

# **Kearney Watershed Environmental Foundation**

**2018**

## **Water Quality Monitoring Report**

Testing performed by

Stan Walker with assistance from our volunteer Lake Stewards

Report prepared by

Stan Walker

# Contents

<b>1.0</b>	<b>Introduction</b>	<b>2</b>
<b>1.1</b>	<b>Background information</b>	<b>2</b>
2.0	Lake Profiles, Maps & Sampling Sites	5
2.1	Grooml/Lynx Lake	5
2.2	Emsdale Lake	6
2.3	Big Clam Lake	7
2.4	Little Clam Lake	8
2.5	Peters Lake	9
2.6	Beaver Lake	10
2.7	Hassard Lake	11
2.8	Perry Lake	12
2.9	Perbeth/Fisher Lake	13
2.10	Mason Lake	14
2.11	Island Lake	15
2.12	Sand Lake	16
2.13	Himbury Lake	17
<b>2.14</b>	<b>Magnetawan Lake</b>	<b>18</b>
<b>2.15</b>	<b>Grass Lake</b>	<b>19</b>
<b>2.16</b>	<b>Loon Lake</b>	<b>20</b>
<b>2.17(a)</b>	<b>Magnetawan River</b>	<b>21</b>
<b>2.17(b)</b>	<b>Magnetawan River</b>	<b>22</b>
<b>3.0</b>	<b>Measurement Methodology</b>	<b>25</b>
<b>4.0</b>	<b>Measured Parameters and Water Quality Standards</b>	<b>26</b>
<b>4.1</b>	<b>Temperature</b>	<b>26</b>
<b>4.2</b>	<b>Secchi Disc</b>	<b>27</b>
<b>4.3</b>	<b>Dissolved Oxygen</b>	<b>27</b>
<b>4.4</b>	<b>Conductivity</b>	<b>28</b>
<b>4.5</b>	<b>pH</b>	<b>28</b>
<b>4.6</b>	<b>Nitrate</b>	<b>28</b>
<b>4.7</b>	<b>Nitrite</b>	<b>28</b>
<b>4.8</b>	<b>Phosphate</b>	<b>29</b>
<b>4.9</b>	<b>Total Phosphorus</b>	<b>29</b>
<b>5.0</b>	<b>Results</b>	<b>30</b>
<b>6.0</b>	<b>Conclusions and comments on the 2018 Water Quality Monitoring Program</b>	<b>45</b>
<b>7.0</b>	<b>Reference</b>	<b>46</b>
<b>8-0</b>	<b>Appendix</b>	<b>50</b>

## **Introduction**

### **1.0 Background information**

#### **General**

In 2014 the University of Waterloo Summit Centre for the Environment (WSCE) partnered with the Kearney Environmental Watershed Foundation (KWEF) to create a lake monitoring program. This lake monitoring program was meant to be a follow up on water testing done by the Town of Kearney several years ago with the Ministry of the Environment and Climate Change. The lakes sampled and tested were Groom/Lynx Lake, Emsdale Lake, Big Clam Lake, Little Clam Lake, Peters Lake, Beaver Lake, Hassard Lake, Perry Lake, Perbcth/Fisher Lake, Mason Lake, Island Lake, Sand Lake, Himbury Lake, Magnetawan Lake, Grass Lake and Loon Lake and two spots on the south branch of the Magnetawan River in the vicinity of the Graphite Mine. Each of these water bodies was sampled in the field and tested at the WSCE lab. The data collected is intended to be part of a long-term monitoring project in order to detect any changes in the quality of the water over time. The long-term goals for this project were to annually sample the lakes in order to identify trends over time. The benefits of long-term water monitoring include detection of positive or negative changes in the data from large annual data sets.

KWEF was created to help preserve the quality of air, water, and terrestrial ecosystems of the Almaguin area ("KWEF," n.d.). Most of the lakes within the Kearney region are part of the Ontario Lake Partner Program. This program monitors total phosphorus concentrations and secchi depth for Ontario's inland lakes collected by volunteer efforts. For the WSCE/KWEF monitoring program, water composition (pH, DO, and conductivity) was tested in the lab as well as water nutrient levels (total phosphorus, phosphate, nitrate, and nitrite) using specific lab detection methods.

Throughout this report references to the "Town of Kearney" usually are referring to the original town site and if just the word "Kearney" is used we are referring to the original town site and the townships (Bethune, Proudfoot, and those parts of Butt and McCraney outside the Algonquin Park boundaries) that were amalgamated in 1979. This municipality of Kearney encompasses 532 square kilometers and has a year round population of approximately 850

All of the 17 water bodies sampled were within the municipality of Kearney with the exception of Magnetawan, Lake which is inside the Park Boundaries. The terrain in the Kearney region which adjoins the western edge of Algonquin Park varies from extensive deposits of sand and gravel or wetland areas along the Magnetawan River to the uplands of Canadian Shield granites (Gartner Lee Water Quality Study, 2002). There is a graphite mine just north of the town which has the potential to impact the water quality of the nearby Magnetawan River. The mine which has been closed for several years was planning to reopen in 2015 and aims to produce one million tonnes of ore and 20,000 tonnes of graphite per year ("The Kearney Mine", n.d.). The dense forest cover has attracted and sustained a large lumbering industry in the past, however water based recreation and tourism have emerged more recently as a source of greater economic growth (Gartner Lee Water Quality Study, 2002). While the town itself is small, tourism and development could impact the watershed .

#### **Background information – Monitoring Program 2014 - 2017**

In 2014 the report was issued in 2 parts. Students from the university sampled and reported results on 16 lakes and the Magnetawan River. In 2015 students again sampled and issued one combined report on all 16 lakes and the river.

Unfortunately in the spring of 2016 we learned that the University of Waterloo would not be able to participate in any way with the monitoring program. After evaluating our options KWEF decided to continue the program but utilize a commercially available portable field instrument and sensor package that would allow us to measure many of the same parameters that the WSCE lab tests provide. Using the previously selected sampling sites on each lake we gathered data and evaluated the suitability of two different instruments.

In 2017 we had the opportunity to rent a YSI PRO DSS multi-parameter instrument - a new version of one of the instruments we tested the previous year. It had two significant improvements - a depth measurement

was recorded with each block of data and the DO sensor used new & improved technology.

We arranged with Near North Labs in North Bay to analyze water samples from the first five lakes for nitrate and ortho-phosphate levels since the multi-parameter instrument wasn't able to measure the low levels found in our lakes. The testing program ran from July 10 – Aug 4<sup>th</sup>. The stormy and rainy weather during the summer of 2017 created additional scheduling problems.

In 2018 we continued our WQM program with support from the Kearney Council. The rental period was from July 16 - Aug 13. We utilized the same type of instrument and the same sample sites as previously and took water samples for nitrates & ortho-phosphates from 5 more lakes.

## 2.0 Lake Profiles, Maps and Sampling Sites

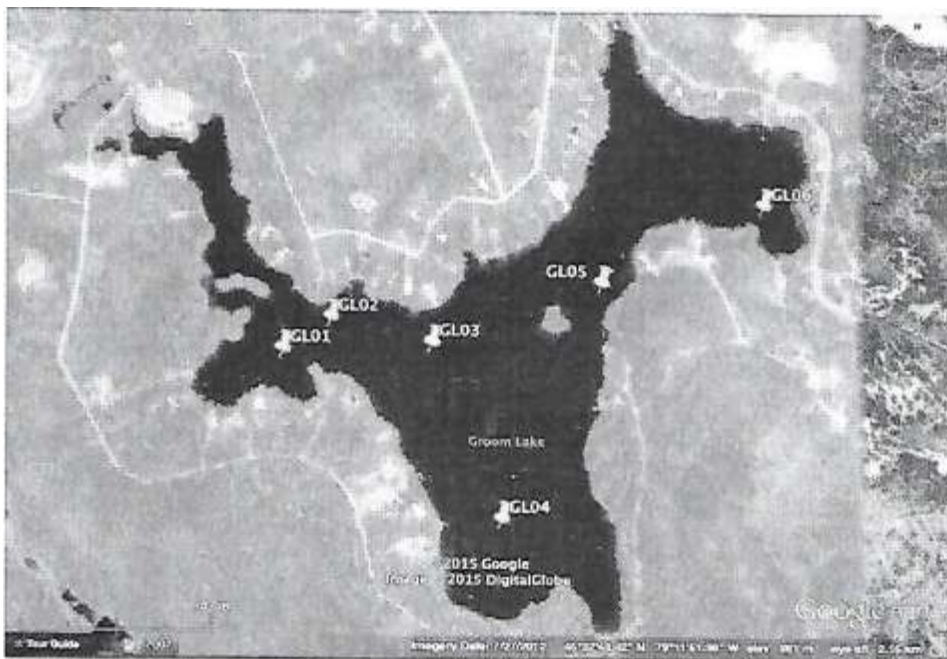
The lake profile information where provided was taken from the Ministry of Natural Resources and Forestry (MNR) lake Fact sheets, Google Earth, and MBendi information services.

### Groom / Lynx Lake

Groom Lake, also known as Lynx Lake, is located 7 km southeast from the town of Kearney. There were several cottages visible from each sampling point. The lake does not have any surrounding crown land. The largest island is Squirrel Island. The map of the lake showing the sample points and the GPS coordinates for each sample site can be found below.

#### Groom/Lynx Lake Characteristics

Surface Area	Mean Depth	Max Depth	Perimeter
59.4 Ha	4.9m	12.5 m	6.7 km (plus 0.5 km island shoreline)



Map of Groom/Lynx Lake with sample sites, Retrieved from Google Earth

#### GPS Coordinates for sample sites at Groom Lake

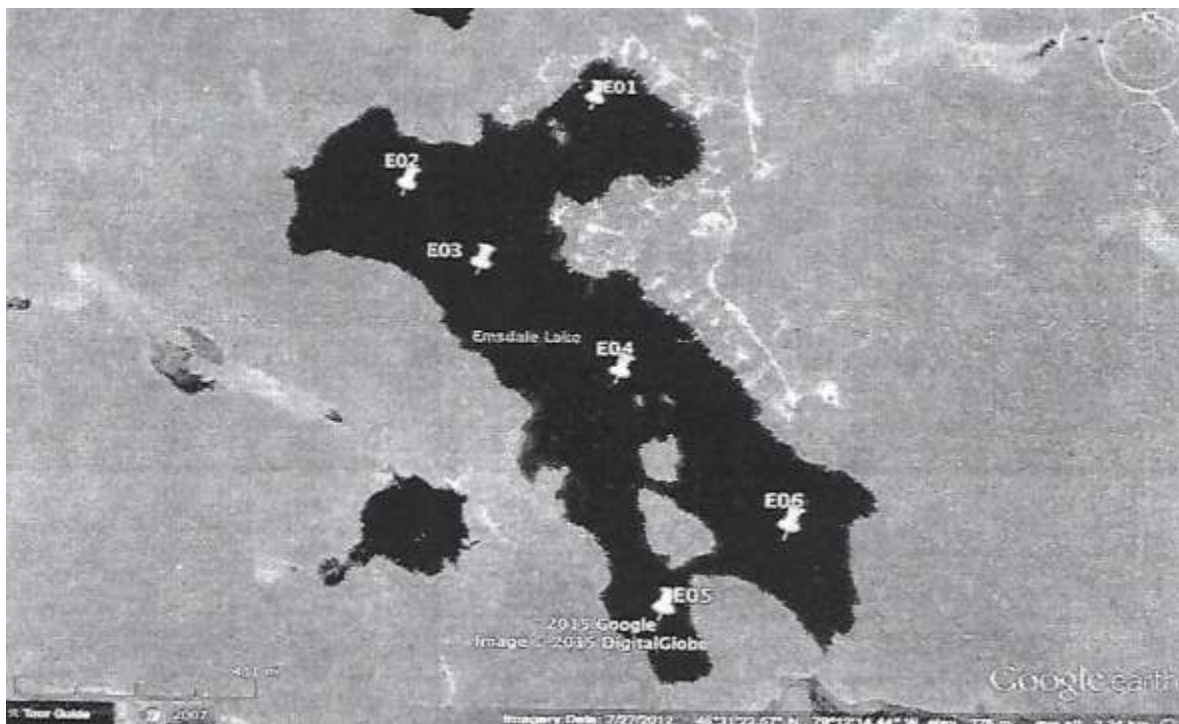
GLO1	N 45° 32' 19.1" W 79° 11' 24.5"	GLO4	N 45° 32' 7.0" W 79° 11' 2.5"
GLO2	N 45° 32' 21.4" W 79° 11' 19.7"	GLO5	N 45° 32' 23.9" W 79° 10' 52.7"
GLO3	N 45° 32' 19.6" W 79° 11' 9.6"	GLO6	N 45° 32' 29.5" W 79° 10' 36.5"

## Emsdale Lake

Emsdale Lake is located 6 km south of Kearney, Ontario. There are a couple of cottages visible from the sampling points. Fifteen percent of the surrounding land is Crown Land. Compared to the other lakes, this lake's water is very clear due to less cottage input and being spring fed. The map of the lake showing the sample sites and the GPS coordinates for each sample site can be found below

Emsdale Lake characteristics (MNRF, 2010).

Surface Area	Mean Depth	Max Depth	Perimeter
61 ha	9m	22 m	5.5 km (plus 1 km island shoreline)



GPS Coordinates for sample sites at Emsdale Lake.

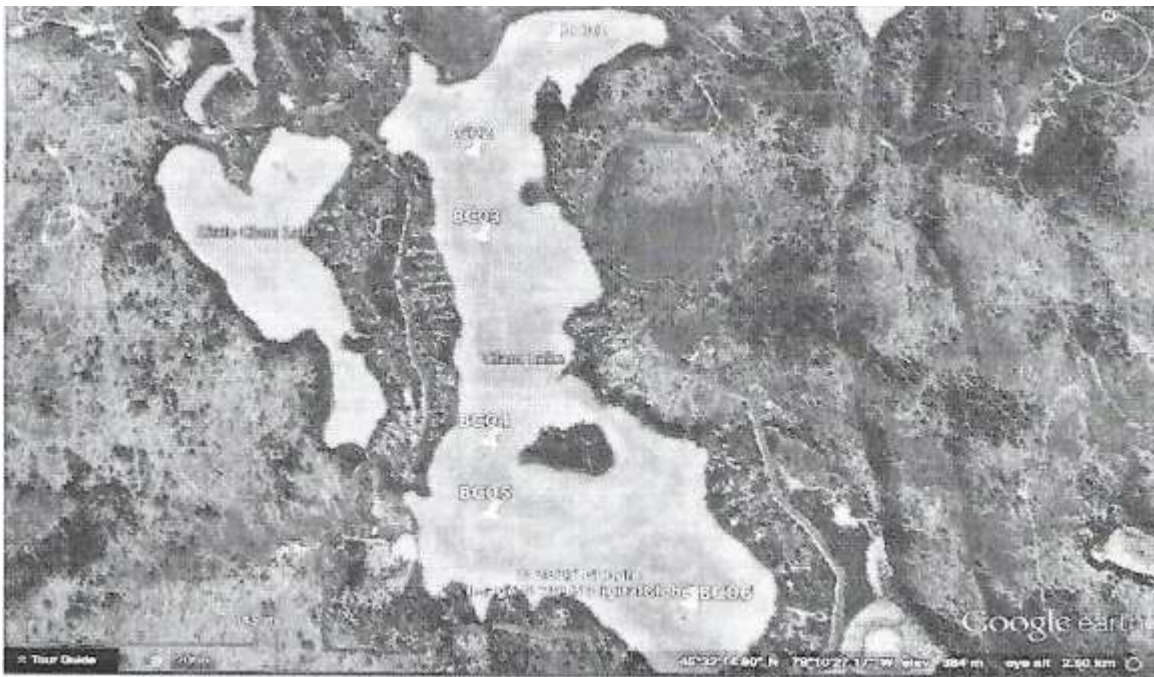
E01	N 45° 31' 17.3" W 79° 11' 50.7"	E04	N 45° 30' 54.9" W 79° 11' 45.8"
E02	N 45° 31' 08.7" W 79° 12' 08.0"	E05	N 45° 30' 38.5" W 79° 11' 40.4"
E03	N 45° 31' 02.7" W 79° 11' 59.8"	E06	N 45° 30' 44.7" W 79° 11' 30.0"

## Big Clam Lake

Big Clam Lake, also known as Clam Lake, is located 11.5 km southeast of Kearney, Ontario. There are a few visible cottages from the lake sample points, the shoreline is moderately developed, and 10% of the surrounding land is Crown Land. Big Clam Lake has one privately owned island known as Prince Edward Island. The map of the sample sites and the GPS coordinates for each sample site can be found below.

### Big Clam Lake characteristics (MNR, 2010).

Surface Area	Mean Depth	Max Depth	Perimeter
71 ha	6111	19 m	6 km (plus 0.5 km island shoreline)



Map of Big Clam Lake with sample sites, Retrieved from Google Earth

### GPS Coordinates for sample sites at Big Clam Lake.

BCO1	N 45° 32' 10.3" W 79° 09' 26.3"	BC04	N 45° 31' 32.5" W 79° 09' 32.1"
BC02	N 45° 31' 58.6" W 79° 09' 34.8"	BC05	N 45° 31' 26.7" W 79° 09' 31.8"
BC03	N 45° 31' 50.5" W 79° 09' 33.6"	BC06	N 45° 31' 19.9" W 79° 09' 13.0"

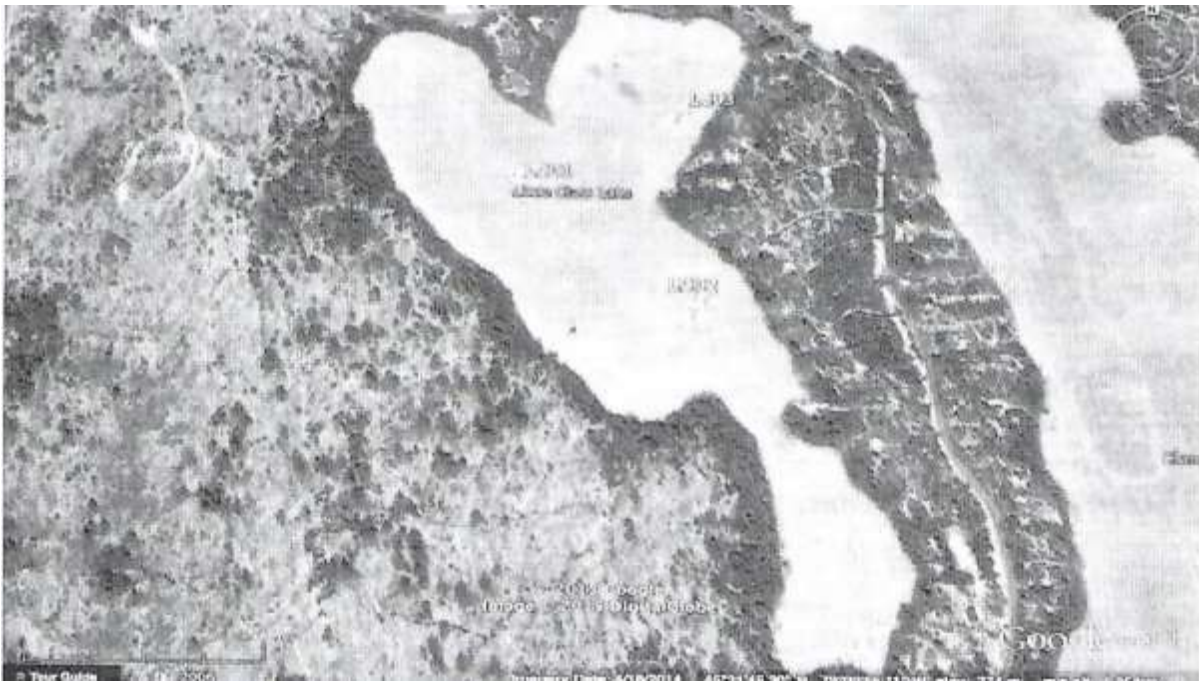


## Little Clam Lake

Little Clam Lake is located 7.3 km southeast of Keamey, Ontario. There are a few visible cottages from the sampling points and Bennett's Beehive Cottages are located near sampling point LC03. The surrounding land is not Crown Land, but the lake is near the Upper Raft Lake Conservation Reserve. The lake is relatively shallow as seen below, with the deepest spot near the center of the lake. The map of the sample sites and the GPS coordinates for sample sites can be found below..

Little Clam Lake characteristics (MNR, 2015).  
Area 22 ha Mean Depth 6m Max Depth 16m Perimeter 3km

Surface



Map of Little Clam Lake with sample sites, Retrieved from Google Earth

GPS Coordinates for sample sites at Little Clam Lake.

LCO1	N 45° 31' 52.0" W 79° 09' 59.6"
LC02	N 45° 31' 46.3" W 79° 09' 50.8"
LC03	N 45° 31' 55.7" W 79° 09' 51.2"



## Peters Lake

Peters Lake is located 10.1 km east of Kearney, Ontario. Peters Lake is a small shallow lake and does not have any visible cottages around the sampling points but was accessed through the Toronto District School Board (TDSB) outdoor children's camp called "Camp Kearney." Most of the surrounding land is owned by TDSB and 5% is Crown Land. The map of the sample sites and the GPS coordinates for sample sites can be found below.

Peters Lake characteristics (MNR, 2010).

Surface Area

48 ha Mean Depth 4m Max Depth 13m Perimeter 5km



Map of Peters Lake with sample sites, Retrieved from Google Earth

GPS Coordinates for sample sites at Peters Lake.

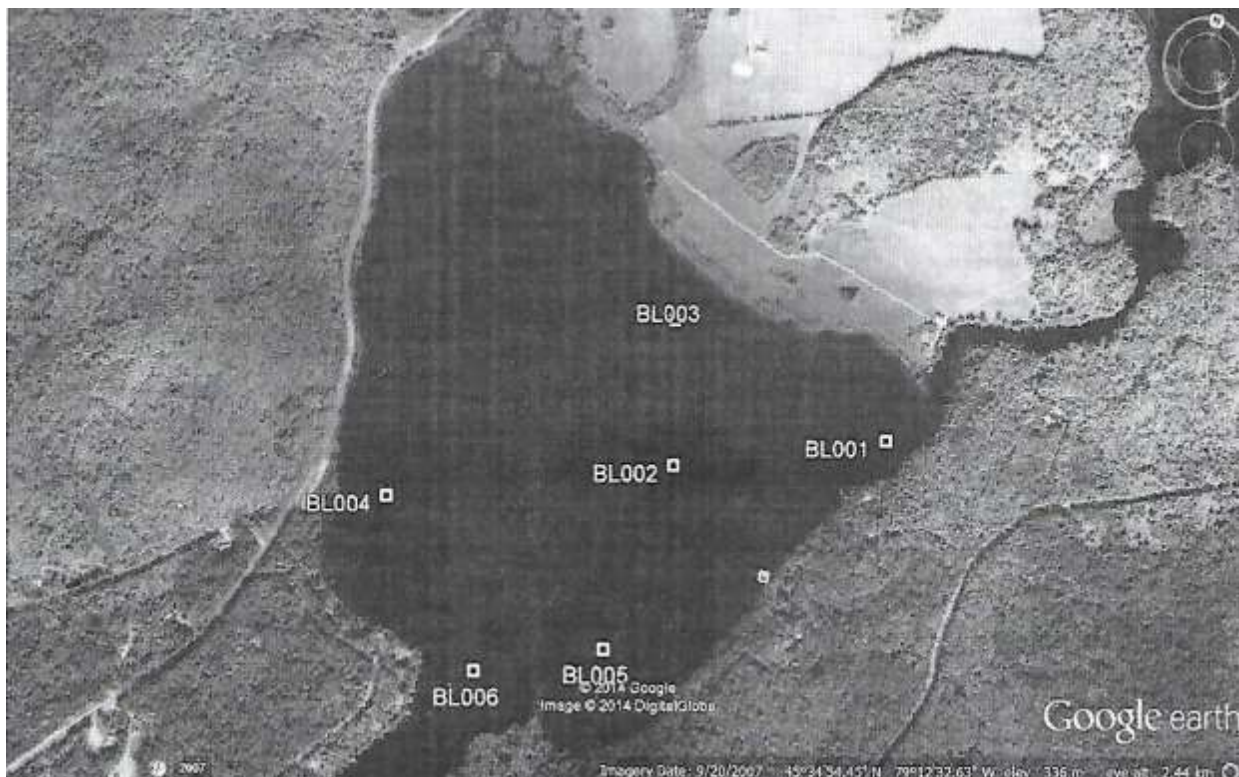
PET1	N 45° 32' 43.6" W 79° 08' 39.5"
PET2	N 45° 32' 39.0" W 79° 08' 58.6"
PET3	N 45° 32' 29.3" W 79° 08' 46.3"

## Beaver Lake

Beaver Lake is located 3.2 km north of Keamey. Highway 518 is located close to the lake and there are many visible cottages from each of the sampling sites. The map of the lake showing sample sites and the GPS coordinates for the sample sites can be found below

Beaver Lake characteristics (MNR, 2015).  
Area 13.6 Ha Max Depth 8.0m Perimeter 2.3 km

Surface



Map of Beaver Lake with sample sites, Retrieved from Google Earth

### GPS Coordinates for sample sites at Beaver Lake

BO1	N 45°34' 1.7" W 79° 12' 9.0"	804	N 45° 34' 44.6" W 79° 12' 51.3"
802	N 45° 34' 50.8" W 79° 12' 27"	805	N 45° 34' 39.4" W 79° 12' 29.3"
803	N 45° 34' 59.4" W 79° 12' 30.3"	806	N 45° 34' 36.2" W 79° 12' 39.9"

## Hassard Lake

Hassard Lake connects to both Beaver and Perry Lake. The lake is beside downtown Kearney, Ontario. Water flows from Beaver Lake into the northern end of Hassard Lake and exits at its southern end into Perry Lake. The surrounding land is developed. There are more lawns and less of a riparian zone visible from the sampling points. The map of the sample sites and the GPS coordinates for the sample sites can be found below.°



Map of Hassard Lake with sample sites, Retrieved from Google Earth

GPS Coordinates for sample sites at Hassard Lake.

H01	N45°34' 1.7" W 79° 13' 4.1"	H04	N 45° 33' 28.7" W 79° 13' 29.7"
H02	N 45° 33' 47.0" W 79° 13' 27.7"	H05	N 45° 33' 33.1" W79° 13'32.6"
H03	N 45° 33' 34.6"	H06	N 45° 33' 37.8"



## Perry Lake

Perry Lake is located in downtown Kearney. There is a public dock on Main St. and there are several cottages and homes visible from the sampling points. There is a heavy riparian zone south of the lake. The map of the lake showing the sample sites and the GPS coordinates for the sample sites can be found below.



GPS Coordinates for sample sites at Perry Lake.

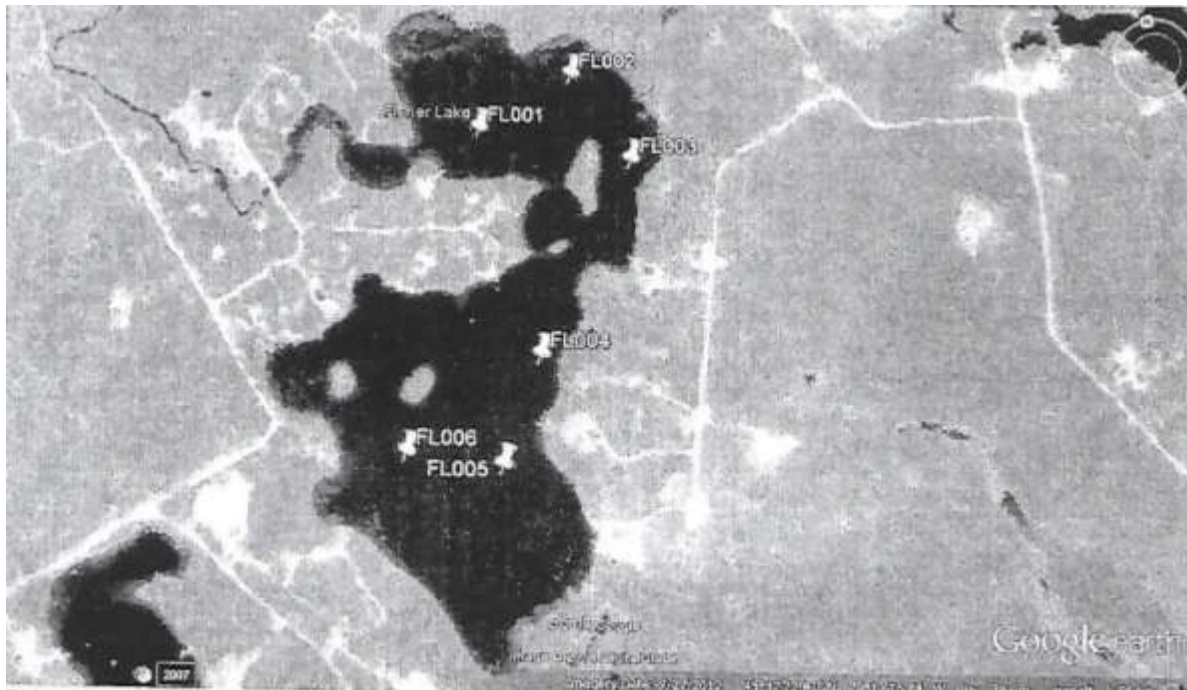
PO1	N 45° 32' 42.9" W 79° 13' 47.7"	P04	N 45° 32' 44.9" W 79° 13' 30.9"
P02	N 45° 32' 36.9" W 79° 13' 41.9"	P05	N 45° 32' 56.2" W 79° 13' 42.0"
P03	N 45° 32' 24.2" W 79° 13' 38.1"	P06	N 45° 33' 17.9" W 79° 13' 35.3"

## Perbeth/Fisher Lake

Perbeth Lake, also known as Fisher Lake, is located 2.8 km south of Kearney. It is a very shallow lake and has both springs and marshes in the lake. There is no Crown Land around the lake and the riparian zone is currently under construction with new cottages being built. The map of the lake with the sample sites and their GPS coordinates are shown below

Perbeth/Fisher Lake characteristics (MNRF, 2015).

Surface Area	Mean Depth	Max Depth	Perimeter
31 Ha	2m	4.5 m	4 km (plus 0.6 km island shoreline)



Map of Perbeth/Fisher Lake with sample sites, Retrieved from Coogle Earth

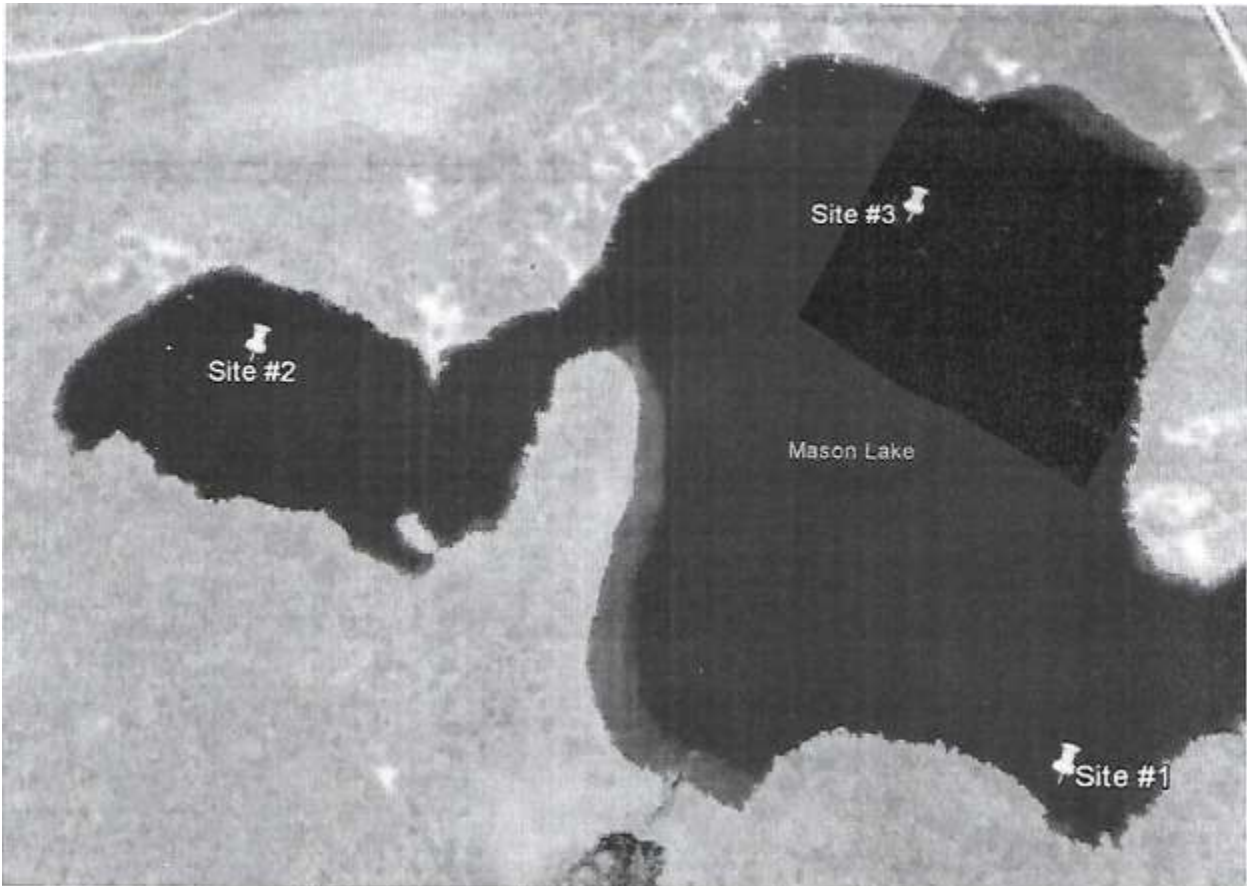
GPS Coordinates for sample sites at Perbeth/Fisher Lake.

PFOI	N 45° 32' 34.7" W 79° 12' 22.5"	PF04	N 45° 32' 22.4" W 79° 12' 12.2"
PF02	N 45° 32' 36.7" W 79° 12' 15.2"	PF05	N 45° 32' 17.6" W 79° 12' 25.1"
PF03	N 45° 32' 31.5" W 79° 12' 12.3"	PF06	N 45° 32' 19.1" W 79° 12' 31.3"

Above PF04 coordinates are incorrect we used N 45° 32' 22.7" W 79° 12' 20.8" based on the above map and our lake stewards memory of the location. PF04 would have put us several hundred feet into the bush.

## Mason Lake

Mason Lake has a surface area of only 40 hectares and is the smallest lake sampled in this report. Maximum depth is 14m, mean depth is 6m and perimeter is 4km. This lake is spring-fed on the northwestern side. Mason Lake is moderately developed with private residences without any public access points. A map of the lake and the location of sampling sites including their GPS coordinates are located below.



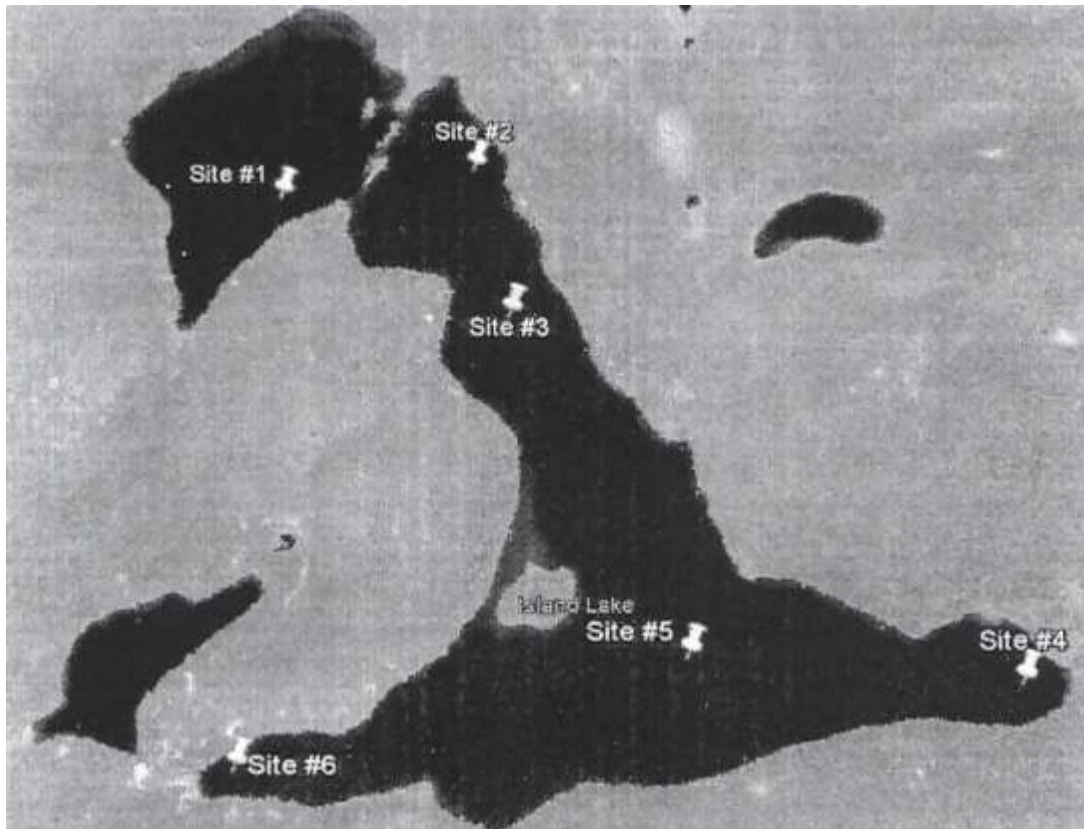
Map of Mason Lake with sample sites, Retrieved from Google Earth

Mason Lake sites and GPS coordinates.

Site	GPS Co-ordinate
M1	N45°38' 15.9" W079°13'55.4"
M2	N45°38'27.5" W079°14'26.7"
M3	N45°38'32.7" W079°14'00.8"

## Island Lake

Island Lake, previously called Proudfoot Lake, is a medium-sized lake which supports a large diversity of fish species (US EPA, 2012b). There is a public access point at the southwestern tip of Island Lake with a small parking lot and dock for cottagers. There is a moderate amount of development surrounding the lake. Surface area is 130 ha, perimeter is 8.7 km Maximum depth is 29 m and mean depth is 10 m. A map of the lake showing the location of the sampling sites plus a list of their GPS coordinates are located below.



Map of Island Lake with sample sites, Retrieved from Coogle Earth

Island Lake sites and coordinates.

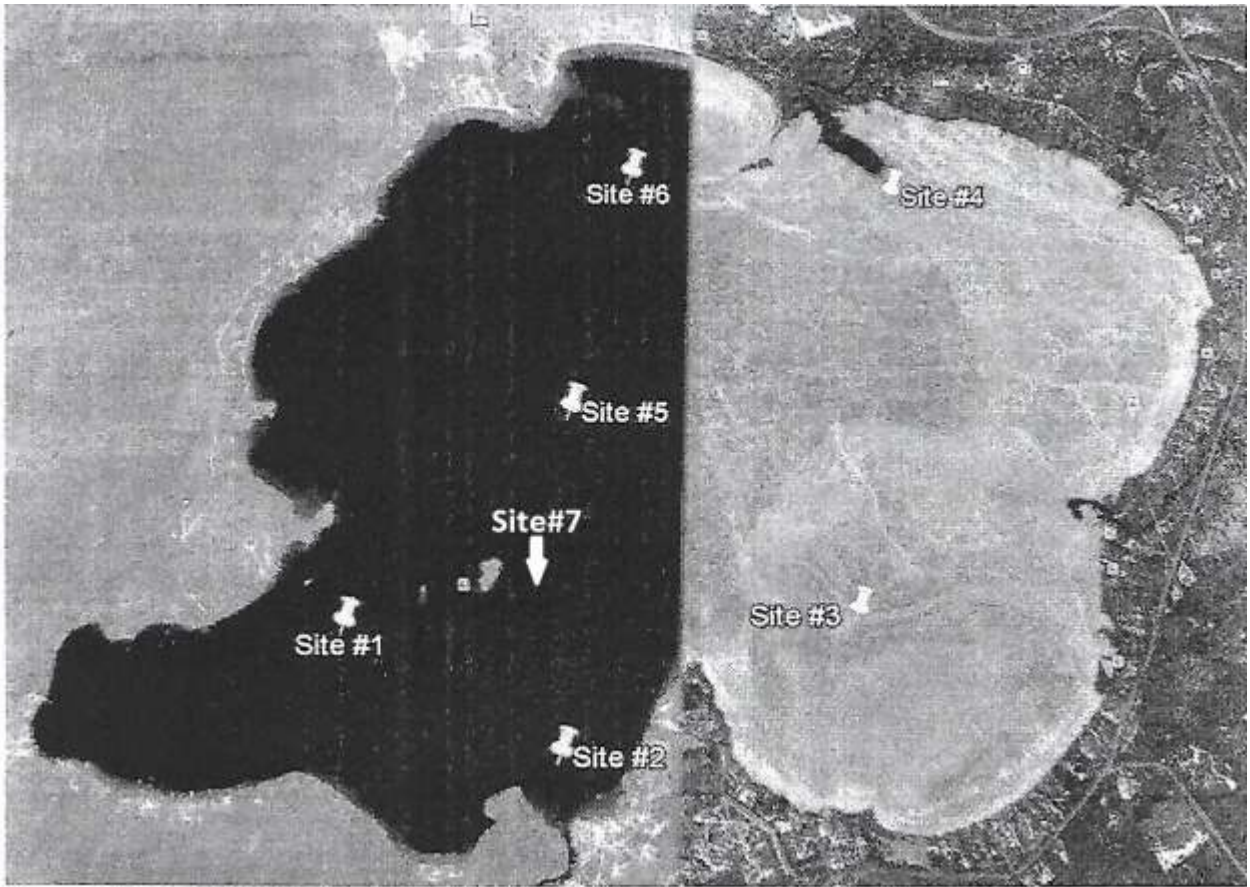
Site	GPS Coordinate	Site	GPS Coordinate
11	N45°41'30.6" W079°14' 52.7"	14	N45° 40' 52.6" W079°14'35.5"
12	N45°41'33.2" W079°14' 31.9"	15	N45° 40' 54.9" W079°14'07.6"
13	N45°41'22.5" W079°14' 25.0"	16	N45° 40' 47.5" W079°14' 51.0"

Site 11, 12 & 13 were all listed as being the same. Using the map above as a reference, our lake steward/volunteer took us to the sites as he remembered them and we recorded new coordinates which are reported above.



## Sand Lake

Sand Lake has a surface area of 580 hectares and is highly developed with approximately 300 cottages and 4 public resorts around its 12.2 km perimeter. It has a maximum depth of 59m and a mean depth of 22m. This lake can be accessed through a public access point. There are sandy beaches along several shores, which appear to be eroding and creating a shallow shoreline. The Magnetawan River flows in through the north side of the lake and exits at the south side. A map of the lake showing the location of sampling sites plus their GPS coordinates are located below.



Map of Sand Lake with sample sites, Retrieved from Google Earth Sand Lake sites and GPS coordinates

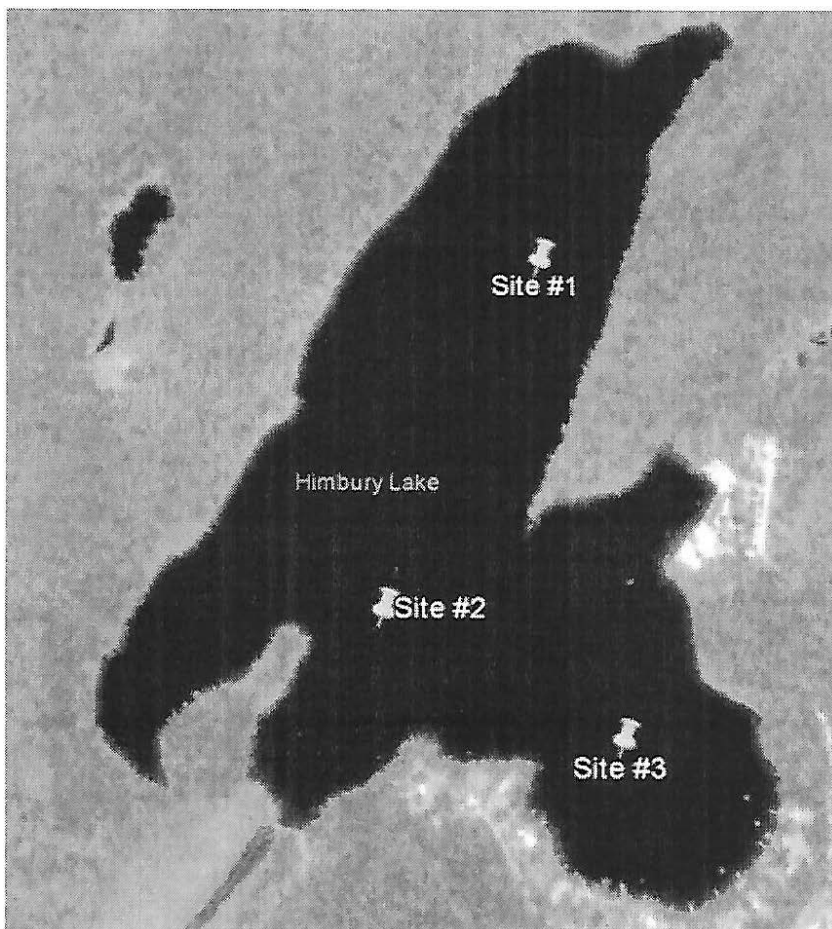
Site	GPS Co-ordinate	Site	GPS Co-ordinate
S1	N45°37'12.7" W079°11'09.6"	S4	N45°37'57.0" W079°09'55.7"
S2	N45°37'09.7" W079°37'09.7"	S5	N45°37'34.0" W079°10'40.4"
S3	N45°37'13.9" W079°10'01.2"	S6	N45°38'12.1" W079°10'32.9"

W

We found S2 coordinates very inaccurate and replaced them with N 45° 37' 04.6" W79° 10' 41.4" We had problems with high wind and a dragging anchor while evaluating the second instrument in 2016 and picked Site #7 (N45°37' 17.3" W79° 10' 44.3") because it was deep but more sheltered. We don't anticipate including it as a regular sampling site.

### 2.13 Himbury Lake

Himbury Lake is a small lake with a surface area of 49 hectares. This lake is located southwest of Sand Lake reached through a short portage between the two lakes. Much of the development on this lake is on the western side and the northern bay of the lake is surrounded by undeveloped Crown Land. This lake is spring fed on the northern side.



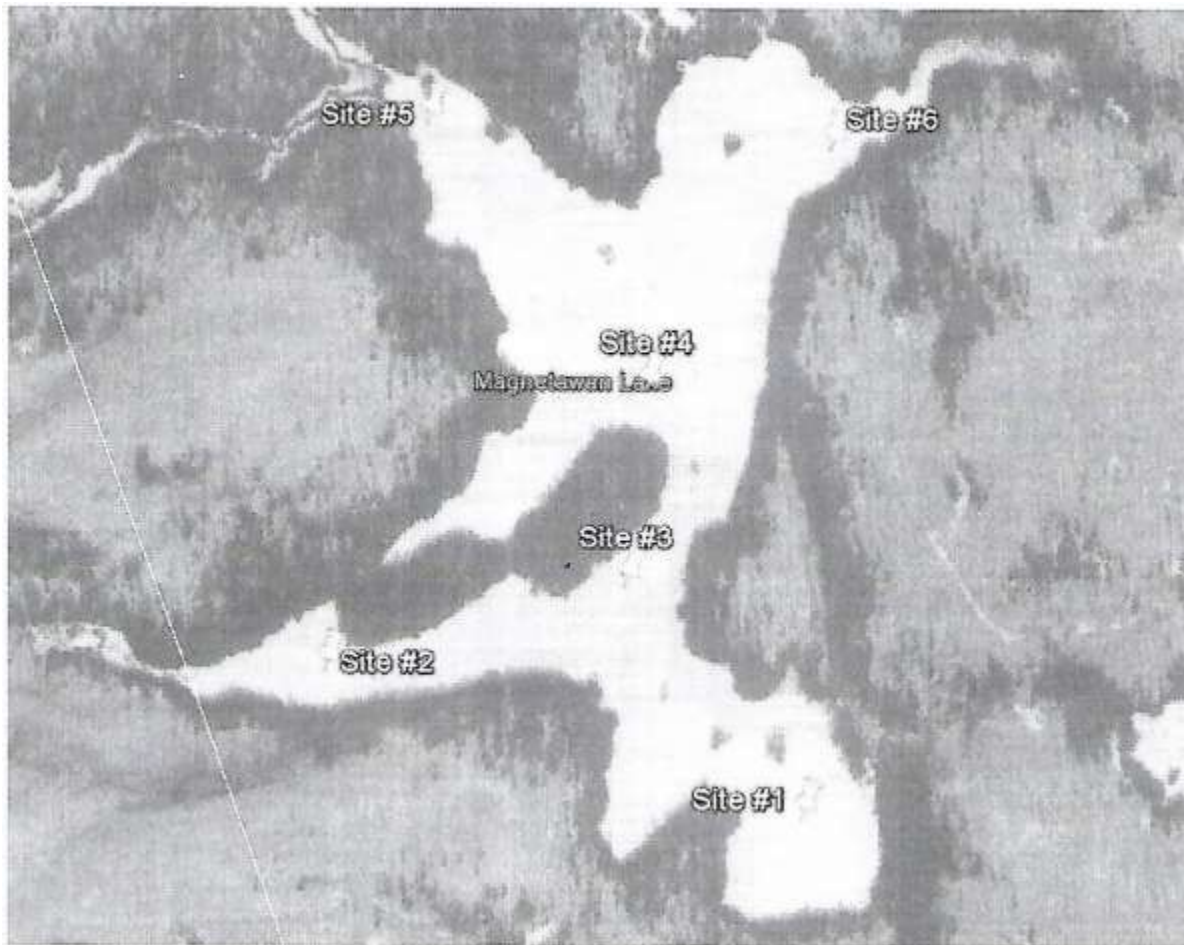
Map of Himbury lake showing sampling sites – retrieved from Google Earth.

GPS Co-ordinates for sample sites listed below.

Site	GPS Co-ordinate
H1	N45°36'31.7" W079°12'12.7"
H2	N45°36'15.4" W079°12'18.5"
H3	N45°36'11.4" W079°12'03.4"

## Magnetawan Lake

Magnetawan Lake is located outside of Kearney and is situated inside the western boundary of Algonquin Provincial Park. This lake is the headwaters for the Magnetawan River and is surrounded by protected land. There are four campsites located around Magnetawan lake. A map of the lake showing the location of the sampling sites plus a list of their GPS coordinates are located below.



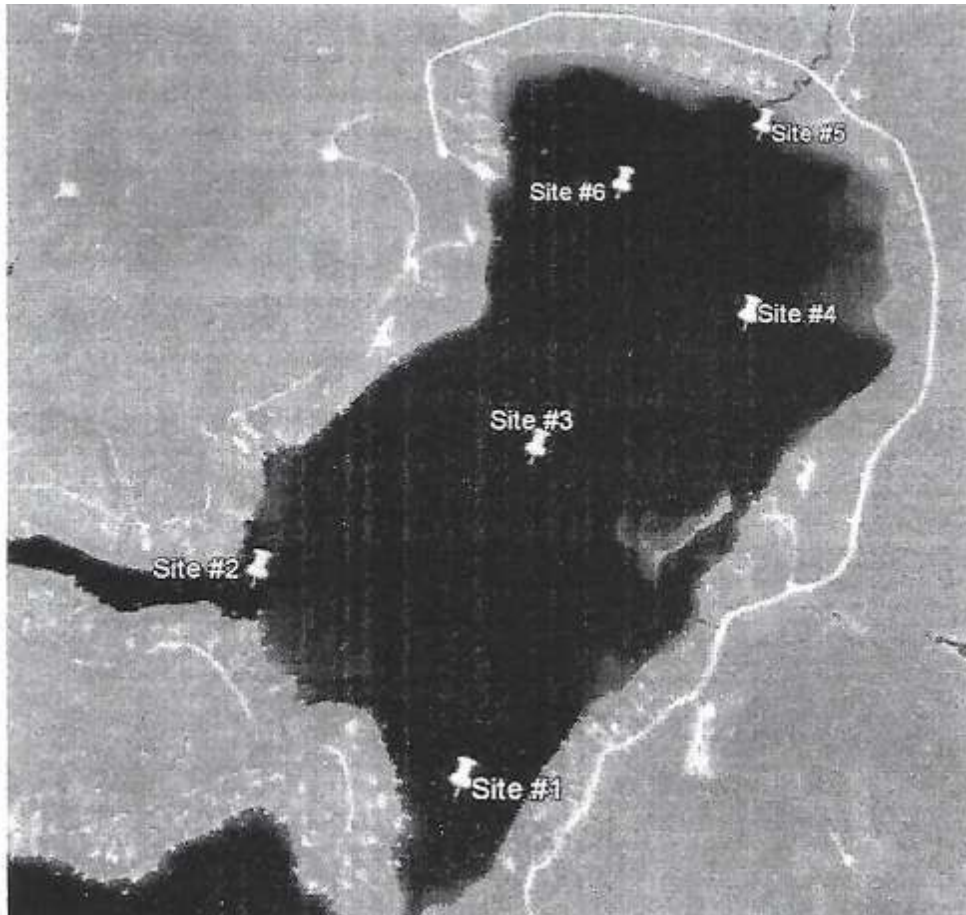
Map of Magnetawan Lake with sample sites, Retrieved from Google

Earth Magnetawan Lake sites and GPS Coordinates

Site	GPS Co-ordinate	Site	GPS Co-ordinate
MW1	N45° 39' 23.4" W078°59'04.2"	MW4	N45° 39' 47.7" W078° 59' 15.4"
MW2	N45° 39' 32.9" W078° 59'39.3"	MWS	N45° 40' 02.1" W078° 59' 32.0"
MW3	N45°39' 37.4" W078°59' 16.9"	MW6	N45°40' 0.07" W078° 59' 1.5"

## Grass Lake

Grass Lake is a medium-sized lake with a surface area of 138 hectares, maximum depth of 37m, mean depth of 11 and a perimeter of 6.4km. This lake is developed with cottages located around the entire perimeter. Grass Lake is connected by a channel to Loon Lake where there is a dam that controls water levels. A map of the lake and the location of sampling sites plus a list of their GPS coordinates are located below.



Map of Grass Lake with sample sites, Retrieved from Google Earth

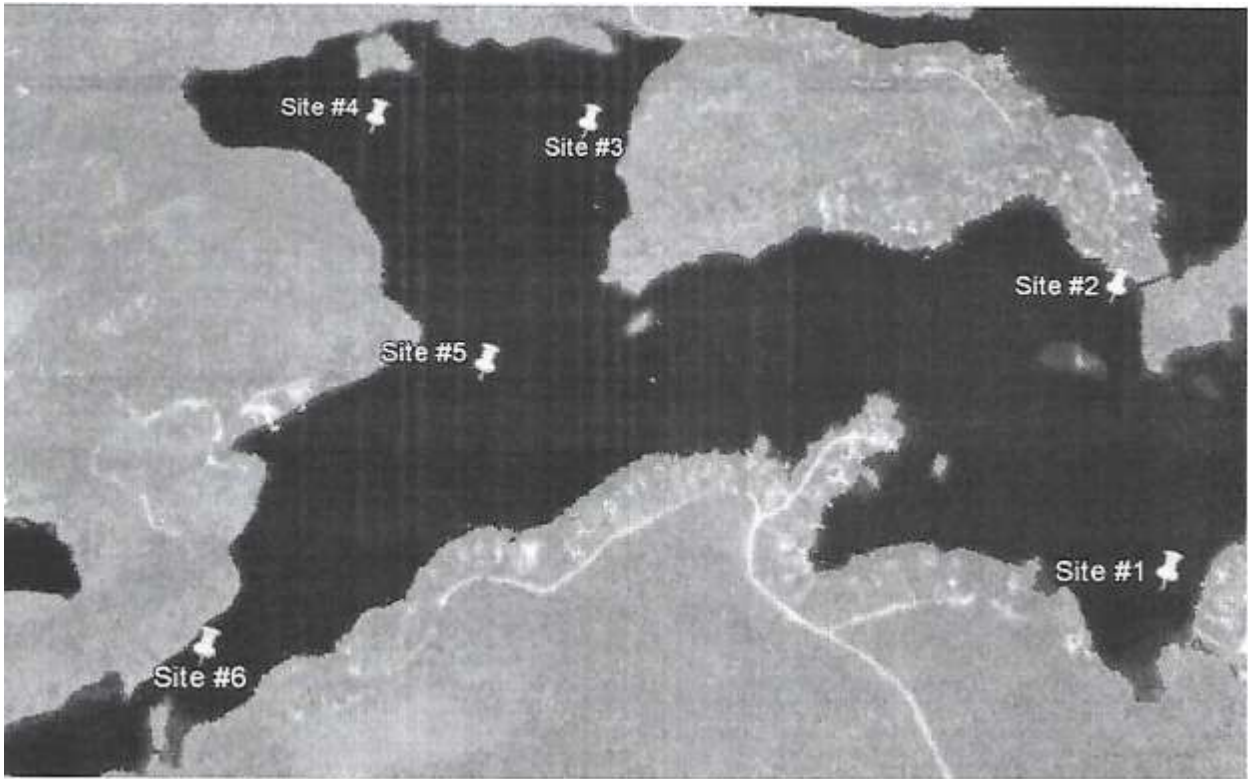
### Grass Lake Sites and Coordinates

Site	GPS Co-ordinate	Site	GPS Co-ordinate
G1	N45° 40' 20.9" W79° 12' 20.6"	G4	N45° 40' 52.7" W79° 11' 56.0"
G2	N45° 40' 33.5" W79° 12' 38.9"	G5	N45° 41' 08.7" W79° 11' 53.7"
G3	N45° 40' 42.6" W79° 12' 15.4"	G6	N45° 41' 03.2" W79° 12' 07.8"



## Loon Lake

Loon Lake has a surface area of 156 hectares, maximum depth of 26.2m, mean depth of 7.1 m and a perimeter of 8.0 km. There is high development along the entire shoreline of this lake. There is a dam operated by the Ministry of Natural Resources that controls water levels in this lake. A map of the lake with the location of sampling sites plus their GPS coordinates are located below



Map of Loon Lake with sample sites, Retrieved from Google Earth

### Loon Lake sites and coordinates

Site	GPS Coordinate	Site	GPS Coordinate
L1	N45° 39' 53.1" W79° 12' 27 .5"	L4	N45° 40' 23.4" W79° 13' 38.0"
L2	N 45° 40' 12.0" W79° 12' 29.6"	LS	N45° 40' 05.3" W79° 12' 29.6"
L3	N45° 40 '23.4" W79° 13' 17.9"	L6	N45° 39' 47.1" W79° 13' 44.2"

## 2.17(a) Magnetawan River

The Magnetawan River is 175 km long and one tributary originates in Algonquin Provincial Park at Magnetawan Lake. The river runs westward and exits into Georgian Bay linking many of the lakes sampled in this report. The sample site MRI is on a tributary that also rises in Algonquin Park passes close to the Kearney Graphite Mine and joins the Magnetawan River just below our sample site MR3. The MR1 sample site is upstream of the mine site and provides us with normal background reading levels. The second site, MR2, was selected about 1.6 km downstream from MRI and the decommissioned graphite mine. There were water quality concerns about mining effluent and tailings leakage. The MR2 sampling site is used to monitor this concern. A map of the river with the location of these two sampling sites plus their GPS coordinates are located below. Map and coordinates for MR3 are on the next page.



Map of Magnetawan River with sample sites, Retrieved from Coogole Earth

Magnetawan River sites and coordinates

Site	GPS Co-ordinate
MRI	N45° 42' 40.3" W79° 04' 07.S"
MR2	N45° 42' 36.7" W79° 05' 20.6"

## 2.17(b) Magnetawan River

We added a third site in 2016 on the Magnetawan River several kilometers below MR2. This additional monitoring point was picked to see how much the pH and conductivity readings were reduced. The site on the river is easily accessed from a bridge over the river. The map of the river with the location of sampling site plus the GPS coordinates are located below.

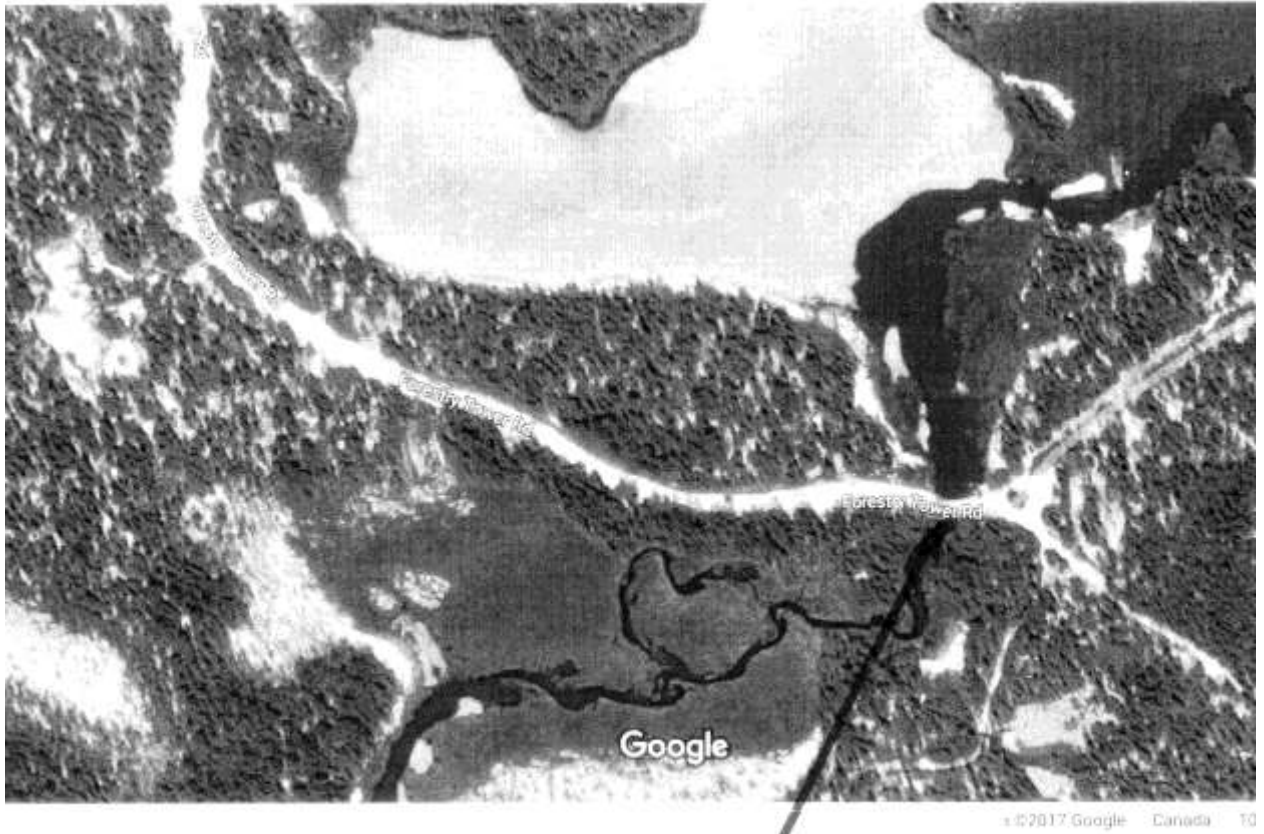


Map of Magnetawan River with third sample site MR3

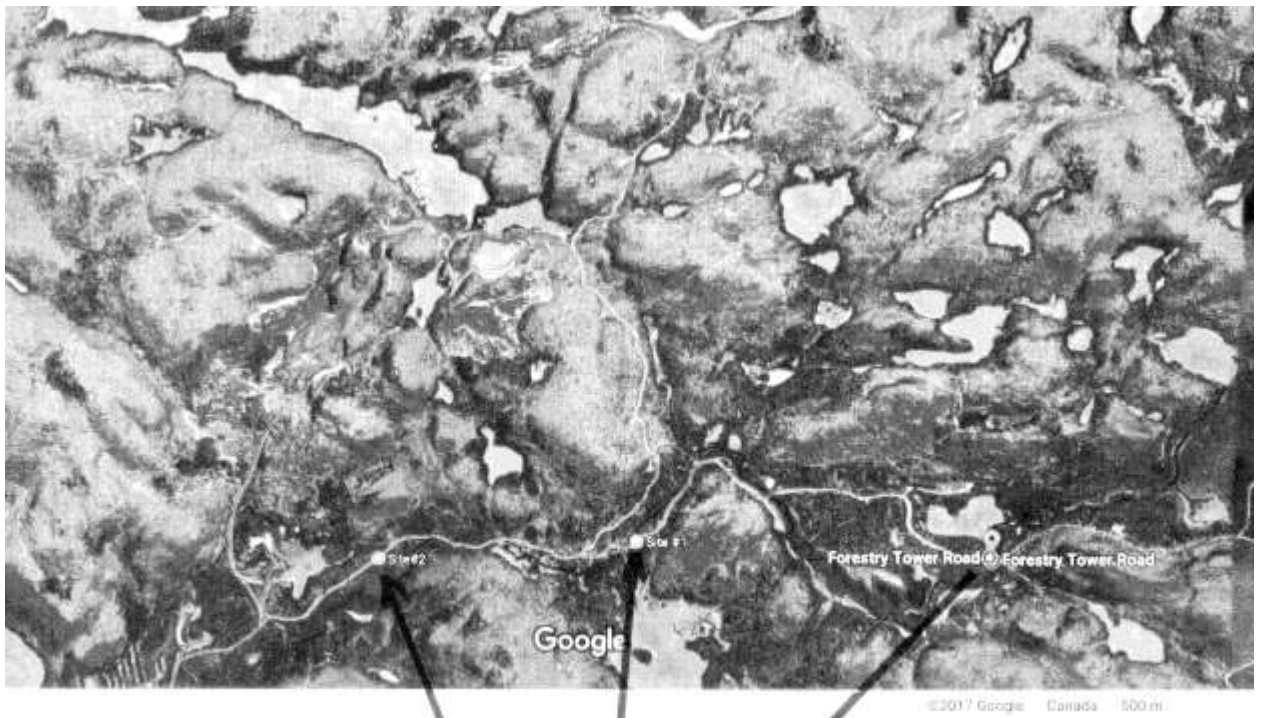
Site #3 GPS coordinates N 45° 40' 12.0" W 79° 07' 46.3

We added two additional sites on the Magnetawan River in 2017. To be sure we were well away from any ground water influences from the mine site we added MR4 which was above MR1 at a culvert on the Forestry Tower Rd that goes to the Magnetawan Lake. This was well above the mine site where water from Charlie's Lake and the headwaters of the Magnetawan River cross the road. Flow is from left-right when you are inbound to Magnetawan Lake. MR5 is at the down river side of the bridge on Hwy #518 where the Magnetawan River crosses just before it enters Sand Lake and was added out of interest to see if the pH and conductivity levels had dropped to background levels this far from the minesite.

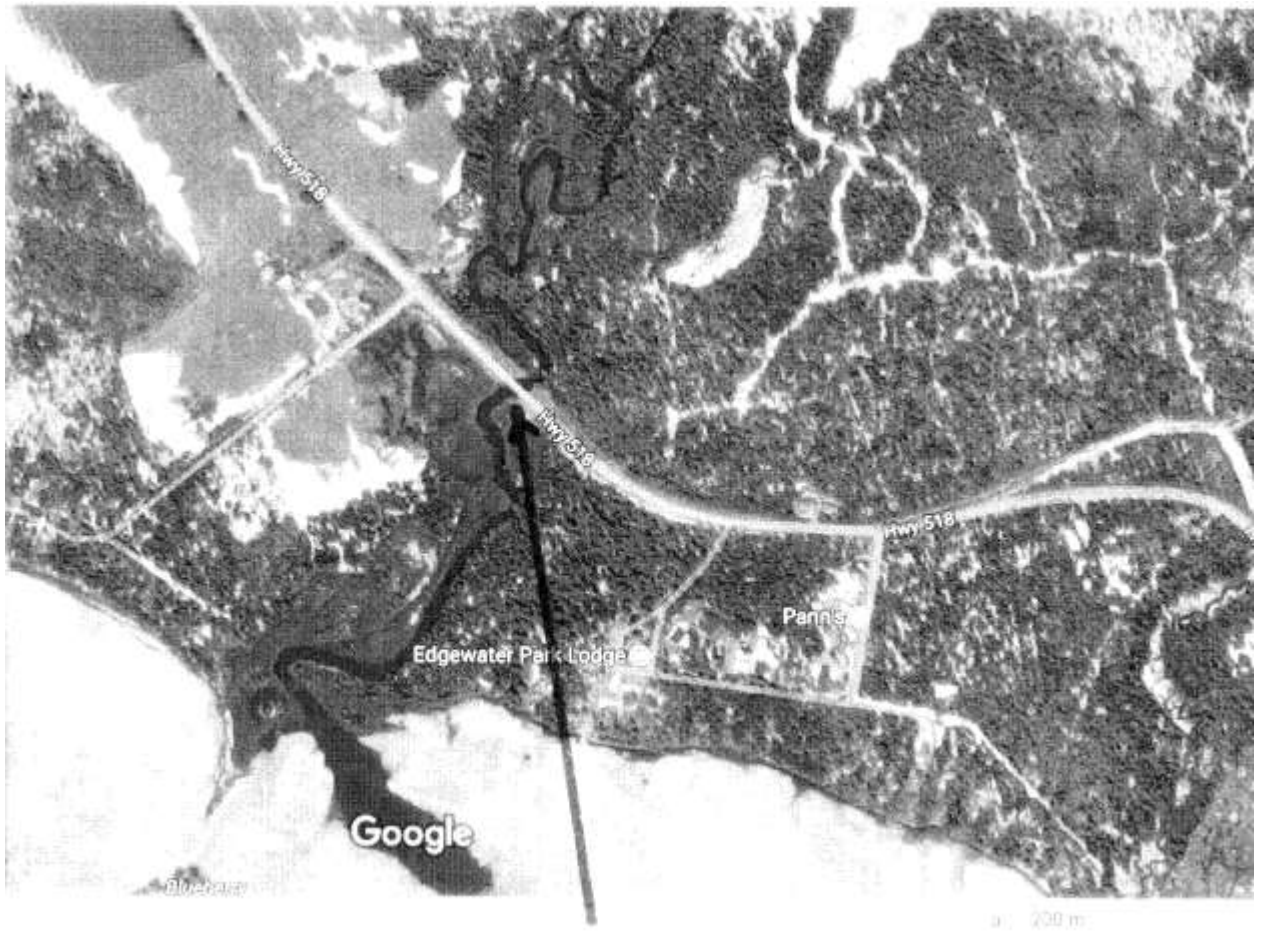




Site #4  
Magnetawan River



Site #2  
Site #1  
Magnetawan River  
Site #4



Site #5 Magnetawan River

**Map of location of Site#5 – Hwy 518 crosses Magnetawan just before the river enters Sand Lake.**

### 3.0 Measurement Methodology

The DO, pH, Conductivity, Turbidity and temperature readings were taken by the YSI PRODSS multi-parameter field instrument on site. The cable connecting the sensor package to the readout unit was marked off in meter intervals. We located the sample sites on the lake using a Magellan eXplorist 310 GPS handheld receiver using the co-ordinates provided in the 2016 reports. Errors in the co-ordinates recorded in 2014/2015 have been corrected. The co-ordinates are entered prior to arriving at the lake..

When we arrived at each sample site we verified the depth of water with a depth finder, and if the volunteer was able to hold the boat on station we didn't use an anchor to avoid stirring up the mud on the bottom. We lowered the sensor package into the water at the surface, waited for the readings to stabilize then took the initial set of readings by pressing the "take sample" button on the instrument. The data is recorded in the memory of the hand held display unit. After that the sensor package was lowered a meter at a time using the markings on the cable as a depth reference. At each depth we would wait for the readings to stabilize before recording the readings. If this was the designated deep spot we would continue down for at least 20 meters or until we approached the bottom. If this was a non- deep spot this year we took readings until we had crossed through and were at least a couple of meters below the thermocline or were within a meter of the bottom. All the readings for that particular site on the lake were kept in the same file in the memory of the display unit.

This year we also took a water sample at two different sites on the next five designated lakes. Once we had established the depth of the thermocline using the PRO DSS instrument, we rinsed the water sampler bottle thoroughly with distilled water and then surface water several times then lowered it down to the thermocline area slowly so that we collect a composite sample. The sampler was then returned to the surface where the lab sample bottle was rinsed 3 times with water from the sampler bottle before filling it with more water from the sampler bottle.

This year we continued to only do a profile on one deep spot per lake to keep our time on the lake to about 90 - 120 minutes if there were six sample sites. On the other sites we still did a profile but generally just down to 5-7 meters if water depth permitted. Each evening the data collected that day was uploaded from the instrument into a spreadsheet on a personal computer.

The YSI ProDSS worked well. The depth measurement capability is essential if there is only one person performing the logging. The instrument was calibrated both times at Hoskins Scientific before we picked them up and we were provided with standard solutions so that we could check the calibration. We checked both instruments at the start, during the test program and before the instrument was returned to be sure the unit was still calibrated.

We also took at least one Secchi disc reading on each lake. We are aware that there can be quite a variation in Secchi disc readings caused by amount of sunlight, wave action and what the individual observer considers a "visible" disc. Secchi readings are also taken by the Lake Partners volunteers throughout the summer and should be similar to our readings. We have continued to include some information copied from the Environment Canada website regarding rainfall and pH.

## Measured Parameters and Water Quality Standards

The parameters measured were chosen by the community partners because of their ability to indicate the health of a lake (WHO, 2011; EPA, 2012). Guidelines describing appropriate or safe levels for measured parameters were found in the MOECC's Provincial Water Quality Objectives (PWQO) and the World Health Organization's (WHO) Guidelines for Drinking-Water Quality (MOECC, 1994; WHO 2011). PWQO measure the aquatic toxicity, bioaccumulation, and mutagenicity of a water source in order to identify the quality of water for human recreation purposes and overall health of the lake (MOECC, 1994). In order to maintain the PWQO, the water quality of lakes in Ontario should be monitored regularly and compared to appropriate standards.

## Temperature

The temperature of a water source can directly affect many of the physical, biological, and chemical factors of aquatic organisms (Environment Canada, 2013). If the temperature rises above the tolerance for a specific organism it can lead to detrimental effects (Environment Canada, 2013). Temperature can also affect other parameters within the water, such as, dissolved oxygen. High water temperatures can decrease oxygen levels and increase algal growth, while low water temperatures can increase oxygen levels (CCME, 2011).

### Preferred Temperature Range for Adult Freshwater Fish (Deg. Celsius)

Name	Range	Limit	Name	Range	Limit
Atlantic Salmon	12-16	23	Lake Trout	9-13	23
Chinook Salmon	12-16	25	Lake Whitefish	11-15	26
Coho Salmon	12-16	25	Pink Salmon	13-17	24
Rainbow Trout	12-20	26	Brook Trout	13-17	24
Northern Pike	17-21	32	Brown Trout	15-18	24
Walleye	19-23	31	Yellow Perch	20-24	31
Black Crappie	21-25	32	White Sucker	22-26	31
Small Mouth Bass	20-26	35	Muskellunge	22-26	33
Freshwater Drum	24-28	32	White Bass	28-32	36

Pumpkinseed	22-30	35	Rock Bass	25-29	36
Bluegill	24-30	35	Brown Bullhead	26-30	36
Bowfin	28-32	35	White Perch	26-30	36
Common Carp	28-32	35	Largemouth Bass	26-30	36

The material above was taken from a poster published by Fisheries & Oceans Canada, Conservation Ontario and Ontario Ministry of Natural Resources.

The “Limit” in the table above is actually Upper Lethal Limit – all temperatures are in degrees Celsius

### Secchi Disc

Secchi discs are used to provide a visual measure of water clarity and optical depth (CCME, 2011). A secchi disc is lowered into the body of water in a shaded location; the best time of day to sample sec chi depth is midday (CCYIE, 2011). The deeper the secchi disc reading is, the clearer the lake. The CCME recommends that secchi measurements should be made every two weeks between June and October, if possible. Secchi depth provides an idea of how turbid the water is. High turbidity can be caused by soil erosion, waste discharge, urban runoff and excessive algal growth (EPA, 2012). The Provincial Water Quality Guidelines states that if the water body is for recreational use, and the bottom is not visible, the water should have a secchi reading of at least 1.2 m (MOECC, 1994).

### 4.0 Dissolved Oxygen

Dissolved oxygen (DO) is present in water due to photosynthetic activity and diffusion (CCME, 1993). The DO concentration is dependent on the temperature and atmospheric pressure within the water (CCME, 2011). Fast moving water will have higher dissolved oxygen due to the mixing of water with air (CCME, 1993). Oxygen is required for basic life processes. Higher levels can better support some sensitive lake species and is used as an indicator of water quality. The presence of agriculture, industry and deforestation can lower dissolved oxygen levels, because runoff from these sources can react with oxygen through decomposition reactions (CCME, 1993). Recommended levels for cold-water systems are no lower than 9.5 mg/L (CCME, 1993).

### Dissolved Oxygen requirements for various fish Species

The following information was taken from the following website :

<http://www.fondriest.com/environmental-measurements/parameters/water-quality/dissolved-oxygen>

Coldwater fish like trout and salmon are most affected by low dissolved oxygen levels. The mean DO level for adult salmonids is 6.5 mg/L, and the minimum is 4 mg/L . These fish generally attempt to avoid areas where dissolved oxygen is less than 5 mg/L and will begin to die if exposed to DO levels less than 3 mg/L for more than a couple days . For salmon and trout eggs, dissolved oxygen levels below 11 mg/L will delay their hatching, and below 8 mg/L will impair their growth and lower their survival rates. When dissolved oxygen falls below 6 mg/L (considered normal for most other fish), the vast majority of trout and salmon eggs will die.

Bluegill, Largemouth Bass, White Perch, and Yellow Perch are considered warm water fish and depend on dissolved oxygen levels above 5 mg/L. They will avoid areas where DO levels are below 3 mg/L, but generally do not begin to suffer fatalities due to oxygen depletion until levels fall below 2 mg/L. The mean DO levels should remain near 5.5 mg/L for optimum growth and survival .

Walleye also prefer levels over 5 mg/L, though they can survive at 2 mg/L DO levels for a short time. Muskie need levels over 3 mg/L for both adults and eggs . Carp are hardier, and while they can enjoy dissolved oxygen levels above 5 mg/L, they easily tolerate levels below 2 mg/L and can survive at levels below 1 mg/L .

The freshwater fish most tolerant to DO levels include fathead minnows and northern pike. Northern pike can survive at dissolved oxygen concentrations as low as 0.1 mg/L for several days, and at 1.5 mg/L for an infinite amount of time. Fathead minnows can survive at 1 mg/L for an extended period with only minimal effects on reproduction and growth.

As for bottom-dwelling microbes, DO changes don't bother them much. If all the oxygen at their water level gets used up, bacteria will start using nitrate to decompose organic matter, a process known as denitrification. If all of the nitrogen is spent, they will begin reducing sulfate<sup>17</sup>. If organic matter accumulates faster than it decomposes, sediment at the bottom of a lake simply becomes enriched by the organic material.

## **Conductivity**

Conductivity is a measure of the ability of water to conduct electricity. This parameter is affected by the number ions that are dissolved in the water (EPA, 2012). If a lake were to have a high amount of inorganic solids, the water would be more conductive whereas if the lake were to have more amounts of organic solids it would be less conductive (EPA, 2012). The conductivity for lake water should be below 500 micro Siemens/centimeter. If a lake were to have a higher conductivity than the suggested limit, the water may not be suitable for living organisms (EPA, 2012).

## **pH**

The pH of a solution is a measure of the concentration of H<sup>+</sup> ions. The pH has a scale from 0-14, where a pH below 7 is acidic and a pH above 7 is basic. A pH of 7 is considered to be neutral (Environment Canada, 2013). Water that has a pH from 6.5-9 is suitable for aquatic organisms (Environment Canada, 2013). The organisms that are most sensitive to extreme changes in pH are young fish and benthic invertebrates. The pH of a water body can be altered by acid rain, wastewater discharges and drainage from coniferous forests (Environment Canada, 2013).

## **Nitrate**

Nitrate is an essential nutrient for plants, however in excess can be considered a contaminate (EPA, 2012). When nitrate is in excess it can accelerate eutrophication by causing increases in plant growth and changing the types of organisms found in the water. High nitrate levels can also lower the dissolved oxygen level and increase temperature (EPA, 2012). Sources of nitrate contamination are wastewater treatment plants, failing septic systems, runoff from fertilized lawns and manure storage sites. The natural level of nitrate in freshwater is commonly less than 1 mg/L, however, in effluent of some wastewater treatment plants nitrate levels can be 30 mg/L (EPA, 2012). Health Canada states that the maximum nitrate level allowable in drinking water is 45 mg/L (Health Canada, 2012).

## **Nitrite**

Nitrite is usually found in minimal concentrations, but it can be damaging. The concentration increases with chloro-aminated waters, which is a result of waste water treatment (WHO, 2011).

Nitrite quickly converts to nitrate when exposed to oxygen, which is part of the reason why nitrite is found in such low levels (Health Canada, 2011). It is naturally present due to the nitrogen cycle, but it can be present in higher levels due to agriculture, fertilizers, waste, and industry input (Health Canada, 2012). Infants are more susceptible to health risks from increased nitrite levels, but the common health concern related to nitrite is methemoglobinemia, which impairs the ability of blood cells to bind with oxygen (Health Canada, 2012). The maximum acceptable nitrite concentration in drinking water is 3 mg/L (Health Canada, 2012)

## Phosphate

Phosphate (orthophosphate) is an inorganic form of phosphorus and an essential nutrient. Aquatic plants use orthophosphate and convert it to organic phosphate for their tissue (EPA, 2012). Phosphate tests measure only the orthophosphate form of phosphorus. Phosphate stimulates the growth of plankton and aquatic plants to provide food for fish. However, human or animal waste, industrial effluents and fertilizer runoff (Oram, n.d.) can provide excess phosphate conditions causing large growth bursts of undesirable organisms and accelerated eutrophication disrupting aquatic ecosystems. (Oram, n.d.). Human consumption of phosphorous has not been found to be a threat to human health, therefore there is no "acceptable" levels for phosphate in drinking water. However, excessive plant growth due to high phosphorous levels can occur at concentrations above 0.03 mg/L (Fleming & Fraser, 1999).

## Total Phosphorus

Total phosphorous is the measure of all forms of phosphorous, including organic, inorganic and poly (EPA, 2012). Phosphorus occurs naturally in rocks and mineral deposits as poly-phosphorous but higher levels can occur as a result of agricultural runoff (CCME, 2011). Phosphorus is a limiting nutrient in freshwater and too much can be harmful resulting in algal blooms and eutrophication (CCME, 2012). Canadian guidelines provide 'trigger ranges' indicating the health of the system according to the total phosphorous level (CCME, 2004). The table below displays these ranges for different trophic systems. The lakes in this study are typically oligotrophic, not exceeding a level of 10 ug/L.

Canadian total phosphorous trigger ranges (CCME, 2004).

<u>Trophic Status</u>	<u>Total Phosphorous (ug/L)</u>
Ultra-oligotrophic	< 4
Oligotrophic	4 - 10
Mesotrophic	10 -- 20
Meso-eutrophic	20 – 35
Eutrophic	.35 - 100
Hyper-eutrophic	> 100



## 5.0 Results

The following tables show the data for temperature, dissolved oxygen (DO), conductivity, pH, turbidity obtained at that specific depth at that site on that specific lake. The depth was chosen as the point where the temperature was approx. 4 degrees lower than the surface temperature which is the area where WSCE had previously taken their water samples.

There are some unusual pH levels in these results. My assumption is that they were caused in large part by the enormous quantities of rain often in a short time period that we experienced over the past summer. Rainfall in our area can be quite acidic (4 - 4.5) as well.

Further on in the results section we have included an example for each lake of the readings obtained at one meter intervals at one of the deep spots on that lake.

TP (Total Phosphorous) levels were obtained from the Lake Partners Program operated by the MOECC in Dorset.

## Beaver Lake

Beaver								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	Ug\L
Site-1	7/26/18 9:18	20.2	32.4	6.86	4.5	6.01		
Site-2	09:39:00	19.7	31.7	6.24	4.8	6.07		
Site-3	10:00:00	24	34.1	8.22	2.6	7.06		
Site-4	10:09:00	23.3	34	7.71	3.6	7.02		
Site-5	10:17:00	24.2	34	8.32	2.4	7.11		
Site-6	10:22:00	24.2	34.1	8.32	2.4	7.11		

## Big Clam Lake

Big Clam-1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/19/18 13:44	23.7	23.2	8.24	3.6	6.93		
Site-2	13:19:00	22.4	23.3	8.54	3.49	6.95		
Site-3	12:56:00	23.5	23.2	8.27	3.4	6.95		
Site-4	12:34:00	22	23.0	9.4	3.5	6.92		
Site-5	12:13:00	22.4	23.3	8.97	3.4	6.94		
Site-6	11:46:00	21.8	22.8	9.55	3.2	6.94		

## Emsdale Lake – not tested in 2018

Emsdale-1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1								
Site-2								
Site-3								
Site-4								
Site-5								
Site-6								

## Fisher / Perbeth Lake

### Fisher/Perbeth-1

Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/26/18 13:44	24.8	29.5	8.00	1.5	6.93		
Site-2	13:55:00	25.1	29.7	8.00	1.1	6.93		
Site-3	14:05:00	24.4	30.2	8.1	1.9	6.84		
Site-4	14:15:00	21.6	37.7	3.48	3.3	6.51		
Site-5	14:27:00	19.3	43.4	1.06	3.6	6.09		
Site-6	14:48:00	23.7	31.2	6.2	2.9	6.41		

## Grass Lake

### Grass-1

Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/23/18	18.6	17.9	10.37	5.5	7.13		
Site-2	10:08:00	23.3	17.8	8.57	5.3	7.22		
Site-3	09:18:00	18.7	17.8	10.48	5.5	7.17		
Site-4	09:25:00	20.7	17.8	10.23	5.5	7.28		
Site-5	09:50:00	21.1	18.1	9.85	5.5	7.23		
Site-6	09:56:00	21.4	18.2	9.44	5.4	7.24		

## Groom/Lynx Lake

### Groom-1

Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug\L
Site-1	7/20/18 9:05	23.7	24.6	7.53	2.6	6.68		
Site-2	09:10:00	24	24.3	7.88	2.2	6.81		
Site-3	09:17:00	23.3	24.3	7.85	3.1	6.79		
Site-4	09:24:00	21.1	24.1	8.83	3.2	6.33		
Site-5	09:40:00	19.7	24.9	7.7	3.7	6.25		
Site-6	09:46:00	19.4	28.4	6.75	3.4	6.31		

## Hassard Lake

Hassard -1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/26/18 10:41	20.3	38.6	5.28	3.9	6.63		
Site-2	10:50	23.2	37	6.94	4.4	6.73		
Site-3	11:30	16.8	36.6	8.15	4.53	6.79		
Site-4	11:24	16	37.1	7.68	4.65	6.75		
Site-5	11:13	19.2	36.5	8.16	3.7	6.81		
Site-6	10:59	12.5	33.6	7.49	5.4	6.25		

## Himbury Lake

Himbury-1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/30/18 13.22	10.6	21.7	12.73	7.4	7.11		
Site-2	13:51	19.4	21	11.08	5.3	7.17		
Site-3	14:06	20.6	20.3	11.9	5.3	7.14		
					..			

## Island Lake

Island-1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/31/18 10:03	19.8	18.3	12.87	4.7	7.01		
Site-2	10:18	21.4	19.4	10.51	5.5	6.96		
Site-3	10:34	21.6	19.4	10.58	5.4	7.00		
Site-4	10:49	22.2	19.6	9.01	5.5	6.93		
Site-5	11:03	21.2	19.5	10.38	5.4	6.96		
Site-6	11:16	22.7	19.7	8.35	5.3	6.85		

## Little Clam Lake

### Little Clam Sampling site

	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	8/10/18 14:02	19.9	21.7	12.29	5.8	7.04		
Site-2	14:13	23.6	21.8	8.72	4.68	6.99		
Site-3	13.41	24.4	21.6	8.52	1.4	7.17		

## Loon Lake

Loon-1 Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	7/23/18 11:16	18.7	17.4	11.99	5.5	6.98		
Site-2	11:28	20.0	18.5	10.30	5.4	6.99		
Site-3	11:39	23.5	18.1	8.58	4.4	6.97		
Site-4	11:51	18.1	18.8	10.73	5.9	7.00		
Site-5	12:02	20.5	18.8	9.66	5.4	6.98		
Site-6	12:16	19.2	17.4	12.16	5.5	7.01		

## Magnetawan Lake

### Magnetawan Lake

Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug\L
Site-1	1/08/18 10:35	19.8	12.9	11.34	4.7	6.29		
Site-2	10:53	17.8	13.1	11.51	4.8	5.99		
Site-3	11:05	19.2	12.9	10.56	4.7	6.18		
Site-4	11.13	18.2	12.3	11.59	4.9	6.41		
Site-5	11.26	17.8	12.9	10.35	4.9	6.38		
Site-6	11:37	19.2	12.7	10.65	4.9	6.43		

## Magnetawan River

### Magnetawan River

Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug/L
Site-1	7/08/18 15:44	24.5	29.8	7.10	.7	6.34		
Site-2	16:23	26.4	839	7.28	.8	6.73		
Site-3	16:41	25.3	132.2	7.97	.9	6.64		
Site-4	16:01	27.9	28.3	8.66	.7	6.95		
Site-5	16:56	23	82.4	8.23	.9	6.53		

## Mason Lake

### Mason-1

Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug/L
Site-1	7/27/18 9:32	23.5	19.7	8.00	2.9	6.75		
Site-2	9:42	18.8	20.7	8.36	3.6	6.07		
Site-3	9:14	18.6	19.7	10.1	3.8	6.43		

## Perry Lake

### Perry Lake

Sampling site	Date Time D/M/Y HH:MM	Temp C	SpCond uS	DO mg/L	Depth meters	pH	Secchi meters	TP (Lpdata) ug/L
Site-1	24/7/18 9:01	18.4	36.9	10.03	4.3	7.11		
Site-2	9:10	18.1	35.5	10.97	4.3	7.03		
Site-3	9:20	17.2	37.4	9.05	4.4	6.87		
Site-4	9:32	17.6	36.0	10.4	4.5	7.07		
Site-5	9:40	24.3	35.7	8.21	4.5	6.91		
Site-6	9:50	18.8	40.6	6.21	4.5	6.79		

## Peters Lake

Peter-1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug/L
Site-1	20/7/18 13:26	24.9	21.0	7.29	1.3	6.5		
Site-2	13:35	23.8	19.5	7.75	2.7	6.63		
Site-3	13:40	12.6	19.2	12.27	3.9	6.72		

## Sand Lake

Sand-1								
Sampling site	Date Time	Temp	SpCond	DO	Depth	pH	Secchi	TP (Lpdata)
	D/M/Y HH:MM	C	uS	mg/L	meters		meters	ug/L
Site-1	30/7/18 10:01	22.4	33.8	8.96	5.8	7.17		
Site-2	10:14	21.8	31.8	8.69	5.7	7.15		
Site-3	10:26	17.3	31.1	9.03	5.8	6.95		
Site-4	10:37	16.3	32.3	9.02	5.8	6.94		
Site-5	9:35	18.7	30.9	8.93	5.8	6.60		
Site-6	9:24	22.4	31.9	8.72	4.1	7.19		



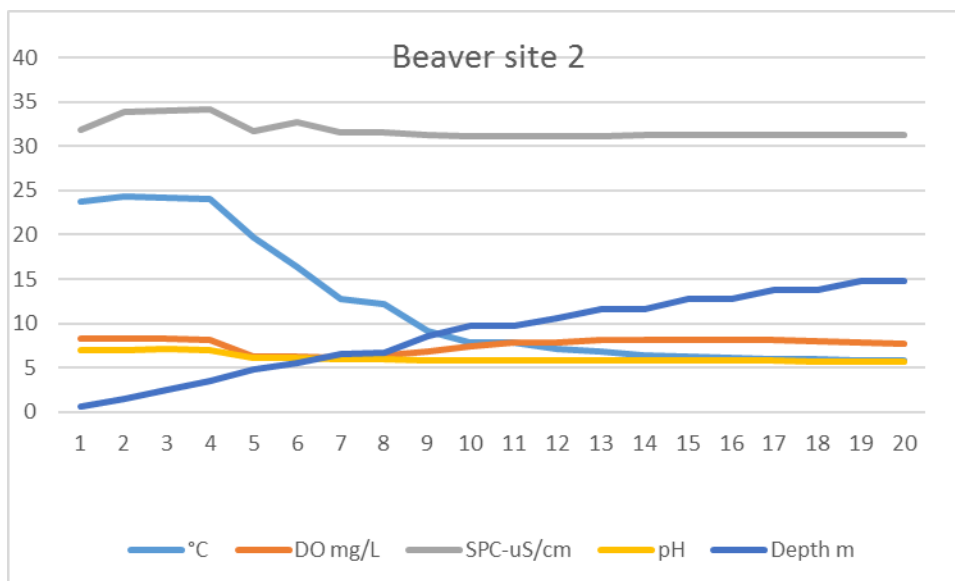
## **Water column profiles for each lake**

We have included an example for each lake of the readings obtained at one meter intervals at one of the deep spots on each lake and we have graphed the readings this year. We also found some interesting information on the DO and temperature requirements for various fresh water fish species which has been included in section 4.3

You will notice that in some lakes the temperature in the lake really starts to drop between 4 - 6 meters and the DO increases. Above that depth the temperature and DO is fairly uniform due to mixing by wind, waves etc. Between 4 and 7 meters the DO is higher than at the surface mainly because the colder water will absorb more oxygen. Based on the secchi disc readings sunlight can penetrate down to these depths so that photosynthesis can occur and oxygen is produced as a by product. Decomposition of plant material etc. at the lower depths consumes oxygen which is not being replenished on an ongoing basis.

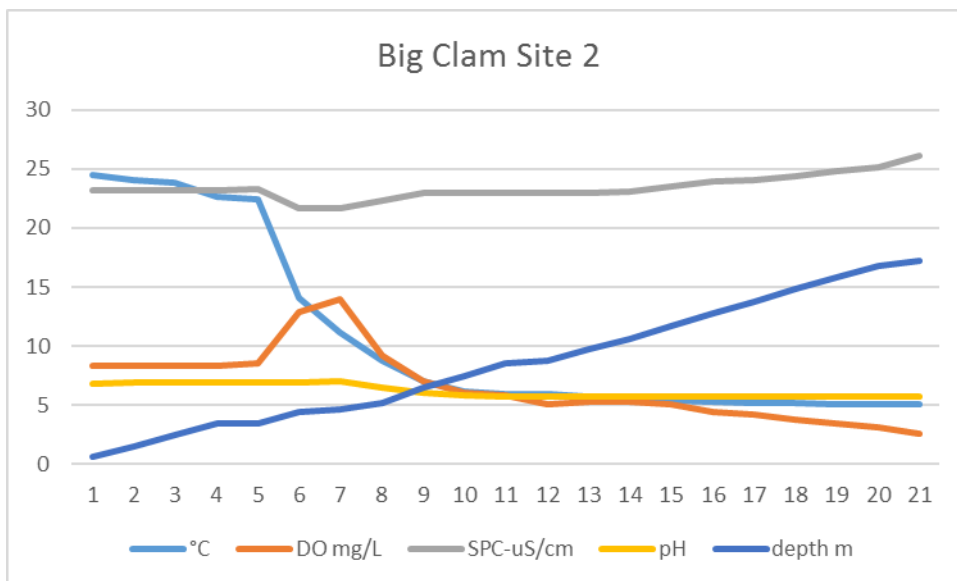
## Beaver Lake Site 2

°C	DO mg/L	SPC- uS/cm	pH	Depth m
23.8	8.32	31.9	7.01	0.6
24.3	8.35	33.9	7.05	1.5
24.2	8.29	34	7.06	2.5
24	8.18	34.1	7.05	3.5
19.7	6.24	31.7	6.07	4.8
16.4	6.28	32.7	6.08	5.6
12.8	6.17	31.6	6.02	6.6
12.2	6.35	31.5	5.96	6.6
9.1	6.77	31.3	5.89	8.6
7.9	7.44	31.1	5.87	9.7
7.8	7.78	31.1	5.86	9.7
7.2	7.91	31.1	5.84	10.6
6.8	8.12	31.1	5.82	11.7
6.4	8.13	31.2	5.79	11.7
6.3	8.09	31.2	5.78	12.7
6.1	8.09	31.2	5.78	12.7
5.9	8.07	31.2	5.76	13.8
5.9	7.94	31.2	5.75	13.7
5.8	7.85	31.3	5.74	14.8
5.8	7.73	31.3	5.73	14.8



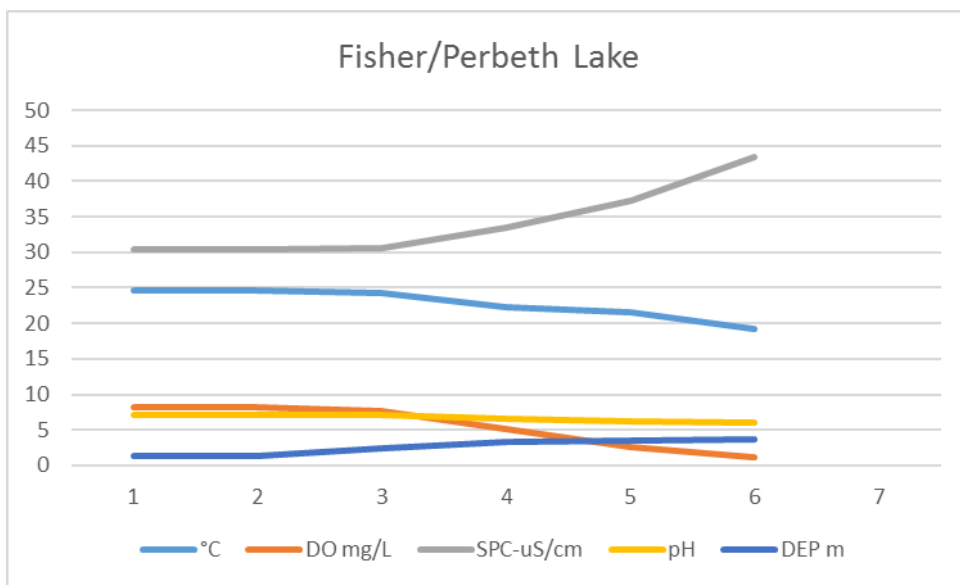
## Big Clam Lake Site 2

°C	DO mg/L	SPC- uS/cm	pH	depth m
24.5	8.32	23.2	6.83	0.7
24.1	8.33	23.2	6.96	1.5
23.8	8.3	23.2	6.98	2.4
22.6	8.35	23.2	6.97	3.5
22.4	8.54	23.3	6.95	3.5
14.1	12.93	21.7	6.97	4.5
11.2	13.94	21.7	7	4.6
8.8	9.18	22.3	6.5	5.2
7	6.99	23	6.01	6.5
6.2	6.03	23	5.83	7.5
5.9	5.81	23	5.78	8.5
5.9	5.13	23	5.72	8.7
5.7	5.25	23	5.72	9.7
5.6	5.27	23.1	5.72	10.7
5.4	5.06	23.5	5.71	11.7
5.3	4.46	23.9	5.7	12.8
5.2	4.22	24.1	5.7	13.8
5.2	3.83	24.4	5.7	14.8
5.1	3.5	24.8	5.7	15.9
5.1	3.14	25.1	5.71	16.8
5.1	2.6	26.1	5.72	17.3



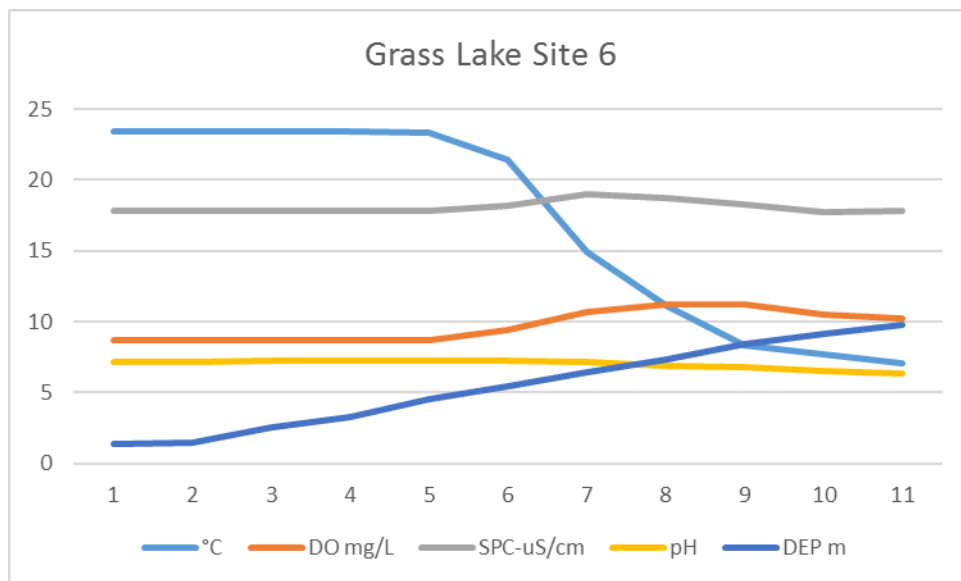
### Fisher / Perbeth Lake Site 5

°C	DO mg/L	SPC- uS/cm	pH	depth m
24.7	8.14	30.4	7.08	1.28
24.6	8.15	30.4	7.07	1.281
24.3	7.61	30.6	7.05	2.353
22.2	5.07	33.4	6.65	3.342
21.5	2.64	37.2	6.22	3.494
19.3	1.06	43.4	6.09	3.618



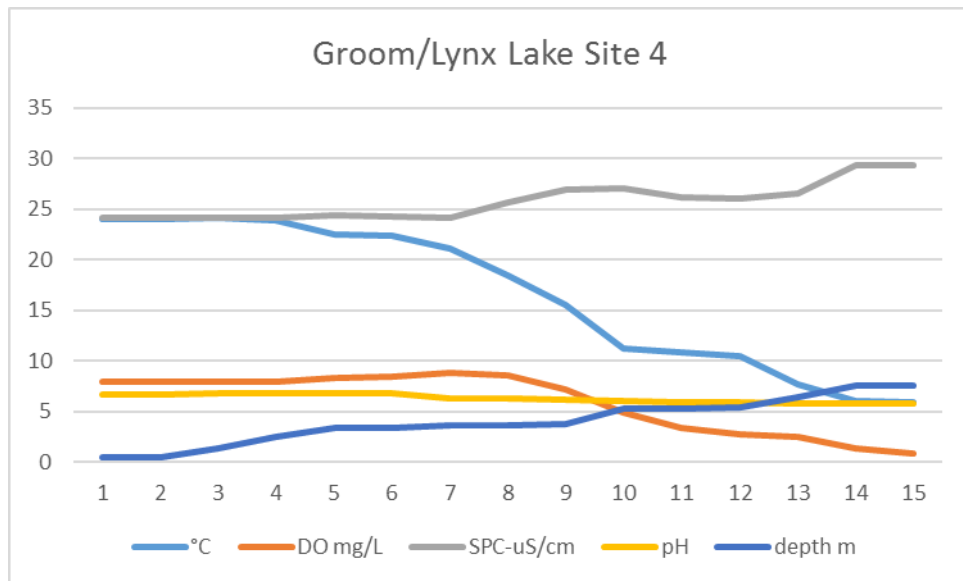
## Grass Lake Site 6

°C	DO mg/L	SPC- uS/cm	pH	depth m
23.4	8.7	17.8	7.16	1.4
23.4	8.71	17.8	7.18	1.5
23.4	8.7	17.8	7.21	2.5
23.4	8.69	17.8	7.23	3.3
23.3	8.68	17.8	7.24	4.5
21.4	9.44	18.2	7.24	5.4
14.9	10.73	19	7.13	6.4
11.1	11.24	18.7	6.88	7.3
8.3	11.19	18.3	6.79	8.4
7.7	10.47	17.7	6.55	9.2
7.1	10.22	17.8	6.33	9.7



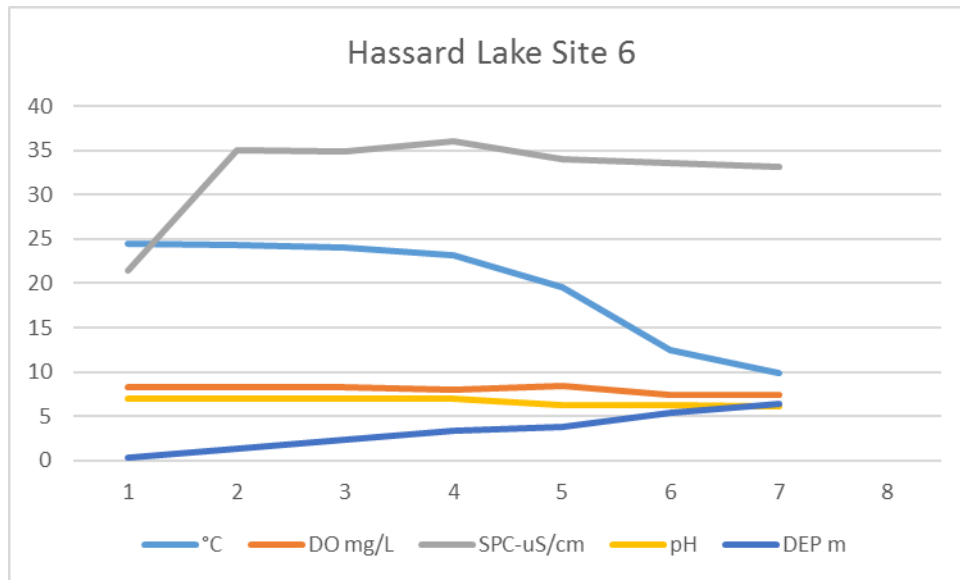
Groom / Lynx Lake Site 4

°C	DO mg/L	SPC- uS/cm	pH	depth m
24	7.95	24.2	6.69	0.46
24	7.94	24.2	6.71	0.47
24.1	7.97	24.2	6.78	1.42
23.9	7.98	24.2	6.82	2.48
22.5	8.31	24.4	6.8	3.38
22.4	8.43	24.3	6.78	3.39
21.1	8.83	24.1	6.33	3.68
18.4	8.62	25.7	6.35	3.71
15.5	7.2	26.9	6.18	3.84
11.3	4.95	27	6.04	5.31
10.9	3.39	26.2	5.97	5.36
10.5	2.83	26.1	5.88	5.42
7.7	2.53	26.5	5.84	6.47
6	1.39	29.3	5.8	7.63
5.9	0.9	29.3	5.83	7.62



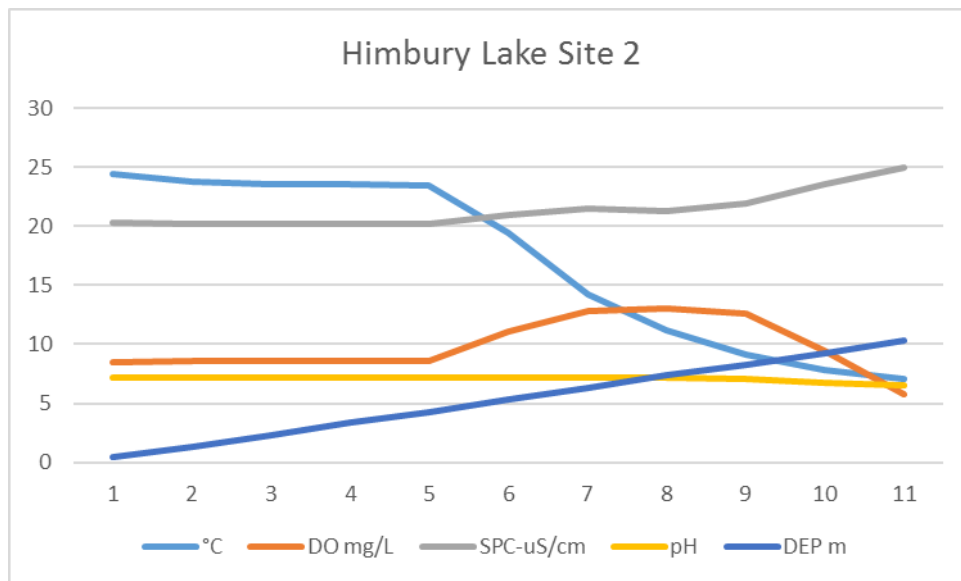
## Hassard Lake Site 6

°C	DO mg/L	SPC- uS/cm	pH	depth m
24.5	8.28	21.5	7.05	0.378
24.3	8.35	35	7.06	1.385
24.1	8.33	34.9	7.05	2.389
23.2	8.04	36	6.96	3.371
19.6	8.4	34	6.31	3.849
12.5	7.49	33.6	6.25	5.425
9.9	7.38	33.2	6.15	6.432



## Himbury Lake Site 2

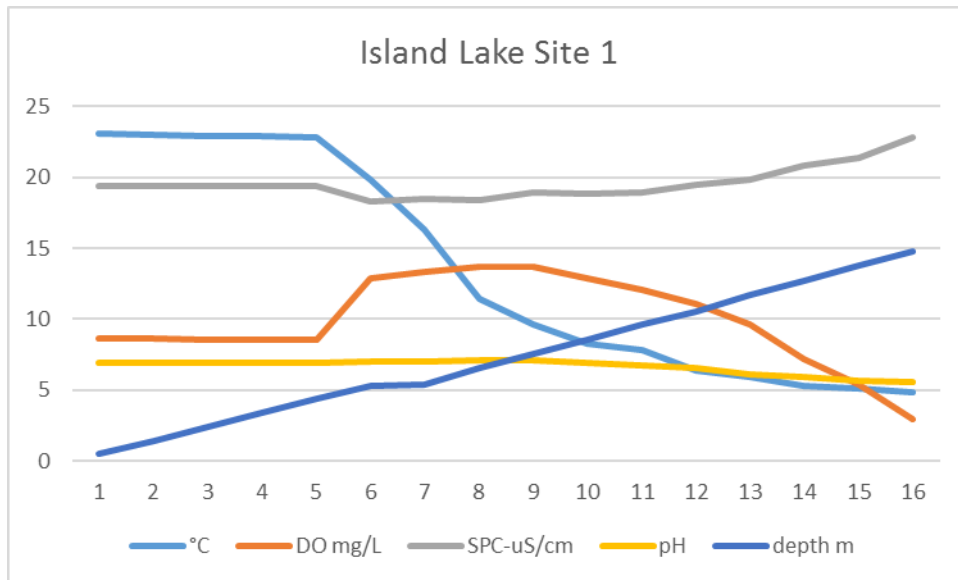
°C	DO mg/L	SPC-uS/cm	pH	Depth m
24.4	8.52	20.3	7.18	0.474
23.8	8.54	20.2	7.17	1.36
23.6	8.58	20.2	7.18	2.343
23.5	8.58	20.2	7.18	3.379
23.4	8.54	20.2	7.17	4.257
19.4	11.08	21	7.17	5.284
14.2	12.77	21.5	7.15	6.337
11.2	13.05	21.3	7.14	7.376
9.1	12.6	21.9	7.05	8.231
7.8	9.49	23.6	6.8	9.236
7.1	5.76	25	6.52	10.321





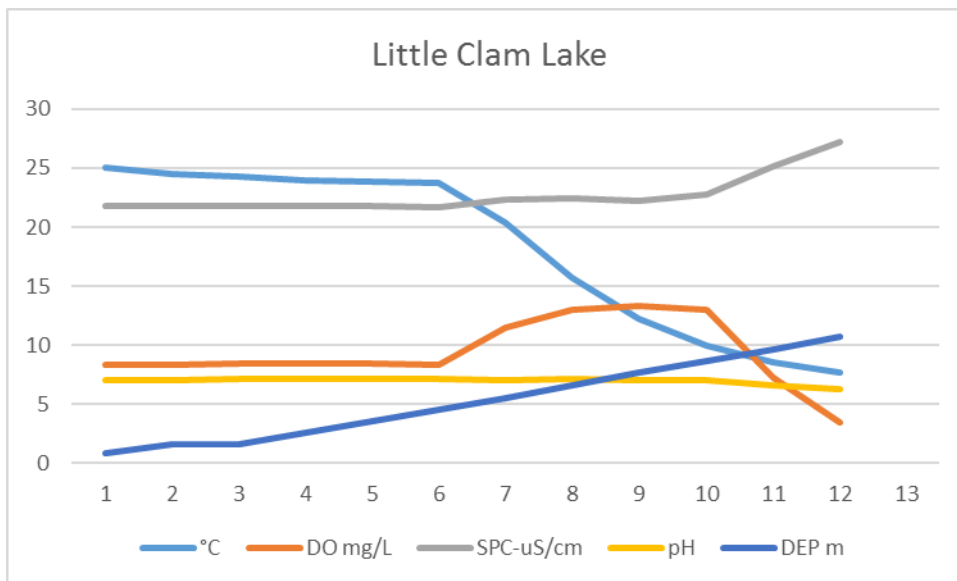
# Island Lake Site 1

°C	DO mg/L	SPC- uS/cm	pH	depth m
23.1	8.61	19.4	6.92	0.52
23	8.6	19.4	6.93	1.424
22.9	8.57	19.4	6.93	2.405
22.9	8.57	19.4	6.92	3.409
22.8	8.59	19.4	6.9	4.422
19.8	12.87	18.3	7.01	5.32
16.3	13.32	18.5	7.04	5.372
11.4	13.69	18.4	7.07	6.518
9.6	13.7	18.9	7.08	7.531
8.3	12.87	18.8	6.96	8.56
7.8	12.07	18.9	6.77	9.622
6.4	11.12	19.5	6.52	10.56
5.9	9.62	19.8	6.13	11.672
5.3	7.23	20.8	5.91	12.726
5.1	5.35	21.4	5.7	13.746
4.8	2.91	22.8	5.61	14.792



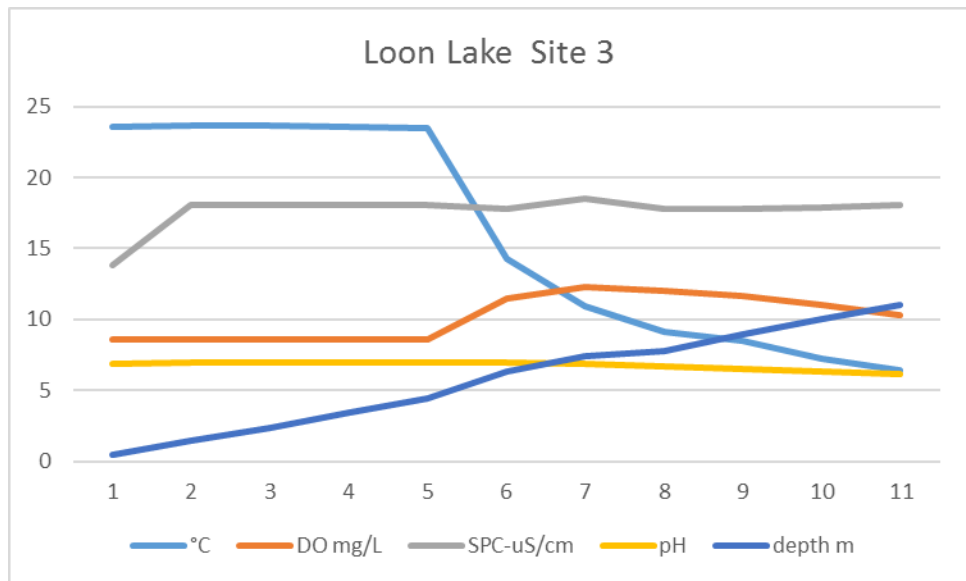
Little Clam Lake – Site 1

°C	DO mg/L	SPC- uS/cm	pH	depth m
25	8.33	21.8	7.08	0.81
24.5	8.33	21.8	7.06	1.57
24.3	8.41	21.8	7.11	1.60
24	8.43	21.8	7.11	2.64
23.8	8.45	21.8	7.1	3.60
23.7	8.38	21.7	7.1	4.57
20.4	11.51	22.3	7.09	5.57
15.7	13	22.4	7.1	6.63
12.3	13.33	22.2	7.05	7.70
10	13.06	22.8	7.02	8.68
8.6	7.31	25.1	6.6	9.70
7.7	3.48	27.2	6.33	10.69



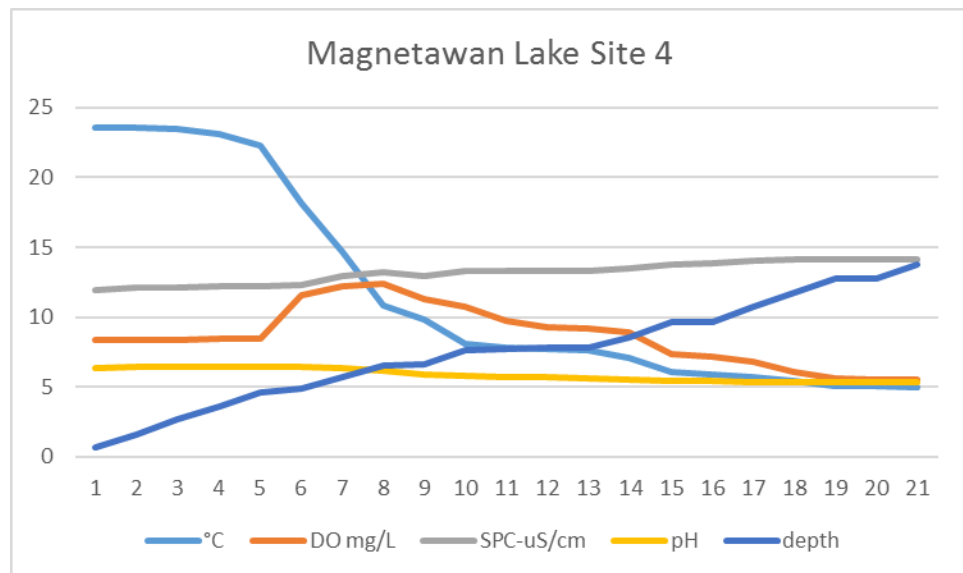
### Loon Lake Site 3

°C	DO mg/L	SPC- uS/cm	pH	depth m
23.6	8.56	13.8	6.88	0.5
23.7	8.58	18.1	6.95	1.4
23.7	8.58	18.1	6.97	2.3
23.6	8.57	18.1	6.97	3.4
23.5	8.58	18.1	6.97	4.4
14.3	11.49	17.8	6.96	6.3
10.9	12.31	18.5	6.9	7.4
9.1	11.99	17.8	6.68	7.8
8.5	11.65	17.8	6.52	9.0
7.2	11.03	17.9	6.32	10.1
6.4	10.3	18.1	6.11	11.0



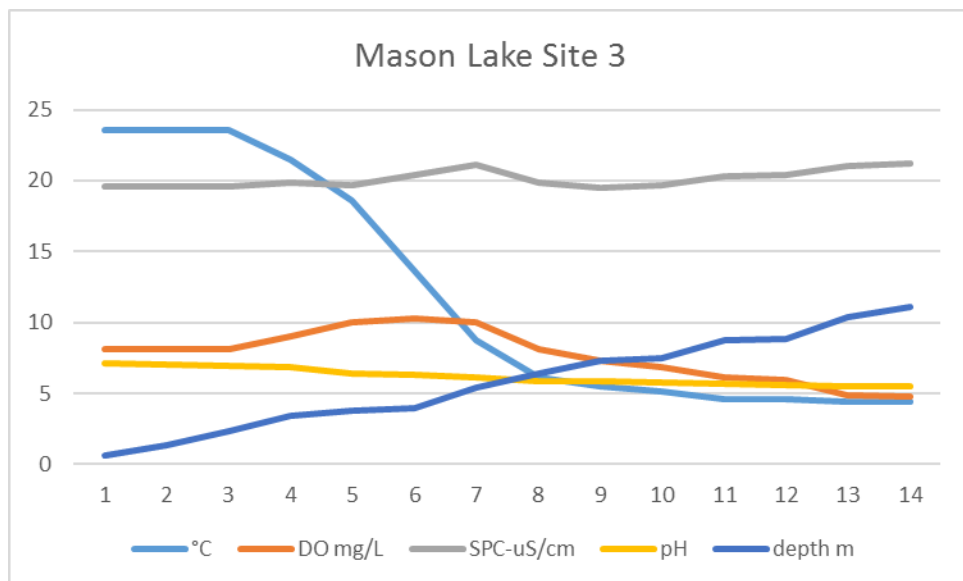
## Magnetawan Lake Site 4

°C	DO mg/L	SPC- uS/cm	pH	Depth m
23.6	8.38	11.9	6.3	0.67
23.6	8.4	12.1	6.42	1.61
23.5	8.38	12.1	6.43	2.68
23.1	8.42	12.2	6.43	3.62
22.3	8.49	12.2	6.43	4.60
18.2	11.59	12.3	6.41	4.89
14.7	12.24	12.9	6.38	5.67
10.8	12.4	13.2	6.16	6.54
9.8	11.26	12.9	5.92	6.64
8.1	10.75	13.3	5.78	7.67
7.8	9.74	13.3	5.7	7.75
7.7	9.28	13.3	5.69	7.78
7.6	9.21	13.3	5.59	7.82
7.1	8.88	13.5	5.54	8.58
6.1	7.39	13.8	5.45	9.67
5.9	7.16	13.9	5.4	9.64
5.7	6.8	14	5.38	10.72
5.4	6.08	14.1	5.35	11.73
5.1	5.58	14.1	5.32	12.75
5.1	5.55	14.1	5.31	12.75
5	5.48	14.1	5.3	13.77



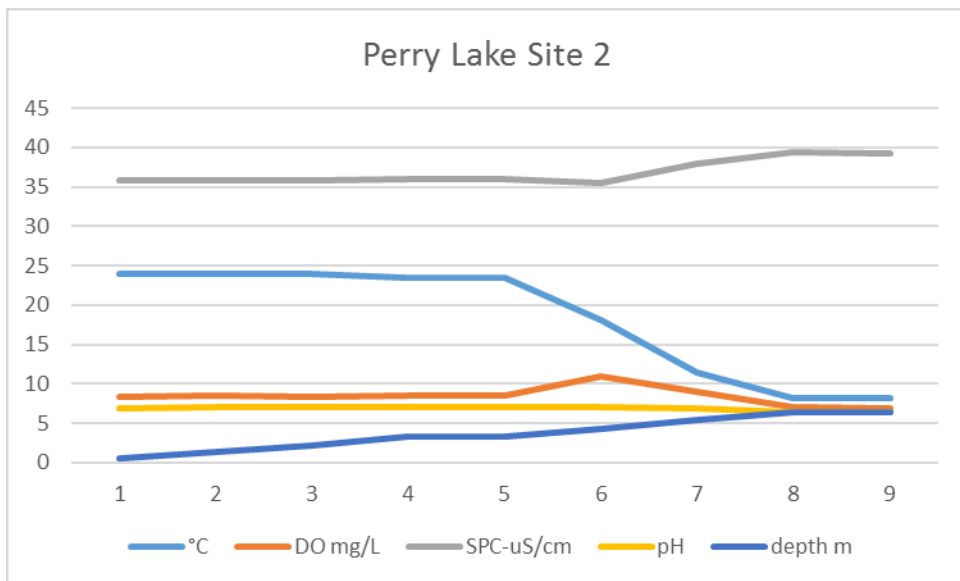
### Mason Lake Site 3

°C	DO mg/L	SPC-uS/cm	pH	depth m
23.6	8.14	19.6	7.13	0.60
23.6	8.13	19.6	7.01	1.38
23.6	8.12	19.6	6.96	2.37
21.5	9.05	19.9	6.87	3.42
18.6	10.04	19.7	6.43	3.75
13.6	10.31	20.4	6.3	3.98
8.7	9.98	21.1	6.14	5.44
6.1	8.14	19.9	5.87	6.41
5.5	7.34	19.5	5.82	7.30
5.1	6.89	19.7	5.72	7.48
4.6	6.16	20.3	5.64	8.73
4.6	5.96	20.4	5.62	8.87
4.4	4.9	21	5.53	10.33
4.4	4.75	21.2	5.51	11.10



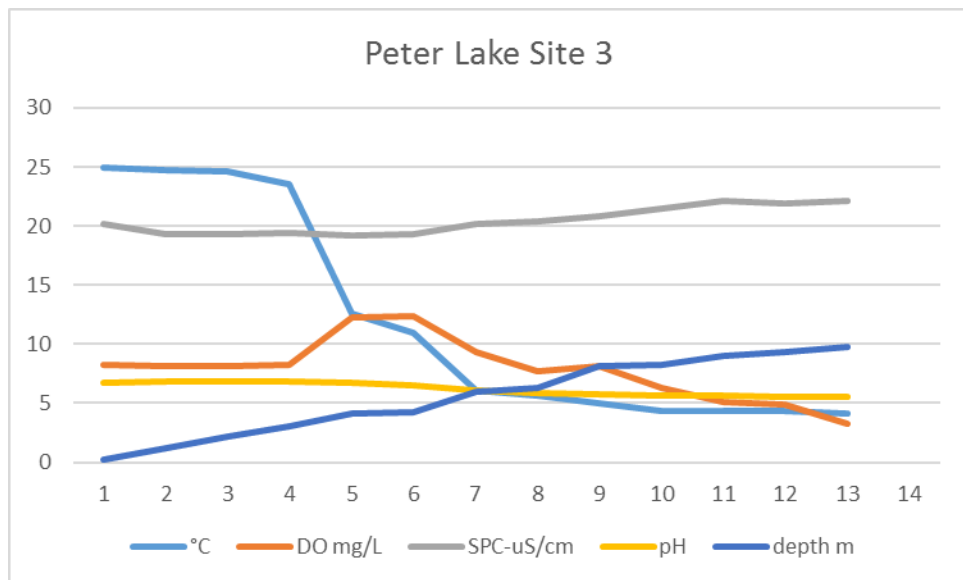
## Perry Lake Site 2

°C	DO mg/L	SPC- uS/cm	pH	depth m
24	8.44	35.9	6.9	0.56
24	8.45	35.9	6.98	1.33
24	8.44	35.9	7.01	2.20
23.5	8.48	36	7.05	3.32
23.5	8.55	36	7.05	3.31
18.1	10.97	35.5	7.03	4.28
11.5	9.01	38	6.82	5.45
8.2	7.01	39.4	6.36	6.39
8.2	6.92	39.2	6.35	6.40



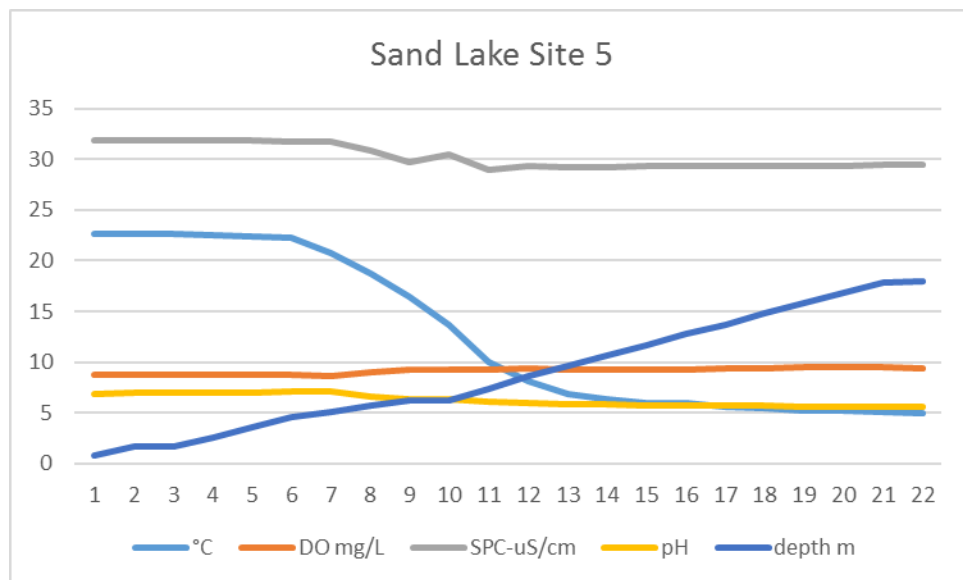
### Peter Lake Site 3

°C	DO mg/L	SPC- uS/cm	pH	depth m
24.9	8.21	20.2	6.77	0.24
24.7	8.14	19.3	6.81	1.21
24.6	8.13	19.3	6.83	2.19
23.5	8.28	19.4	6.83	3.01
12.6	12.27	19.2	6.72	4.17
11	12.41	19.3	6.53	4.29
6.1	9.34	20.2	6.05	5.95
5.6	7.71	20.4	5.82	6.25
5	8.13	20.8	5.75	8.11
4.4	6.32	21.5	5.7	8.30
4.3	5.14	22.1	5.63	8.96
4.3	4.87	21.9	5.59	9.31
4.1	3.21	22.1	5.54	9.78



## Sand Lake Site 5

°C	DO mg/L	SPC- uS/cm	pH	depth m
22.7	8.79	31.9	6.78	0.71
22.6	8.78	31.9	6.92	1.60
22.6	8.78	31.9	6.93	1.60
22.5	8.78	31.9	6.98	2.61
22.4	8.75	31.9	7.03	3.59
22.3	8.73	31.8	7.07	4.57
20.8	8.64	31.7	7.04	5.07
18.7	8.93	30.9	6.6	5.77
16.4	9.22	29.7	6.4	6.18
13.7	9.22	30.5	6.36	6.25
10	9.22	29	6.06	7.41
8.1	9.38	29.3	6.01	8.64
6.9	9.25	29.2	5.82	9.59
6.3	9.26	29.2	5.77	10.65
6	9.27	29.3	5.72	11.70
5.9	9.24	29.3	5.71	12.76
5.6	9.32	29.3	5.68	13.73
5.4	9.41	29.3	5.66	14.76
5.2	9.52	29.3	5.64	15.78
5.2	9.52	29.4	5.64	16.82
5.1	9.48	29.5	5.62	17.80
5	9.43	29.5	5.62	17.92





## Nitrate & Ortho-phosphate Results

2017 was the first year that KWEF took water samples and had them analyzed at the Near North lab in North Bay. We had been concerned that the results from the WSCE lab did not specify the MDL (method detection limit) and their results indicated .01 mg/L for nitrates and .05 mg/L for phosphates was their minimum resolution. Near North Labs has a stated MDL on their reports of .0031 mg/L for nitrates and .001 mg/L for ortho-phosphates. We did 5 lakes in 2017 – Perry, Hassard, Beaver, Groom/Lynx and Fisher taking a sample from 2 sites on each lake,. We also took 2 samples from Big Clam Lake – one (a) using the Beta Bottle Sampler and one (b) using the type of sample bottle and technique used by the Lake Partners Program to sample for total phosphorous. Both samples were taken at the same spot moments apart. Sample (a) was water taken at a specific depth (in this case 4 meters) while (b) was a composite sample taken over the first 4 meters. The results were identical for both Big Clam Lake samples so we decided to use the Lake Partners sampling method in future.

### Results for Nitrates and Ortho-Phosphates (mg/L)

No.	Lake	Date	Site	Nitrate	Phosphate	Site	Nitrate	Phosphate
1	Sand	30/07/18	#6	.013	< MDL	#3	.012	< MDL
2	Himbury	30/07/18	#2	< MDL	< MDL	#3	<MDL	<MDL
3	Grass	23/07/18	#2	<MDL	<MDL	#3	< MDL	<MDL
4	Loon	23/07/18	#1	<MDL	<MDL	#5	<MDL	<MDL
5	Big Clam	29/07/18	#2	<MDL	<MDL			

1. The PRO DSS instrument worked quite well in our application. They only had a 20m cable available for rental this year which allowed us to do profiles down to almost 60 feet. Recording the depths with each measurement allowed us to take multiple readings or skip readings at a particular depth without requiring a second person to maintain a log of the depth / time for each set of readings. That the cable & sensor might not be hanging vertical and therefore the sensor package was no longer at the depth indicated by the marks on the cable due to boat drift was no longer a major concern. The use of an optical sensor for measuring DO meant we no longer needed to agitate the sensor to get accurate DO readings.
2. We tried for a Grant under the Great Lakes Guardian Community Fund that would allow us to purchase a YSI PRODSS instrument so that we could monitor some of the lakes more frequently throughout the year or repeat tests if the readings we were getting seemed unusual. Unfortunately while we made the short list we did not get a grant.

**PRO DSS system accuracy for the following sensors**

Dissolved Oxygen	0-20 mg/L range	+/- 1% of reading or .1 mg/L if greater
Temperature		+/- .2 deg C
Conductivity		+/- 0.5 % of reading or .001mS/cm "
pH		+/- .2 units
Barometer		+/- 1.5 mmHg
Depth	20m or greater cable	+/- .04m
Turbidity	.3 FNU or	+/- 2% of reading if greater

Please note that values were often reported to 2 decimal places to show variations but actual accuracy should be taken into consideration when looking at individual readings.

The specification data sheets for the instrument is included in the Appendix

## 7.0 Reference

- Augsburger, T., Keller, A. E., Black, M. c., Cope, W. G., & Dwyer, F. J. (2003). Water quality guidance for protection of freshwater mussels (Unionidae) from ammonia exposure. *Environmental Toxicology and Chemistry*, 22(11), 2569.
- CCME. (2012). Canadian Water Quality Guidelines: Nitrate Ion. Scientific Criteria Document. Canadian Council of Ministers of the Environment, Winnipeg.
- CCME. (2004). Canadian Water Quality Guidelines for the Protection of Aquatic Life. Phosphorus: - Canadian Guidance Framework for the Management of Freshwater Systems.<http://cegg-rcqe.ccme.ca/download/en/205?redir=1439582439>
- CCME. (1993). Guidance Manual on Sampling, Analysis, and Data Management for Contaminated Sites. Ministry of the Environment, Canadian Council of Ministers of the Environment
- CCME. (2011). Protocols Manual for Water Quality Sampling in Canada. Canadian Council of Ministers of the Environment.
- Cilliers, R. (2014, May 30). Mine equipment leaving Kearney, Ontario Graphite staying put. MuskokaRegion.com. Retrieved June 2,2014, from <http://www.muskokaregion.com/news-story/4550003-mine-equipment-leaving-keamey-ontario-graphite-staying-put>
- Town of Kearney. "Corporation of the Town of Keamey Community Map." Retrieved August, 2014 from <http://townofkearney.com/our-community/maps/>
- DR 2700 Spectrophotometer User Manual*. (2013). Germany: HACH Company. (Original work published 2007)
- Erol, A., & Randhir, T. O. (2013). Watershed ecosystem modeling of land-use impacts on water quality. *Ecological Modelling*, 270, 54-63.
- Environment Canada. (2011). Environmental Indicators. *Environment Canada*. Retrieved July 28,2014, from <https://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En&n=DB689C68-J>
- Environment Canada. (2013). Canadian Aquatic Biomonitoring Network: Wadeable Streams Field Manual. *Environment Canada*. Retrieved August 5, 2014, from I &offset=6&toc=show

Fish ON-Line. (2012, June 27). *Fish ON-Line*. Retrieved July 26,2014, from [http://www.web2.mnr.gov.on.ca/fish\\_online/fishing/fishingExplorer\\_en.html](http://www.web2.mnr.gov.on.ca/fish_online/fishing/fishingExplorer_en.html)

Fleming, R., Fraser, H. (J999). Nitrate and Phosphorus Levels in Selected Surface Water Sites in Southern Ontario- 1964-1994. *Ridgetown College-University of Guelph*. Retrieved August 8, 2014 from [http://www.ridgetownc.uoguelph.ca/research/documents/fleming\\_nitphos.PDF](http://www.ridgetownc.uoguelph.ca/research/documents/fleming_nitphos.PDF)

Gartner Lee Ltd .. (2005). Kearney Watershed Environmental Foundation. Kearney Watershed Study. Retrieved May 30,2014, from <http://kwefcalinfo01.htm>

Great Lakes - Phosphorous. (2013, July 5). Environment Canada. Retrieved June 1,2014, from <http://www.ec.gc.ca/grandslacs-greatlakes/default.asp?lang=En&n=6201FD24-1>

Halliday, S. 1., Wade, A. J., Skeffington, R. A., Neal, e., Reynolds, B., Rowland, P., et al. (2012). An analysis of long-term trends, seasonality and short-term dynamics in water quality data from Plynlimon, Wales. *Science of The Total Environment*, 434, 186-200.

HACH Company. (2011). Ultra Low Range Total and Reactive Phosphorus.

HACH Company. (2014). Hach Water Analysis Handbook (9th ed.).

Health Canada. (2012). Nitrate and Nitrite in Drinking Water. Retrieved July 28,2014, from <http://www.hc-sc.gc.ca/ewh-semt/consult/2012/nitrite-nitrite/draft-ebauche-eng.php#aIO.O>

Kearney, Ontario, Canada. (2014). *MBendi Information Services*. Retrieved July 26,2014, from <http://www.mbendi.com/place/kearney-ontario-canada-4038293>

Kearney Watershed Environmental Foundation (2002-2004). "Gartner Lee Water Quality Study." Retrieved June 5th, 2014 from <http://www.kwefcalinfo01.htm>

Kearney Watershed Environmental Foundation. "Purpose." Retrieved June 5th, 2014 from <http://www.kwefca>

MNR. (2010). Lake Fact Sheets. *Muskoka Water Web*. Retrieved July 29,2014, from <http://www.muskokawaterweb.ca/lake-data/mnr-data/lake-fact-sheet>

MOECe. (1994). Policies, Guidelines, Provincial Water Quality Objectives. Retrieved June 6<sup>th</sup>, 2014. ISBN: 0-7778-3494-4

MOECe. (1994). Sampling Procedures. *Lake Partner Program*. Retrieved May 30,2014, from <http://www.foca.on.ca/lake-partner>

Monitoring Parameters. (n.d.). *Muskoka Water Web*. Retrieved June 1, 2014, from <http://www.muskokawaterweb.ca/water-101/monitoring/parameters>

Ontario Graphite. "The Kearney Mine." Retrieved June 4<sup>th</sup>, 2014 from [http://www.ontariographite.com/s/keamey\\_mine.asp?ReportID=477207](http://www.ontariographite.com/s/keamey_mine.asp?ReportID=477207)

Oram, B. (n.d.). Phosphates in the Environment. *Water Research Centre*. Retrieved August 5, 2014 from <http://www.water-research.net/index.php/phosphates>

Policies, guidelines, provincial water quality objectives of the Ministry of Environment and Energy. (1994) Toronto: Ontario Ministry of Environment and Energy.

- Quay, P., Broecker, W. S., & Hesslein, R. H. (1980). Vertical diffusion rates determined by tritium tracer experiments in the thermocline and hypolimnion of two lakes. *Limnology and Oceanography*, 25(2), 201-218.
- University of Oregon. (n.d.) interpreting test statistics, p-values, etc .. *Geographic Data Analysis and Visualization*. Retrieved July 28, 2014, from <http://geog.uoregon.edu/geogrltopicslinterpstats.htm>
- Statistics Canada. 2012. Kearney, Ontario (Code 3549018) and Parry Sound, Ontario (Code 3549) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Retrieved July 29, 2014 from <http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?lang=E>
- Water Quality Conditions. (2012, March 6). *United States Environmental Protection Agency*. Retrieved May 30, 2014, from <http://water.epa.gov/type/rsl/monitoring/vms50.cfm>
- World Health Organization. (2011). *Guidelines for drinking-water quality* (4th ed.). Geneva.



Parameters:  
 Dissolved Oxygen (Optical)  
 Turbidity  
 pH  
 ORP/Redox  
 Conductivity  
 Specific Conductance  
 Salinity  
 Total Dissolved Solids (TDS)  
 Resistivity  
 Seawater Density  
 Total Suspended Solids (TSS)  
 Depth  
 GPS Coordinates  
 Ammonium  
 Ammonia  
 Chloride  
 Nitrate  
 Temperature  
 Barometric Pressure

**SPECIFICATIONS**

DOCUMENT #W83-04

**YSI ProDSS Multiparameter Sampling Instrument**

Portable digital sampling system for the measurement of pH, ORP, dissolved oxygen (optical-based sensor), conductivity, turbidity, temperature, depth and more.

Designed for use in applications such as surface water, groundwater, coastal waters, aquaculture, and wastewater, the rugged and reliable ProDSS allows for measurement of up to 19 parameters. The ProDSS features digital smart sensors that are automatically recognized by the instrument when connected. A backlit color display, large memory, convenient calibration procedures, rechargeable battery, and powerful PC data management program (KorDSS) make the ProDSS user friendly. The optional GPS function, wide selection of sensors, and varying cable options and lengths allow for complete customization of the ProDSS. Mil-spec (military spec) connectors and a waterproof (IP-67), rubber over-molded case ensures durability to provide years of sampling even in the harshest field conditions.

- Single cable design with lengths up to 100 meters
- User-replaceable cables provide versatility, reduce down time and reduce overall cost of ownership
- 4 port cables feature user-replaceable sensors; universal ports can accept any 4 sensors; optional depth sensor available
- ODO/CT probe and cable assemblies feature integral (built-in) optical DO and conductivity sensors; rugged ODO sensor cap with 2-year warranty is pre-installed on new assemblies
- Long-life rechargeable lithium-ion battery to power handheld and sensors
- Color display and backlit keypad allow for sampling in all lighting conditions
- Digital smart sensors are automatically recognized by the instrument and store calibration data
- Large memory (> 100,000 data sets) with extensive site list and Data ID tag capabilities
- KorDSS, a powerful PC data management program, is included with the instrument
- USB On-The-Go connector for PC connection, recharging/powering the ProDSS and connecting directly to a USB stick
- Global Positioning System (GPS) (optional)
- Rugged, waterproof case (IP-67 rated) with rubber over-mold and metal, military-spec (MS) cable connectors as well as rugged titanium sensors
- Multiple languages in handheld and KorDSS: English, Spanish, Portuguese, French, German, Italian, Japanese, Norwegian, Chinese (simplified and traditional), Korean, and Thai
- Warranty: 3-year instrument; 2-year cable assembly and sensors; 1-year pH and pH/ORP sensor modules; 6-months ammonium, nitrate and chloride sensor modules.

YSI.com/ProDSS



ProDSS General Specifications		
Size	Instrument: 4 port bulkhead with sensor guard, no depth: 4 port bulkhead with sensor guard, with depth: ODO/CT assembly with sensor guard.	8.3 cm width x 21.6 cm length x 5.6 cm depth (3.27 in x 8.5 in x 2.21 in) 42.82 cm (16.86 in) length and 4.75 cm (1.87 in) outer diameter 45.36 cm (17.86 in) length and 4.75 cm (1.87 in) outer diameter 26.14 cm (10.29 in) length and 2.46 cm (0.97 in) outer diameter
Handheld weight with batteries	567 grams (1.25 lbs)	
Power	Rechargeable lithium-ion battery pack provides ~48 hours with the handheld only and ~20 hours with the handheld, 4 port cable and 4 smart sensors; battery recharge time is ~9 hours with the AC power adapter. The instrument can also be powered via AC or external power pack through the USB port.	
Instrument operating temperature	0 to 50 °C (32 to 122 °F)	
Instrument storage temperature	0 to 45 °C (32 to 113 °F) with battery installed; 0 to 60 °C (32 to 140 °F) without battery installed	
Display	Color, LCD graphic display, 3.9 cm width x 6.5 cm height	
USB port	Built-in micro USB On-The-Go port for PC connection, recharging/powering the ProDSS and connecting directly to a USB stick	
Cables	ProDSS 4 port, ProDSS ODO/CT, and ProODO field cables available in 1, 4, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100 meters; ProDSS 4 port cables feature an optional depth sensor; ProODO cable assemblies are also compatible	
Sensor ports	4 port cables feature universal sensor ports that can accept any ProDSS sensor; other compatible cables feature integral sensors	
Warranty	3-year instrument; 2-year bulkhead, cable assembly, sensors, and extended warranty ODO sensor cap (627180); 1-year pH and pH/ORP sensor modules, ODO sensor caps, and Li-ion battery pack; 6-months ammonium, nitrate, and chloride sensor modules	
Memory	> 100,000 data sets	
Logging modes	Single point or continuous with adjustable feature	
GLP compliance	Yes; 400 detailed GLP records can be stored and are available to view, download, and print.	
Languages	English, Spanish, German, French, Italian, Norwegian, Portuguese, Japanese, Chinese (Simplified & Traditional), Korean, Thai	
Certifications	CEC, CE, RoHS, IP-67, WEEE, FCC, UN Part III, Section 38.3, test methods for lithium-ion batteries (Class 9)	
GPS	Optional internal GPS; coordinates are stored with measurement data and site lists	
Sites and data ID	100 user-defined sites and 100 user-defined data ID tags; site pictures can be sent to the handheld via ProDSS	

ProDSS System Specifications (Instrument, Sensor, and Cable)				
Sensor/Parameter	Range	Accuracy	Resolution	Units
Temperature	-5 to 70 °C (temperature compensation range for DO mg/L measurement: -5 to 50 °C)	±0.2 °C	0.1 °C or 0.1 °F (user selectable)	°C, °F, K
pH	0 to 14 pH units	±0.2 pH units	0.01 pH units	pH, pH mV
ORP	-1999 to 1999 mV	±20 mV	0.1 mV	mV
Dissolved Oxygen	0 to 500%, 0 to 50 mg/L	0 to 200%: ±1% of reading or 1% saturation, whichever is greater 200 to 500%: ±8% of reading 0 to 20 mg/L: ±0.1 mg/L or 1% of reading, whichever is greater 20 to 50 mg/L: ±8% of reading	0.01 mg/L and 0.1%, or 0.1 mg/L and 1% (user selectable)	% saturation, % saturation local, mg/L, ppm
Barometer	375 to 825 mmHg	±1.5 mmHg from 0 to 50 °C	0.1 mmHg	mmHg, inHg, mbar, psi, kPa, atm
Conductivity	0 to 200 mS/cm	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading	0.001, 0.01 or 0.1 µS/cm (range dependent)	µS/cm, mS/cm
Specific Conductance*	0 to 200 mS/cm	0 - 100 mS/cm: ±0.5% of reading or .001 mS/cm, whichever is greater 100 - 200 mS/cm: ±1.0% of reading User selectable reference temperature (15 to 25 °C; default 25 °C) and compensation coefficient (0 to 4%/°C; default 1.91%)	0.001, 0.01, 0.1 mS/cm	µS/cm or mS/cm
Salinity*	0 to 70 ppt	±1.0% of reading or ±0.1 ppt, whichever is greater	0.01 ppt	ppt or PSU
Total Dissolved Solids (TDS)*	0 to 100 g/L	Calculated from specific conductance and a user-selectable TDS multiplier (0.30 to 1.00; default 0.65)	0.001, 0.01, 0.1 g/L	mg/L, g/L, kg/L
Resistivity*	0 to 2 Mohms	±0.1% Full Scale	0.001, 0.01, 0.1 ohms	ohm-cm, kohm-cm, Mohm-cm
Seawater Density*	0.0 to 50.0 sigma_t, sigma_T	-	0.1 sigma_t or sigma_T	Sigma_t, Sigma_T
Turbidity	0 to 4000 FNU	0 to 999 FNU: 0.3 FNU or ±2% of reading, whichever is greater 1000 to 4000 FNU: ±5% of reading	0.1 FNU	FNU, NTU
Total Suspended Solids (TSS)*	-	User correlated from turbidity field measurements and lab TSS measurements from grab samples	0.01, 0.1 mg/L	mg/L
Ammonium**	0 to 200 mg/L NH <sub>4</sub> -N	±10% of reading or 2 mg/L, whichever is greater	0.01 mg/L	NH <sub>4</sub> -N mg/L, NH <sub>4</sub> -N mV
Ammonia**	0 to 200 mg/L NH <sub>3</sub> -N	-	0.01 mg/L	NH <sub>3</sub> -N mg/L
Chloride**	0 to 18000 mg/L Cl	±15% of reading or 5 mg/L, whichever is greater	0.01 mg/L	Cl mg/L, Cl mV
Nitrate**	0 to 200 mg/L NO <sub>3</sub> -N	±10% of reading or 2 mg/L, whichever is greater	0.01 mg/L	NO <sub>3</sub> -N mg/L, NO <sub>3</sub> -N mV
Depth	0 to 328 feet (0 to 100 m)	±0.013 ft (±0.004 m) for 1, 4, and 10 m cables ±0.13 ft (±0.04 m) for cables 20 m and longer	0.001 m or 0.01 ft	m, ft

\*mV and µV are linear positions \*\*mV is for chem only 2000mV is non-linear



