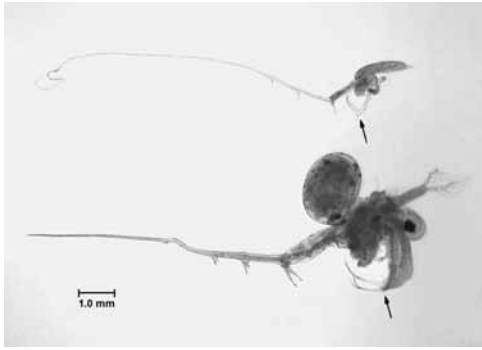
Above Left: Dog Strangling Vine is found in dry to moist soils; more dominant in meadows and woodland edges.



Above Centre: Round Goby has successfully spread through all five Great Lakes and has begun to invade inland waters.

Right: Mute Swan are large, aggressive birds that outcompete native waterfowl for food and nesting sites.





The **Spiny Waterflea** (*Bythotrephes longimanus*) first arrived in Lake Ontario in 1982 and has now invaded all of the Great Lakes. The Spiny Waterflea is believed to be spread by anchors and fishing lines. This species feeds on zooplankton, reducing the abundance of native zooplankton, consumed by a variety of native fish species. The population grows so quickly that natural predators cannot keep the populations stable. Native fish don't feed on it due to a long barb-like tail spine that runs down its body. It is affecting

fish populations in the Great Lakes. Cleaning of recreational boats and recreational equipment may help slow the spread of this species.



Rainbow Smelt (*Osmerus mordax*)

Rainbow Smelt disrupt local food webs. The introduction of Rainbow Smelt in Ontario Lakes has led to decreased Yellow Perch, Walleye, Lake Herring, Whitefish and Lake Trout populations. Never use Rainbow Smelt as bait, never release live fish into Ontario's lakes, rivers and streams. When cleaning smelt don't dump entrails into a lake or river.



Above: Zebra Mussels attached to the bottom of a fishing boat.



Eurasian Water-Milfoil (*Myriophyllum spicatum*)

Eurasian water-milfoil is an invasive aquatic species native to Europe, Asia and northern Africa. It prefers shallow waters, and can form dense underwater mats that can shade other aquatic plants. When the plant dies off, the decaying plants can reduce oxygen levels in the water. Because tiny plant pieces can develop into new plants, Eurasian water-milfoil is easily spread when water currents, boat propellers, trailers or fishing gear carry plant fragments to new areas.

i. East Lake Birds

In January 2013 an inventory of bird species found in East Lake was compiled. A total of 239 species were identified from the records "The Birds of Prince Edward County" by Terry Sprague and Ron D. Weir (1984), and from the files of Terry Sprague. All species have been confirmed. A bird checklist for East Lake can be found in Appendix 2.

Quinte Conservation field surveys in the summer of 2013 noted the Least Bittern, a sensitive species was present. Two focal marsh-nesting obligate birds were present, American Bittern and Pied-billed Grebe. Black Terns and Mute Swans were also noted on the lake.

8. Land Use Controls and Regulations

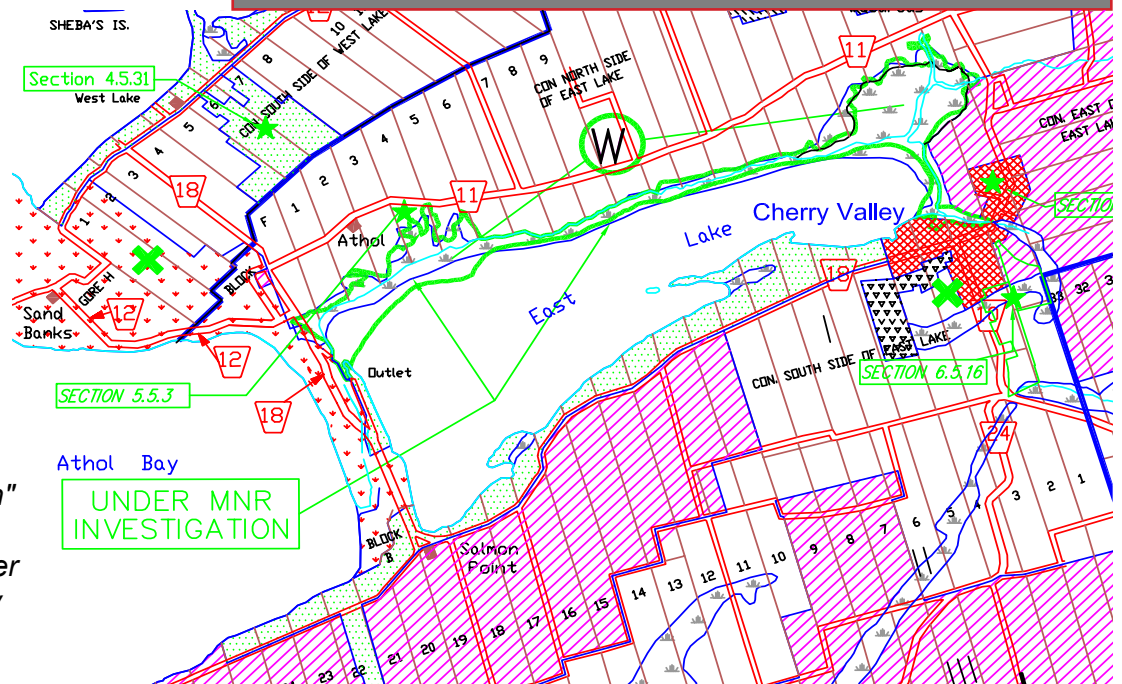
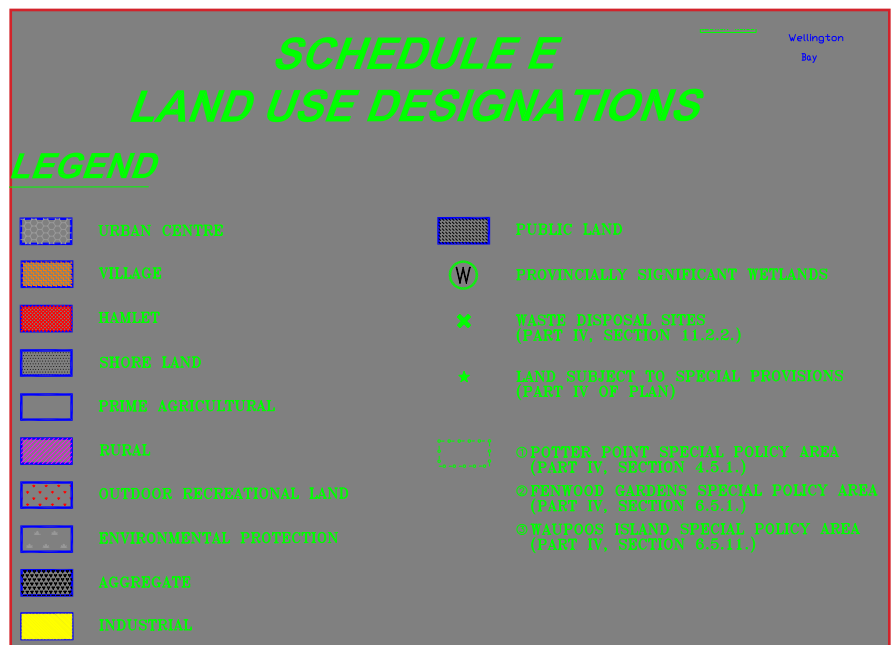
a. County Official Plan

The Official Plan (OP) is a municipal land-use planning document that provides guidance for the physical development of the municipality while having regard for social, economic and environmental matters. It is prepared with input from the community and helps to ensure that future planning and development will meet the specific needs of the community. Once an official plan is in effect, it guides all of the municipality's planning decisions.

The current Prince Edward County Official Plan was adopted in 1993, and approved in 1998, and has been consolidated and in use since then.

As illustrated in the images to the right and below (a portion of Schedule E Land Use Designations from the Prince Edward County Official Plan) the lands around East Lake are comprised of six land use designations.

1. Provincially Significant Wetland
2. Prime Agriculture
3. Shorelands
4. Hamlet
5. Rural
6. Outdoor Recreational Land



* "Under MNR Investigation" was referring to a study of the north shore wetland, later designated as a Provincially Significant Wetland (PSW).

Some of the key policies and concepts in the current official plan include:

Section 2.1.3 - In the future, Prince Edward County will be a tranquil and beautiful place to live and visit. It will be unique from most parts of the Province because of its combination of natural beauty, heritage and rural charm. These special attractions will have been properly preserved and enhanced over the years by the people of Prince Edward County. (Policy 2.1.3)

Section 2.2.1 - As a result of environmental awareness and the desire for linking economic growth with environmental sustainability, the management and preservation of the County's natural resources will play a prominent role in the evolution of the community. (Policy 2.2.1)

Section 2.2.2 - Important wetlands, floodplains, areas of natural and scientific interest, fisheries and wildlife habitat, agricultural land, aggregate reserves, valleys, cliffs, escarpments and woodlands will be managed and protected since these natural constraints, resources and attractions are an important part of what makes the County special and unique. (Policy, 2.2.2)

Section 2.4.10 - Settlement in the rural areas will maintain the quality, diversity and character of the rural landscape, will be directed away from agricultural and aggregate areas and will not create an overcrowded and suburbanized countryside. (pg. 13, Item 2.4.10)

Section 1.1.2 - In planning to protect and manage environmental resources, the County will apply the ecosystem approach, which takes into account an area's relationship to the surrounding environment and its links with other resources. The ecosystem approach recognizes the reliance of communities in Prince Edward County and all aspects of the County's economy – agriculture, tourism, and business – on a healthy environment including clean air, land and water, renewable and non-renewable resources and natural areas and wildlife. The environmental features are also an essential component of the County's landscape and identity, providing an important "sense of place" to residents and visitors. (Policy 1.1.2)

Section 1.1.3 - Council will encourage the participation and cooperation of other public authorities, private individuals and organizations in protecting and restoring the environmental resources in the County. The integrity of the County's natural ecosystem needs to be maintained by preventing unacceptable levels of pollution of the air, land, surface and ground water. In this regard, Council recognizes that the Official Plan alone cannot guarantee the environmental health of the community, that private stewardship of land, incentive programs, and community based actions, and public education will go even further in the proper management of the environment. (pg. 18, Item 1.1.3)

Section 1.2.1 - All waterbodies in Prince Edward County, including the Bay of Quinte, Lake Ontario, inland lakes and creeks contain significant fisheries habitat, including important spawning, nursery and feeding areas. The near shore areas, nursery habitat and water quality of these waterbodies must be protected and managed to assist in ensuring the long-range health of the fish population. A healthy fish population is important to local fishermen who rely on the fish for a source of income, and to the tourist and service industry which caters to recreational fishermen. (pg. 19, Item 1.2.1 c)

Section 1.4.1 - The inland lakes of Prince Edward County have impaired water quality, which affects their recreational and aesthetic attributes. These lakes will continue to be subject to further pressures for residential, recreational and commercial developments. Shoreland Management Plans may be undertaken for the inland lakes in the County to provide for more specific land use policies and designations related to future shoreland development; protection of environmentally sensitive areas and consideration of other tourism, recreational, agricultural; and other land uses within each lake shoreland. (pg. 22, Item 1.4.1)

Section 3.14 - Shoreland management plans set development capacities for inland lakes to prevent ecological impairment. These should be developed in consultation with municipalities adjacent to the same lake system, the local Conservation Authority, government agencies, and the affected public. In setting the acceptable level of development, the shoreland management plan should account for existing and future environmental and social issues. (pg. 6, Item 3.14)

Section 4.1.3 - It is the intent of the County to protect the shore land from development that would compromise its environmental and ecological integrity. Residential and commercial development should be sensitively designed and located to enhance and protect the shoreline resources and should avoid crowding of buildings, the removal of earth and vegetation and the pollution of surface and subsurface waters. (pg. 81, Item 4.1.3)

Section 1.4.7 - A Watershed Plan may be prepared to provide further input into the remediation and protection of the inland lakes of the County and other shoreline water bodies. (pg. 23, Item 1.4.7)

Section 1.4.4 - The Shoreland Management Plan will provide an inventory of fishery and wildlife habitat, vegetation, and shoreline uses, erosion and flooding areas, surface water quality and factors contributing to environmental degradation in the watershed. The Shoreland Management Plan shall provide policies and designations for each of these lakes to ensure environmental protection, public access, and appropriate land use types and density. The policies and designations resulting from the recommendations of each Shoreland Management Plan will be incorporated into this Plan by way of amendment. (Policy 1.4.4)

b. County Land Use Zoning

Prince Edward County regulates land use and the location and construction of new buildings and structures through Comprehensive Zoning By-law 1816-2006, which has been in place since October 23, 2006.

Zoning by-laws must conform to the policies of the official plan and be consistent with the Provincial Policy Statement (2005). Zoning by-laws provide specific classes of land use and associated standards (e.g. setbacks) to ensure that new construction or changes to existing land uses are undertaken with regard for safety, privacy and the peaceful enjoyment of neighbouring land uses and the protection of ratepayers from undue expenses related to development.

A building permit is required for all buildings and structures over 10 sq. m. (108 sq ft). Before proceeding with any development activity, the building department should be consulted. All development, including some activities that do not require a building permit, must conform to the requirements of the zoning by-law.

Each zone provides different standards for lot frontage, area, lot coverage and setbacks. The setback from lakes or creeks for any development is either 30 m from the High Water Mark, or 15 m from the Regulatory Flood Plain, where it is known.

Figure 5 provides a list of the zone requirements (lot frontage, lot area, setbacks) for each shoreline lot. Many lots were created before these zoning requirements were put in place and are recognized as existing undersized lots (section 4.6 of the By-law) which permits existing development.

Figure 5 - Zoning By-Law Requirements

	Lot Frontage (m)	Lot Area (ha)	Lot Coverage (%)	Front Yard (street) (m)	Setback Lakes /creeks (m)
Rural					
RU1	60	10	10	15	15 / 30 ^a
RU2	75	20	10	15	15 / 30 ^a
RU3	90	24	10	15	15 / 30 ^a
Residential					
HR - Hamlet ^{***}	30	0.4	15	6	15 / 30 ^a
RR1 - Rural	44.8	0.38	15	15	15 / 30 ^a
RR2 - Rural	60	0.8	15	15	15 / 30 ^a
LSR - Limited Services	45	0.4	15	7.5	15 / 30 ^a
MHR - Mobile Home	10	4.0	25	15	15 / 30 ^a
Commercial					
TC - Tourist	60	0.8	15	30	15 / 30 ^a
TPC - Trailer Park	100	4.0	15	25	15 / 30 ^a
HC - Highway	60	0.8	30	15	15 / 30 ^a
Industrial					
IR -	60	8	25	15	15 / 30 ^a
^a 15m from regulatory flood plain(RFP), or 30m from HWM where RFP is unknown.(4.25 2/.3/4)					
^{***} for Cherry Valley only					

c. Conservation Authority Shoreline and Flood Regulations

All Conservation Authorities have Development, Interference with Wetlands, Alteration to Shorelines & Watercourses Regulations which require Conservation Authorities to regulate development, such as construction, filling, and site grading and other activities in or adjacent to any watercourse, river or stream valleys, Great Lake and inland lake shorelines, wetlands, and other hazardous lands. Hazardous lands include unstable slopes, other flood prone areas, or areas of unstable bedrock. Development taking place on these lands requires permission from the Conservation Authority.

Activities that fall under the review of the Conservation Authority permit application process include:

- the construction, reconstruction, erection or placing of a building or structure of any kind;
- any change to a building or structure that would have the effect of altering the use or potential use of the building or structure, increasing the size of the building or structure or increasing the number of dwelling units in the building or structure;
- site grading, or the temporary or permanent placing, dumping or removal of any material, originating on the site or elsewhere; and
- the straightening, changing, diverting or interfering in any way with the existing channel of a river, creek, stream, watercourse or for changing or interfering in any way with a wetland.

There are setbacks from watercourses, wetlands, and shorelines for new development, such as buildings & sewage systems. It is general Conservation Authority policy to require that new development be at least 15 metres from the 1:100 year floodplain, or 30 metres from a Provincially Significant Wetland.

Setbacks may be increased for unstable slopes, and Municipalities may require a greater setback than the Authority.

The purpose of the setback is to provide a margin of error in the floodplain mapping, to provide access during a flood, to provide for wave uprush and ice push, and to assist in reducing pollution loading of our watercourses.



Photo by Linda Cole



Photo by Linda Cole



Photos by Barbara Wyatt
(above, below, left)



Photo by Linda Cole



Photo by Fred Lester

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APPENDIX 1 BIRDS – Beaver Meadow Wildlife Area

DUCKS, GEESE & SWANS

- _ Snow Goose
- _ Canada Goose
- _ Mute Swan
- _ Trumpeter Swan
- _ Tundra Swan
- _ Wood Duck
- _ Gadwall
- _ American Wigeon
- _ American Black Duck
- _ Mallard
- _ Blue-winged Teal
- _ Green-winged Teal
- _ Canvasback
- _ Redhead
- _ Ring-necked Duck
- _ Bufflehead
- _ Common Goldeneye
- _ Hooded Merganser
- _ Common Merganser

GROUSE & TURKEYS

- _ Ruffed Grouse
- _ Wild Turkey

LOONS

- _ Common Loon

GREBES

- _ Pied-billed Grebe

HERONS & BITTERNS

- _ American Bittern
- _ Least Bittern
- _ Great Blue Heron
- _ Great Egret
- _ Green Heron

VULTURES

- _ Turkey Vulture

HAWKS & EAGLES

- _ Osprey
- _ Bald Eagle
- _ Northern Harrier
- _ Sharp-shinned Hawk
- _ Cooper's Hawk
- _ Red-tailed Hawk

FALCONS

- _ American Kestrel

- _ Merlin

RAILS, GALLINULES & COOTS

- _ Virginia Rail
- _ Sora
- _ Common Moorhen (Gallinule)
- _ American Coot

CRANES

- _ Sandhill Crane

PLOVERS

- _ Killdeer

SANDPIPERS & PHALAROPES

- _ Greater Yellowlegs
- _ Lesser Yellowlegs
- _ Spotted Sandpiper
- _ Semipalmated Sandpiper
- _ Wilson's Snipe
- _ American Woodcock

JAEGERS, GULLS & TERNS

- _ Ring-billed Gull
- _ Caspian Tern
- _ Black Tern

PIGEONS & DOVES

- _ Mourning Dove

CUCKOOS

- _ Black-billed Cuckoo

TYPICAL OWLS

- _ Eastern Screech-Owl
- _ Great Horned Owl
- _ Barred Owl

GOATSUCKERS

- _ Common Nighthawk

SWIFTS

- _ Chimney Swift

HUMMINGBIRDS

- _ Ruby-throated Hummingbird

KINGFISHERS

- _ Belted Kingfisher

WOODPECKERS

- _ Red-headed Woodpecker
- _ Red-bellied Woodpecker
- _ Yellow-bellied Sapsucker
- _ Downy Woodpecker
- _ Hairy Woodpecker
- _ Northern Flicker
- _ Pileated Woodpecker

TYRANT FLYCATCHERS

- _ Eastern Wood-Pewee
- _ Alder Flycatcher
- _ Willow Flycatcher
- _ Least Flycatcher
- _ Eastern Phoebe
- _ Great Crested Flycatcher

- _ Western Kingbird

- _ Eastern Kingbird

SHRIKES

- _ Northern Shrike

VIREOS

- _ Blue-headed Vireo
- _ Warbling Vireo
- _ Red-eyed Vireo

CROWS & JAYS

- _ Blue Jay
- _ American Crow
- _ Common Raven

LARKS

- _ Horned Lark

SWALLOWS

- _ Purple Martin
- _ Tree Swallow
- _ Northern Rough-winged Swallow
- _ Bank Swallow
- _ Barn Swallow

CHICKADEES/TITMICE

- _ Black-capped Chickadee

NUTHATCHES

- _ Red-breasted Nuthatch
- _ White-breasted Nuthatch

CREEPERS

- _ Brown Creeper

WRENS

- _ House Wren
- _ Marsh Wren

KINGLETS

- _ Golden-crowned Kinglet
- _ Ruby-crowned Kinglet

GNATCATCHERS

- _ Blue-gray Gnatcatcher

THRUSHES

- _ Eastern Bluebird
- _ Veery
- _ Swainson's Thrush
- _ Hermit Thrush
- _ Wood Thrush
- _ American Robin

MOCKINGBIRDS & THRASHERS

- _ Gray Catbird
- _ Brown Thrasher

STARLINGS

_ European Starling

PIPITS

_ American Pipit

WAXWINGS

_ Cedar Waxwing

WOOD-WARBLERS

_ Nashville Warbler
 _ Yellow Warbler
 _ Chestnut-sided Warbler
 _ Magnolia Warbler
 _ Black-throated Blue Warbler
 _ Yellow-rumped Warbler
 _ Black-throated Green Warbler
 _ Blackburnian Warbler
 _ Pine Warbler
 _ Palm Warbler
 _ Bay-breasted Warbler
 _ Black-and-white Warbler
 _ American Redstart
 _ Ovenbird
 _ Northern Waterthrush

_ Mourning Warbler
 _ Common Yellowthroat
 _ Wilson's Warbler

TANAGERS

_ Scarlet Tanager

EMBERIZIDS

_ Eastern Towhee
 _ American Tree Sparrow
 _ Chipping Sparrow
 _ Vesper Sparrow
 _ Savannah Sparrow
 _ Song Sparrow
 _ Swamp Sparrow
 _ White-throated Sparrow
 _ White-crowned Sparrow
 _ Dark-eyed Junco
 _ Snow Bunting

CARDINALS & ALLIES

_ Northern Cardinal
 _ Rose-breasted Grosbeak
 _ Blue Grosbeak
 _ Indigo Bunting

_ Painted Bunting (2004)
 _ Dickcissel

BLACKBIRDS

_ Bobolink
 _ Red-winged Blackbird
 _ Eastern Meadowlark
 _ Rusty Blackbird
 _ Common Grackle
 _ Brown-headed Cowbird
 _ Baltimore Oriole

FINCHES

_ Purple Finch
 _ Common Redpoll
 _ Pine Siskin
 _ American Goldfinch
 _ Evening Grosbeak

OLD WORLD SPARROWS

_ House Sparrow

FISH – Beaver Meadow Wildlife Management Area**Common Name****CENTRARCHIDAE** (Sunfish Family)

Pumpkinseed Sunfish
 Bluegill Sunfish

Scientific Name

Lepomis gibbosus
Lepomis macrochirus

CYPRINIDAE (Minnow, Carp Family)

Goldfish
 Northern Redbelly Dace
 Golden Shiner
 Roseyface Shiner
 Creek Chub

Carassius auratus
Chrosomus eos
Netemigonus crysoleucas
Naropis rubellus
Semotilus atromaculatus

ICTALURIDAE (Catfish Family)

Black Bullhead
 Yellow Bullhead

Ictalurus melas
Ictalurus natalis

UMBRIDAE (Mudminnow Family)

Central Mudminnow

Umbra limi

MAMMALS – Beaver Meadow Wildlife Management Area

Coyote
 White-tailed Deer
 Muskrat
 Raccoon
 Gray Squirrel
 Eastern Cottontail
 Eastern Chipmunk
 Red Squirrel

Canis latrans
Odocoileus virginianus
Ondatra zibethica
Procyon lotor
Sciurus carolinensis
Sylvilagus floridanus
Tamias striatus
Tamiasciurus hudsonicus

FUNGI – Beaver Meadow Wildlife Management Area

Common Name

Scientific Name

AGARICACEAE (Gill Fungi)

Green Gill
Two-toned Scalecap

Chlorophyllum molybdites
Pholiota mutabilis

AMANITACEAE (Deathcaps, Grisettes and Slime Mushrooms)

Jeweled Deathcap
Destroying Angel

Amanita gemmata
Amanita virosa

AURICULARIACEAE (Jelly Fungi)

Witches' Butter

Tremella mesenterica

BOLETACEAE (Boletes)

Question Bolete
Wooly Cap
Birch Scaberstalk
King Bolete
Bitter Bolete

Tylopilus indecicus
Suillus tomentosus
Leccinum scabrum
Boletus edulis
Tylopilus felleus

CLAVARIACEAE (Coral Fungi)

Crown Coral

Clavaria purpurea

HERPTILES – Beaver Meadow Wildlife Management Area

Common Name

Scientific Name

SNAKES

COLUBRIDAE (Colubrid Snake Family)

Common Garter Snake
Northern Watersnake

Thamophis sirtalis
Nerodia sipedon

TURTLES

EMYDIDAE (Pond, Marsh and Box Turtle Family)

Blanding's Turtle
Eastern Painted Turtle

Emcloidea blandingi
Chrysemys picta

CHELYDRIDAE (Snapping Turtle Family)

Common Snapping Turtle

Chelydra serpentina

TOADS AND FROGS

RANIDAE (True Frog Family)

Bullfrog
Green Frog
Northern Leopard Frog

Rana catesbelana
Rana clamitans
Rana pipiens

BUFONIDAE (Toad Family)

American Toad

Bufo americanus

HYLIDAE (Treefrog Family)

Common Grey Treefrog
Spring Peeper

Hyla versicolor
Hyla crucifer

SALAMANDERS

PLETHODONTIDAE (Lungless Salamander Family)

Red-backed Salamander

Plethodon cinereus

AMBYSTOMIDAE (Mole Salamander)

Blue-spotted Salamander

Ambystoma laterale

INSECTS AND SPIDERS – Beaver Meadow Wildlife Management Area

INSECTS

Anopheles Mosquito
Ant
Aphid
Blackfly
Blue Damselfly
Bumblebee
Cabbage Butterfly
Carrion Beetle
Centipede
Common Wasp
Cricket
Deer Fly
Eastern Tent Caterpillar
Eastern Tiger Swallowtail
European Earwig
Eyed Elator
Giant Dragon Fly
Green Darner Damselfly
Gypsy Moth
Honey Bee
Horse Fly
House Fly
Leaf Hopper
Little Wood Satyr
Maple Spindlegal Mite
Monarch Butterfly
Mourning Cloak
Phantom Crane Fly
Red Admiral
Seven spotted Ladybird
Six Spotted Tiger Beetle
Spring Azure
Stag Beetle
Whirligig Beetle

Anopheles sp.
Family Formicidae
Family Eriosomatidae
Family Simuliidae
Calopteryx virgo
Subfamily Culicinae
Pieris rapae
Nicrophorus marginatus
Class Chilopoda
Paravespula septempunctata
Order Orthoptera
Chrysops sp.
Malacoma americanum
Papilio glaucus
Family Lucanidae
Alaus oculatus
Anax imperator
Anax junius
Lymantria dispar
Apis mellifera
Haematopoda convergens
Family Cicadellidae
Class Chilopoda
Euptycia cymela
Vasatesacerus crummena
Danaus plexippus
Nymphalis atalanta
Ptychoptera sp.
Vanessa atalanta
Hippodamia convergens
Cicindela sexguttata
Lycaenopsis argiolus
Family Lucanidae
Gyinius natator

SPIDERS

Black and Yellow Argiope
Daddy-long Legs
Flower Spider
Jumping Spider
Velvet Mite
Water Mite

Argiope Aurantia
Order Phalangida
Misumana vatia
Phidippus clarus
Trombidium sp.
Limrochares americana

APPENDIX 2 East Lake Watershed Bird Inventory

East Lake Watershed Checklist of Birds (January, 2013)

The following checklist comprises all of the bird species (**239**) that have been recorded within the East Lake watershed. The list was compiled from the records *The Birds of Prince Edward County* by R. Terry Sprague and Ron D. Weir (1984), and from the files of Terry Sprague. All listed species have been confirmed.

DUCKS, GEESE & SWANS

- _ Greater White-fronted Goose
- _ Snow Goose
- _ Canada Goose
- _ Brant
- _ Mute Swan
- _ Trumpeter Swan
- _ Tundra Swan
- _ Wood Duck
- _ Gadwall
- _ American Wigeon
- _ American Black Duck
- _ Mallard
- _ Blue-winged Teal
- _ Northern Shoveler
- _ Northern Pintail
- _ Green-winged Teal
- _ Canvasback
- _ Redhead
- _ Ring-necked Duck
- _ Greater Scaup
- _ Lesser Scaup
- _ Long-tailed Duck
- _ Bufflehead
- _ Common Goldeneye
- _ Hooded Merganser
- _ Common Merganser
- _ Red-breasted Merganser

GROUSE & TURKEYS

- _ Ring-necked Pheasant
- _ Ruffed Grouse
- _ Wild Turkey

LOONS

- _ Red-throated Loon
- _ Common Loon

GREBES

- _ Pied-billed Grebe
- _ Horned Grebe

PELICANS

- _ American White Pelican
- _ Brown Pelican

CORMORANTS

- _ Double-crested Cormorant

HERONS & BITTERNS

- _ American Bittern
- _ Least Bittern
- _ Great Blue Heron
- _ Great Egret
- _ Cattle Egret

- _ Green Heron
- _ Black-crowned Night-Heron
- _ Yellow-crowned Night Heron (June 30/08)

VULTURES

- _ Turkey Vulture

HAWKS & EAGLES

- _ Osprey
- _ Bald Eagle
- _ Northern Harrier
- _ Sharp-shinned Hawk
- _ Cooper's Hawk
- _ Northern Goshawk
- _ Red-shouldered Hawk
- _ Broad-winged Hawk
- _ Red-tailed Hawk
- _ Rough-legged Hawk
- _ Golden Eagle

FALCONS

- _ American Kestrel
- _ Merlin
- _ Peregrine Falcon

RAILS, GALLINULES & COOTS

- _ Virginia Rail
- _ Sora
- _ Common Gallinule
- _ American Coot

CRANES

- _ Sandhill Crane

PLOVERS

- _ Black-bellied Plover
- _ American Golden-Plover
- _ Semipalmated Plover
- _ Piping Plover
- _ Killdeer

SANDPIPERS & PHALAROPES

- _ Greater Yellowlegs
- _ Lesser Yellowlegs
- _ Solitary Sandpiper
- _ Willet
- _ Spotted Sandpiper
- _ Upland Sandpiper
- _ Whimbrel
- _ Sanderling
- _ Semipalmated Sandpiper
- _ Least Sandpiper
- _ White-rumped Sandpiper
- _ Baird's Sandpiper
- _ Pectoral Sandpiper



Pied-billed Grebe
Photo by Derek Dafoe



Black-capped Chickadee



Pileated Woodpecker



Bald Eagle
Photo by Ian Dickinson

- _ Dunlin
- _ Short-billed Dowitcher
- _ Wilson's Snipe
- _ American Woodcock
- _ Wilson's Phalarope

JAEGERS, GULLS & TERNS

- _ Little Gull
- _ Bonaparte's Gull
- _ Ring-billed Gull
- _ Herring Gull
- _ Great Black-backed Gull
- _ Caspian Tern
- _ Common Tern
- _ Black Tern

PIGEONS & DOVES

- _ Rock Pigeon
- _ Mourning Dove
- _ Passenger Pigeon (Extinct)

CUCKOOS

- _ Black-billed Cuckoo
- _ Yellow-billed Cuckoo

TYPICAL OWLS

- _ Eastern Screech-Owl
- _ Great Horned Owl
- _ Snowy Owl
- _ Barred Owl
- _ Great Gray Owl
- _ Long-eared Owl
- _ Short-eared Owl
- _ Northern Saw-whet Owl

GOATSUCKERS

- _ Common Nighthawk
- _ Whip-poor-will

SWIFTS

- _ Chimney Swift

HUMMINGBIRDS

- _ Ruby-throated Hummingbird
- _ Rufous hummingbird

KINGFISHERS

- _ Belted Kingfisher

WOODPECKERS

- _ Red-headed Woodpecker
- _ Red-bellied Woodpecker
- _ Yellow-bellied Sapsucker
- _ Downy Woodpecker
- _ Hairy Woodpecker
- _ Northern Flicker
- _ Pileated Woodpecker

TYRANT FLYCATCHERS

- _ Eastern Wood-Pewee
- _ Yellow-bellied Flycatcher
- _ Alder Flycatcher
- _ Willow Flycatcher
- _ Least Flycatcher
- _ Eastern Phoebe

- _ Great Crested Flycatcher
- _ Eastern Kingbird

SHRIKES

- _ Loggerhead Shrike
- _ Northern Shrike

VIREOS

- _ Blue-headed Vireo
- _ Warbling Vireo
- _ Philadelphia Vireo
- _ Red-eyed Vireo

CROWS & JAYS

- _ Blue Jay
- _ American Crow
- _ Common Raven

LARKS

- _ Horned Lark

SWALLOWS

- _ Purple Martin
- _ Tree Swallow
- _ Northern Rough-winged
- _ Bank Swallow
- _ Cliff Swallow
- _ Barn Swallow

CHICKADEES/TITMICE

- _ Black-capped Chickadee
- _ Tufted Titmouse

NUTHATCHES

- _ Red-breasted Nuthatch
- _ White-breasted Nuthatch

CREEPERS

- _ Brown Creeper

WRENS

- _ Carolina Wren
- _ House Wren
- _ Winter Wren
- _ Sedge Wren
- _ Marsh Wren

KINGLETS

- _ Golden-crowned Kinglet
- _ Ruby-crowned Kinglet

GNATCATCHERS

- _ Blue-gray Gnatcatcher

THRUSHES

- _ Eastern Bluebird
- _ Veery
- _ Gray-cheeked Thrush
- _ Swainson's Thrush
- _ Hermit Thrush
- _ Wood Thrush
- _ American Robin



Ruby-throated Hummingbird



Common Loon
Photo by Derek Dafoe



American Coot
Photo by John Vieira



Virginia Rail
Photo by Ian Dickinson



American Bittern

MOCKINGBIRDS & THRASHERS

- _ Gray Catbird
- _ Northern Mockingbird
- _ Brown Thrasher

STARLINGS

- _ European Starling

PIPITS

- _ American Pipit

WAXWINGS

- _ Bohemian Waxwing
- _ Cedar Waxwing

WOOD-WARBLERS

- _ Blue-winged Warbler
- _ Golden-winged Warbler
- _ Tennessee Warbler
- _ Orange-crowned Warbler
- _ Nashville Warbler
- _ Northern Parula
- _ Yellow Warbler
- _ Chestnut-sided Warbler
- _ Magnolia Warbler
- _ Cape May Warbler
- _ Black-throated Blue Warbler
- _ Yellow-rumped Warbler
- _ Black-throated Green Warbler
- _ Blackburnian Warbler
- _ Pine Warbler
- _ Palm Warbler
- _ Bay-breasted Warbler
- _ Blackpoll Warbler
- _ Black-and-white Warbler
- _ American Redstart
- _ Ovenbird
- _ Northern Waterthrush
- _ Mourning Warbler
- _ Common Yellowthroat
- _ Wilson's Warbler
- _ Canada Warbler

TANAGERS

- _ Scarlet Tanager

EMBERIZIDS

- _ Eastern Towhee
- _ American Tree Sparrow
- _ Chipping Sparrow
- _ Clay-colored Sparrow
- _ Field Sparrow
- _ Vesper Sparrow
- _ Savannah Sparrow
- _ Grasshopper Sparrow
- _ Fox Sparrow
- _ Song Sparrow
- _ Lincoln's Sparrow
- _ Swamp Sparrow
- _ White-throated Sparrow
- _ White-crowned Sparrow
- _ Dark-eyed Junco
- _ Lapland Longspur
- _ Snow Bunting

CARDINALS & ALLIES

- _ Northern Cardinal
- _ Rose-breasted Grosbeak
- _ Indigo Bunting
- _ Painted Bunting (2004)

BLACKBIRDS

- _ Bobolink
- _ Red-winged Blackbird
- _ Eastern Meadowlark
- _ Rusty Blackbird
- _ Common Grackle
- _ Brown-headed Cowbird
- _ Orchard Oriole
- _ Baltimore Oriole

FINCHES

- _ Pine Grosbeak
- _ Purple Finch
- _ House Finch
- _ White-winged Crossbill
- _ Common Redpoll
- _ Pine Siskin
- _ American Goldfinch
- _ Evening Grosbeak

OLD WORLD SPARROWS

- _ House Sparrow

ADDITIONAL SPECIES

- _
- _



Orchard Oriole



Northern Cardinal



Blue-winged Warbler

APPENDIX 3 2013 Field Survey and Sampling Results

Site Code	Date	Time	Temp (C)	pH	Cond (uS/cm)	DO (% sat)	DO (mg/L)
EL01	28-May-13	12:30	11.61	7.57	504	130.9	14.14
EL02	28-May-13	12:00	8.95	7.57	506	74.5	8.36
EL03	28-May-13	11:45	17.3	7.68	301	137.0	13.08
EL04	28-May-13	11:17	15.99	7.77	242	117.2	11.45
EL05	28-May-13	10:55	11.08	7.65	425	126.3	14.03
EL08	28-May-13	13:20	12.97	7.83	317	123.0	
EL01	25-Jun-13	10:25	19.05	7.6	457	145.1	13.08
EL02	25-Jun-13	10:50	11.3	7.63	527	102.9	10.87
EL03	25-Jun-13	11:45	24.14	7.81	272	166.2	13.12
EL04	25-Jun-13	12:30	22.84	7.77	178	142.1	11.99
EL05	25-Jun-13	12:50	16.54	7.56	324	144.1	13.91
EL06	25-Jun-13	10:10	13.62	7.5	550	134.9	13.92
EL08	25-Jun-13	11:10	20.27	7.83	302	155.9	13.91

Sample Summary

Site	28-May-13	25-Jun-13	30-Jul-13	20-Aug-13
EL01	Yes	Yes	No	No
EL02	Yes	Yes	Yes	No
EL03	Yes	Yes	Yes	Yes
EL04	Yes	Yes	Yes	Yes
EL05	Yes	Yes	No	No
EL06	Yes	No	No	No
EL08	Yes	Yes	Yes	Yes
EL09	Yes	Yes	Yes	Yes
EL10	Yes	Yes	Yes	Yes

Sample Locations

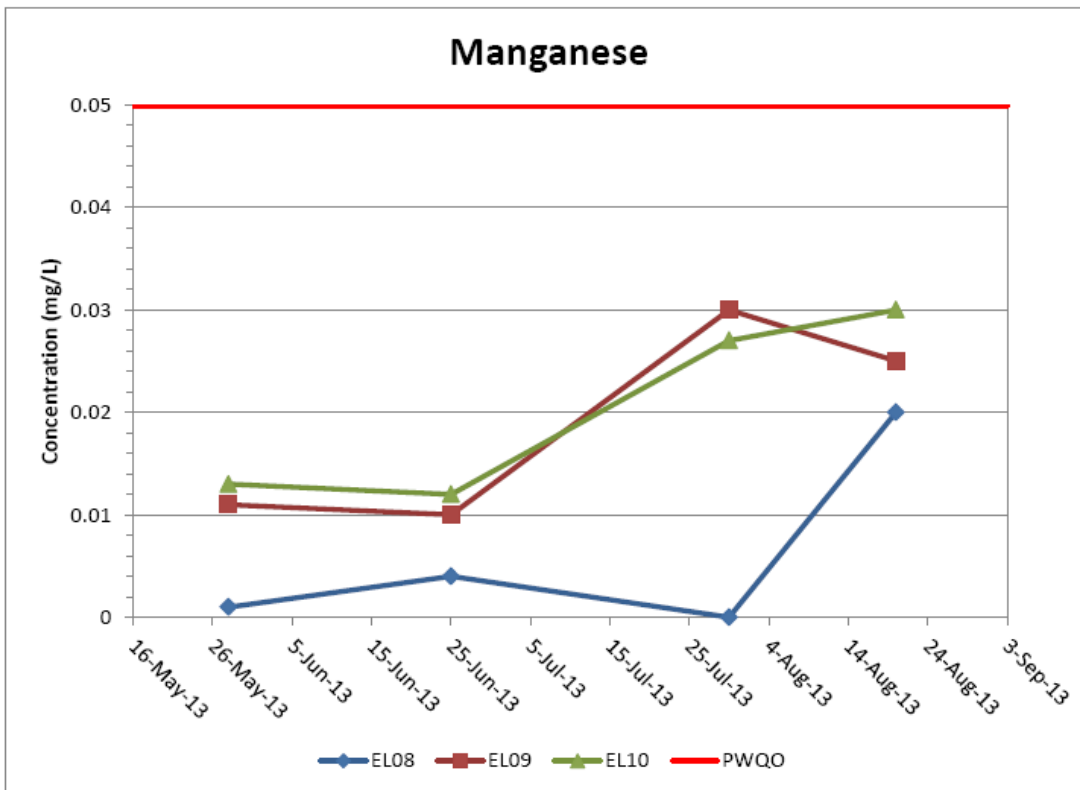
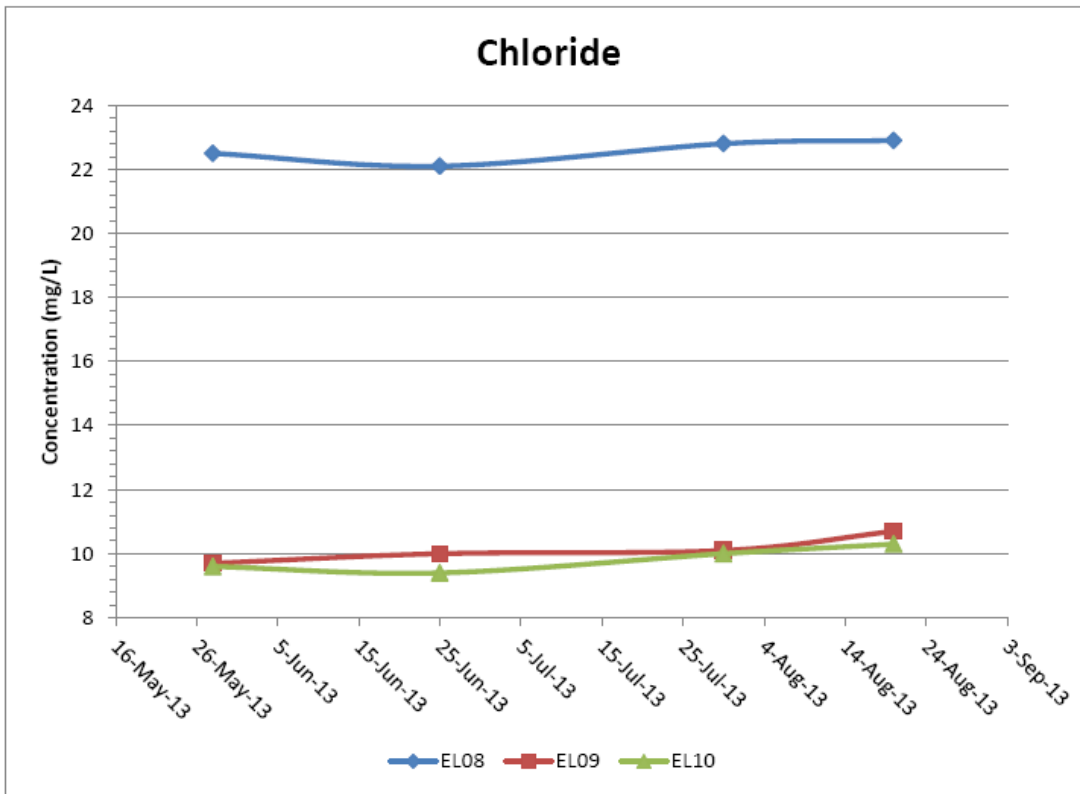
Site	Location	
EL01	Beaver Meadows	Tributaries
EL02	Kleinstuber Parks Road	
EL03	Outlet River	
EL04	Cherry Valley	
EL05	Thompson Road	
EL06	Eames Road	
EL08	Lake Ontario	Open Water
EL09	East Lake	
EL10	East Lake	

Water Quality Exceedances

Parameter	Tributary Exceedance	Open Water Exceedance	Standard
Alkalinity(CaCO3) to pH4.5	n/a	n/a	
pH @25°C	No	Yes	PWQO
Conductivity @25°C	n/a	n/a	
Chloride	n/a	n/a	
Nitrite (N)	No	No	
Nitrate (N)	No	No	
Phosphate	n/a	n/a	
Phosphorus-Total	Yes	Yes	PWQO
Total Kjeldahl Nitrogen	n/a	n/a	
Ammonia (N)-Total	n/a	n/a	
Organic Nitrogen	n/a	n/a	
Total Dissolved Solids	n/a	n/a	
Dissolved Organic Carbon	Yes	Yes	ODWS
Dissolved Inorganic Carbon	n/a	n/a	
Total Solids	n/a	n/a	
Total Suspended Solids	n/a	n/a	
Aluminum	Yes	Yes	PWQO
Barium	No	No	
Beryllium	No	No	
Cadmium	No	No	
Calcium	n/a	n/a	
Chromium	No	No	
Cobalt	No	No	
Copper	No	No	
Iron	Yes	No	PWQO & ODWS
Lead	No	No	
Magnesium	n/a	n/a	
Manganese	Yes	No	ODWS
Molybdenum	No	No	
Nickel	No	No	
Silicon	n/a	n/a	
Strontium	n/a	n/a	
Titanium	n/a	n/a	
Vanadium	No	No	
Zinc	No	No	

Provincial Water Quality Objectives (PWQO) are standards developed by MOE to help protect aquatic life and recreational opportunities (i.e. water sports and swimming). Generally, a parameter with a concentration greater than its PWQO can potentially be a concern for the environment depending on what it is, how often and by how much. Occasionally where there is no PWQO the Ontario Drinking Water Standard (ODWS) is used to put the results into context. ODWS is an MOE standard used to protect drinking water for human consumption. (2007 Water Quality Sampling Results Report)

Note: During all four sampling events, the Outlet River did not flow into Lake Ontario.



Benthic Biomonitoring

Watershed	Biotic Index	Grade
EL01	5.396	C
EL04	6.194	D
EL05	5.728	C
East Lake (Average)	5.828	D

Benthic Macroinvertebrates are small creatures without backbones that live in the sediment on the bottom of streams and include aquatic insects, snails, clams and worms. They are good indicators of water quality and stream health. Biotic index values are used to score each taxa according to its pollution tolerance.

Locations chosen for benthic macroinvertebrate sampling were not ideal, but were done as they were also sampled for water chemistry parameters. The locations had a substrate ranging from silt to some cobble, very rarely had macrophytes present, and all had low flow, thus providing a poor environment for the benthos to live and thrive. The tributaries are also intermittent and therefore tend to dry up during the summer months, preventing benthos from living long-term in these locations.

Site ID	Date	sampled	Replicate	Date															
				AMPHIPODA	ANISOPTERA	CERATOPOGONIDAE	CHIRONOMIDAE	COLEENTERATA	COLEOPTERA	CULICIDAE	DECAPODA	EPHEMEROPTERA	GASTROPODA	HEMIPTERA	HIRUDINEA	HYDRACARINA	ISOPODA	LEPIDOPTERA	
EI01	6/11/2013	1	0	0	2	16	0	5	0	0	0	0	0	0	0	0	0		
EI01	6/11/2013	2	1	0	1	11	0	2	0	0	0	0	0	0	0	0	0		
EI01	6/11/2013	3	2	0	0	23	0	2	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	1	1	0	0	33	0	0	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	2	2	0	0	30	0	1	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	3	0	0	0	23	0	0	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	1	2	0	1	70	0	4	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	2	0	0	0	50	0	0	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	3	4	0	2	75	0	1	0	0	0	0	0	0	0	0	0		

Site ID	Date	sampled	Replicate	Date															
				DECAPODA	EPHEMEROPTERA	GASTROPODA	HEMIPTERA	HIRUDINEA	HYDRACARINA	ISOPODA	LEPIDOPTERA	MISC_DIPTERA	NEMATODA	OLIGOCHAETA	PELECYPODA	PLECOPTERA	SIMULIIDAE	TABANIDAE	
EI01	6/11/2013	1	2	0	5	0	0	0	0	0	0	0	0	0	0	0	0		
EI01	6/11/2013	2	1	0	14	0	0	1	0	0	0	0	0	0	0	0	0		
EI01	6/11/2013	3	25	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	1	14	0	5	0	0	0	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	2	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	3	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		

Site ID	Date	sampled	Replicate	Date															
				MEGALOPTERA	MISC_DIPTERA	NEMATODA	OLIGOCHAETA	PELECYPODA	PLECOPTERA	SIMULIIDAE	TABANIDAE								
EI01	6/11/2013	1	0	0	0	0	2	0	0	12	1	0	0	0	0	0	0		
EI01	6/11/2013	2	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0		
EI01	6/11/2013	3	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0		
EI04	6/11/2013	1	0	0	0	0	4	0	0	3	0	0	0	0	0	0	0		
EI04	6/11/2013	2	0	0	0	0	1	0	0	3	0	0	0	0	0	0	0		
EI04	6/11/2013	3	0	0	0	0	7	0	0	6	0	0	0	0	0	0	0		
EI05	6/11/2013	1	0	0	0	0	3	0	0	1	0	0	0	0	0	0	0		
EI05	6/11/2013	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0		
EI05	6/11/2013	3	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0		

Biotic Index	Water Quality	Degree of Organic Pollution	2011 Grades
0.00-3.75	Excellent	Organic pollution unlikely	A
3.76-4.25	Very Good	Possible slight organic pollution	A
4.26-5.00	Good	Some organic pollution probable	B
5.01-5.75	Fair	Fairly substantial pollution likely	C
5.76-6.50	Fairly Poor	Substantial pollution likely	D
6.51-7.25	Poor	Very substantial pollution likely	F
7.26-10.00	Very Poor	Severe organic pollution likely	F

Watershed	Biotic Index	Grade
EL01	5.396	C
EL04	6.194	D
EL05	5.728	C
East Lake	5.828	D

Date

Site ID	sampled	Replicate	TIPULIDAE	TRICHOPTERA	TURBELLARIA	Unknown	ZYGOPTERA
EL01	6/11/2013	1	0	27	0	0	0
EL01	6/11/2013	2	0	1	0	0	0
EL01	6/11/2013	3	0	0	0	0	0
EL04	6/11/2013	1	0	1	0	0	1
EL04	6/11/2013	2	0	0	0	0	0
EL04	6/11/2013	3	0	4	0	0	1
EL05	6/11/2013	1	0	2	0	0	0
EL05	6/11/2013	2	0	1	0	0	0
EL05	6/11/2013	3	1	1	0	0	0

Ground Water Levels - Data (2013)

Date	Well 1		Well 2		Well 3	
	Water Level	Water Temp	Water Level	Water Temp	Water Level	Water Temp
4/30/2013	659.43	10.10	823.00	10.50	605.58	9.60
5/1/2013	653.59	10.08	821.90	10.50	605.67	9.60
5/2/2013	649.95	10.07	822.22	10.50	605.82	9.60
5/3/2013	649.85	10.08	821.79	10.50	605.98	9.60
5/4/2013	649.10	10.08	820.57	10.50	606.13	9.60
5/5/2013	649.77	10.08	819.64	10.50	606.20	9.60
5/6/2013	648.96	10.06	818.22	10.50	606.32	9.60
5/7/2013	647.45	10.02	816.33	10.50	606.45	9.60
5/8/2013	646.80	10.01	814.64	10.50	606.52	9.60
5/9/2013	648.47	10.01	812.82	10.50	606.48	9.60
5/10/2013	647.53	10.01	810.97	10.50	606.61	9.60
5/11/2013	651.35	10.00	811.90	10.50	606.65	9.60
5/12/2013	648.84	10.00	809.07	10.50	606.62	9.60
5/13/2013	640.25	10.00	805.28	10.50	606.58	9.60
5/14/2013	636.54	9.99	804.71	10.50	606.70	9.60
5/15/2013	647.73	10.00	806.97	10.50	606.67	9.60
5/16/2013	644.07	9.99	803.00	10.50	606.66	9.60
5/17/2013	630.98	9.98	799.39	10.50	606.66	9.60
5/18/2013	626.33	9.99	799.43	10.50	606.68	9.60
5/19/2013	627.96	9.98	799.70	10.46	606.65	9.60
5/20/2013	631.70	10.00	798.64	10.40	606.68	9.60
5/21/2013	635.15	9.98	797.64	10.40	606.63	9.60
5/22/2013	637.10	9.96	795.46	10.40	606.58	9.60
5/23/2013	636.10	9.95	793.19	10.40	606.48	9.60
5/24/2013	624.63	9.96	788.92	10.40	606.43	9.60
5/25/2013	620.61	9.95	788.75	10.40	606.35	9.60
5/26/2013	619.96	9.92	788.27	10.40	606.40	9.60
5/27/2013	616.07	9.92	786.67	10.40	606.34	9.60
5/28/2013	618.12	9.92	786.37	10.40	606.28	9.60
5/29/2013	621.71	9.91	789.86	10.40	606.21	9.60
5/30/2013	617.69	9.90	787.67	10.40	606.16	9.60
5/31/2013	621.59	9.90	786.68	10.40	606.10	9.60
6/1/2013	627.19	9.90	786.17	10.40	606.04	9.60
6/2/2013	630.95	9.90	802.18	10.40	606.05	9.60
6/3/2013	630.35	9.89	810.48	10.40	605.92	9.60
6/4/2013	637.20	9.90	814.40	10.40	605.85	9.60
6/5/2013	645.15	9.88	813.12	10.40	605.88	9.60
6/6/2013	656.54	9.88	812.83	10.40	605.85	9.60
6/7/2013	663.22	9.88	828.53	10.40	605.82	9.60
6/8/2013	663.98	9.88	835.12	10.40	605.79	9.60
6/9/2013	663.35	9.85	832.73	10.40	605.76	9.60
6/10/2013	673.79	9.87	830.40	10.40	605.76	9.60
6/11/2013	686.01	9.86	871.42	10.40	605.71	9.60
6/12/2013	687.12	9.88	933.40	10.40	605.73	9.60
6/13/2013	699.85	9.88	952.35	10.40	605.81	9.60
6/14/2013	693.20	9.86	942.86	10.40	605.92	9.60
6/15/2013	692.19	9.86	927.63	10.40	605.97	9.60
6/16/2013	699.33	9.88	911.41	10.40	606.02	9.60

Date	Well 1		Well 2		Well 3	
	Water Level	Water Temp	Water Level	Water Temp	Water Level	Water Temp
6/17/2013	695.49	9.86	949.33	10.40	606.05	9.60
6/18/2013	689.97	9.87	965.45	10.40	606.06	9.60
6/19/2013	683.95	9.88	945.90	10.40	606.00	9.60
6/20/2013	679.56	9.88	916.41	10.33	606.01	9.60
6/21/2013	675.32	9.88	888.88	10.30	606.05	9.60
6/22/2013	674.77	9.87	870.27	10.30	606.05	9.60
6/23/2013	671.77	9.88	857.60	10.30	606.04	9.60
6/24/2013	667.70	9.89	846.72	10.30	606.08	9.60
6/25/2013	666.49	9.90	842.74	10.30	606.10	9.60
6/26/2013	663.65	9.89	846.63	10.30	606.14	9.60
6/27/2013	660.58	9.90	847.32	10.30	606.08	9.60
6/28/2013	661.99	9.89	845.75	10.30	606.03	9.60
6/29/2013	658.20	9.89	839.68	10.30	606.06	9.60
6/30/2013	647.65	9.88	831.82	10.30	606.02	9.60
7/1/2013	639.84	9.89	826.03	10.30	605.93	9.60
7/2/2013	637.08	9.88	822.89	10.30	605.92	9.60
7/3/2013	634.08	9.89	819.45	10.30	605.91	9.60
7/4/2013	632.68	9.88	816.80	10.30	605.86	9.60
7/5/2013	632.44	9.89	814.33	10.30	605.80	9.60
7/6/2013	630.77	9.89	811.44	10.30	605.75	9.60
7/7/2013	633.31	9.90	808.84	10.30	605.71	9.60
7/8/2013	632.14	9.89	805.65	10.30	605.71	9.60
7/9/2013	631.53	9.88	804.05	10.30	605.67	9.60
7/10/2013	635.50	9.88	803.86	10.30	605.66	9.60
7/11/2013	617.49	9.87	798.86	10.30	605.56	9.60
7/12/2013	596.11	9.97	796.10	10.30	580.71	9.85
7/13/2013	579.43	9.83	794.55	10.30	606.58	9.60
7/14/2013	565.67	9.83	792.98	10.30	606.55	9.60
7/15/2013	554.46	9.81	791.39	10.30	606.46	9.60
7/16/2013	554.59	9.80	789.80	10.30	606.48	9.60
7/17/2013	560.94	9.81	788.95	10.27	606.45	9.60
7/18/2013	569.34	9.81	787.41	10.20	606.39	9.60
7/19/2013	580.07	9.83	787.47	10.20	606.41	9.60
7/20/2013	583.83	9.81	792.33	10.20	606.38	9.60
7/21/2013	578.65	9.83	785.25	10.20	538.17	9.60
7/22/2013	582.10	9.84	783.71	10.20	603.08	9.60
7/23/2013	591.08	9.84	783.38	10.20	605.07	9.60
7/24/2013	582.38	9.83	777.83	10.16	605.00	9.60
7/25/2013	573.32	9.83	774.84	10.10	593.89	9.60
7/26/2013	571.50	9.83	773.26	10.10	600.55	9.60
7/27/2013	573.96	9.83	772.00	10.10	353.69	9.60
7/28/2013	572.73	9.83	768.06	10.10	535.98	9.60
7/29/2013	566.83	9.85	763.23	10.10	605.33	9.60
7/30/2013	561.95	9.85	759.67	10.10	605.55	9.60
7/31/2013	558.17	9.83	758.14	10.10	605.65	9.60
8/1/2013	551.57	9.83	758.07	10.10	605.83	9.60
8/2/2013	543.89	9.83	754.48	10.10	605.84	9.60
8/3/2013	538.91	9.82	753.41	10.10	605.85	9.60
8/4/2013	532.15	9.82	749.57	10.10	605.84	9.60

Date	Well 1		Well 2		Well 3	
	Water Level	Water Temp	Water Level	Water Temp	Water Level	Water Temp
8/5/2013	527.81	9.84	747.40	10.12	605.86	9.60
8/6/2013	527.54	9.83	745.45	10.17	605.84	9.60
8/7/2013	528.70	9.87	742.98	10.20	605.80	9.60
8/8/2013	527.71	9.89	750.07	10.19	605.81	9.60
8/9/2013	533.53	9.89	749.27	10.20	605.73	9.60
8/10/2013	532.89	9.90	748.40	10.20	605.67	9.60
8/11/2013	533.30	9.90	749.43	10.20	605.62	9.60
8/12/2013	537.58	9.90	750.39	10.20	605.67	9.60
8/13/2013	542.67	9.90	755.65	10.20	605.61	9.60
8/14/2013	437.32	11.60	627.49	11.71	605.61	9.60
8/15/2013	465.54	9.93	736.34	10.20	605.50	9.60
8/16/2013	492.93	9.90	747.05	10.20	605.48	9.60
8/17/2013	497.33	9.90	744.33	10.20	605.43	9.60
8/18/2013	497.78	9.90	742.16	10.20	605.41	9.60
8/19/2013	492.89	9.90	739.96	10.20	605.35	9.60
8/20/2013	485.00	9.90	734.95	10.20	605.33	9.60
8/21/2013	481.07	9.90	730.13	10.20	605.32	9.60
8/22/2013	483.76	9.90	726.55	10.20	605.31	9.60
8/23/2013	475.83	9.90	718.06	10.20	605.18	9.60
8/24/2013	467.14	9.90	710.80	10.20	605.14	9.60
8/25/2013	466.33	9.90	706.73	10.20	605.18	9.60
8/26/2013	472.92	9.90	704.13	10.20	605.13	9.60
8/27/2013	474.40	9.90	699.50	10.20	605.10	9.60
8/28/2013	473.27	9.92	694.47	10.20	605.09	9.60
8/29/2013	467.24	9.93	688.40	10.20	605.02	9.60
8/30/2013	468.97	9.97	685.95	10.20	605.07	9.60
8/31/2013	468.52	10.00	682.76	10.20	604.98	9.60
9/1/2013	462.43	10.00	678.30	10.20	604.96	9.60
9/2/2013	462.85	10.00	677.25	10.20	604.95	9.60
9/3/2013	460.54	10.00	672.95	10.20	604.86	9.60
9/4/2013	458.87	10.00	669.55	10.20	604.87	9.60
9/5/2013	453.92	10.00	665.14	10.20	604.77	9.60
9/6/2013	450.58	10.00	662.72	10.20	604.78	9.60
9/7/2013	457.45	10.00	663.18	10.20	604.78	9.60
9/8/2013	453.16	10.01	659.22	10.20	604.68	9.60
9/9/2013	447.93	10.00	656.54	10.20	604.69	9.60
9/10/2013	449.45	10.00	661.46	10.20	604.72	9.60
9/11/2013	444.48	10.00	667.09	10.20	604.69	9.60
9/12/2013	447.89	10.00	676.38	10.20	604.63	9.60
9/13/2013	443.82	10.00	678.48	10.20	604.48	9.60
9/14/2013	437.26	10.00	678.13	10.20	604.46	9.60
9/15/2013	434.45	10.00	678.89	10.20	604.49	9.60
9/16/2013	425.53	10.00	676.72	10.20	604.37	9.60
9/17/2013	418.80	10.00	674.53	10.20	604.36	9.60
9/18/2013	425.97	10.00	675.97	10.20	604.37	9.60
9/19/2013	429.27	10.00	674.44	10.20	604.33	9.60
9/20/2013	434.20	10.00	673.26	10.20	604.29	9.58
9/21/2013	440.57	10.00	675.75	10.20	604.06	9.51
9/22/2013	436.75	10.00	690.90	10.20	603.92	9.50

Date	Well 1		Well 2		Well 3	
	Water Level	Water Temp	Water Level	Water Temp	Water Level	Water Temp
9/23/2013	438.93	10.00	711.60	10.20	603.91	9.50
9/24/2013	450.21	10.00	718.98	10.20	603.92	9.50
9/25/2013	456.01	10.00	718.98	10.20	603.80	9.50
9/26/2013	451.33	10.00	714.21	10.20	603.81	9.50
9/27/2013	444.41	10.02	709.46	10.20	603.68	9.50