A Preliminary Review of the BC Ministry of Environment Water Quality Data for Elk Lake

Supplied to the Victoria Golden Rods and Reels Society by Rick Nordin Ph.D. as part of the Elk Lake project 2014.

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HABITAT CONSERVATION TRUST FOUNDATION

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Introduction

In response to what is seen as deterioration in water quality and a declining quality of fisheries production, Victoria Golden Rods and Reels (GRR) took the initiative to apply for a grant from the Habitat Conservation Trust Fund to provide a preliminary evaluation of Elk Lake in response to concerns about apparent changes in recent years. GRR approached and received support from several other groups and agencies for this initiative including BC Ministry of Environment.

This report provides a summary of the data stored on the BC Ministry of Environment's EMS database under site number 1100844 as well as some context and important other reports. Data from 1983 to the present is available and provides an opportunity to examine trends over the past 30 years. The site is located at the deep point in the lake and, as in most lakes, is used to represent the general water quality of the lake. A question that has been posed and will be addressed is whether the data in the Ministry database indicates deterioration in conditions from water quality data collected in the past. It should also be noted that this sampling site may not properly represent the near-shore (littoral) water quality that is the basis of many concerned about the lake (aquatic plants, beach bacteriology, fish habitat etc.) or the areas of the lake closest to inflows (creeks, groundwater). The goal of this report is to provide a review of the currently available information about Elk Lake since no recent technical information has been assembled. This report is hoped to provide an introduction to the present issues. It is intended that after the 2014 sampling program has been completed, a more detailed report would be prepared.

The BC MoE designed and implemented a water quality sampling program in a partnership with GRR to be carried out from spring 2014 to autumn and winter 2014-2015 which will be used to provide a basis for future actions.

The last detailed evaluation of Elk Lake water quality was done in 1992 in a report by the BC Ministry of Environment written by McKean. That report provided an excellent summary of pertinent information. At that time he noted

"Recent observations by the public suggest that water quality in Elk and Beaver Lakes has deteriorated. Aquatic weeds such as coontail, native water lilies and pondweeds are a problem in many near shore areas and are mechanically removed. Dense blooms of microscopic free floating algae cause excessive turbidity in the water and surface films that are aesthetically displeasing to recreational users. It is anticipated that increasing residential, agricultural and commercial development in the watershed will affect water quality. In response to these observations, the Capital Regional District and the Ministry of Environment undertook an extensive water quality monitoring program in 1988 to assess the water quality of Elk and Beaver lakes." In 2014 the situation seems very similar and again a major study is being undertaken.

The McKean report generated a set of water quality objectives to provide a quantitative basis to evaluate water quality. The Ministry monitored Elk Lake for several years in the 1990's and reported the results in a series reports called Attainment Reports. Water quality attainment sampling was done in 2007 to be used in the production of an attainment monitoring report; this report was never finalized..

The report for the 1995 data (published in 1997), scanned below, noted:

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unless development occurs in the watershed.

Elk and Beaver Lakes

Table 2 lists results and Figure 2 shows site locations.

Located near Victoria, these are the most important recreational fisheries lakes on southern Vancouver Island. Water-contact recreation is also very important in the lakes. Residential and agricultural development and the release of phosphorus from lake sediments are responsible for the present eutrophic state of the lakes.

This is the third year we monitored to check the attainment of objectives. As in previous years, objectives for dissolved oxygen, chlorophyll-*a*, and the phytoplankton community were not met, reflecting the eutrophic nature of the lakes. The water quality index gave ratings of fair (index = 38) for Elk Lake and poor (index = 87) for Beaver Lake in 1995. These ratings were due to many of the objectives not being met, especially those for algae growth. Monitoring in the future will be a lower priority until action is taken to improve water quality conditions.

The results for the monitoring, when compared to the water quality objectives that had been set, showed that the water quality was poor and since there was no restoration or remediation plans or expectation that the situation would become better, it was recommended that the regular monitoring program be curtailed.

The parameters measured during this period are essentially the same that are being monitored in the 2014 program: temperature, dissolved oxygen, chlorophyll a, water clarity and phytoplankton community structure. The report table for 1995 is attached as an appendix at the end of this report. The quantitative objectives for water quality included hypolimnetic (deep water) temperature (objective <15ºC), dissolved oxygen in the hypolimnion (>5mg/L one m above the bottom), chlorophyll a (a summer mean between 1.5 and 2.5 mg/L), Secchi (no reading less than 1.5 m) and phytoplankton (less than 50% of algae being cyanobacteria – blue-green algae). Only one or two of these objectives for Elk Lake were met in 1995 and similar results would be expected at the present time.

A longer-term view of water quality trends in Elk Lake was completed by Groeneveld (2002) who used lake sediment cores to evaluate water quality changes over the past 500 years.

The graph below from Groeneveld's study shows the rate of accumulation of sediment in the lake and there is a noticeable increase in the 1950s and 1960s that would probably coincide with highway construction and development in the watershed at that time. It is important to note that the rate of sediment input has continued to the present and appears that some threshold was reached that accelerated a continued input of sediment.

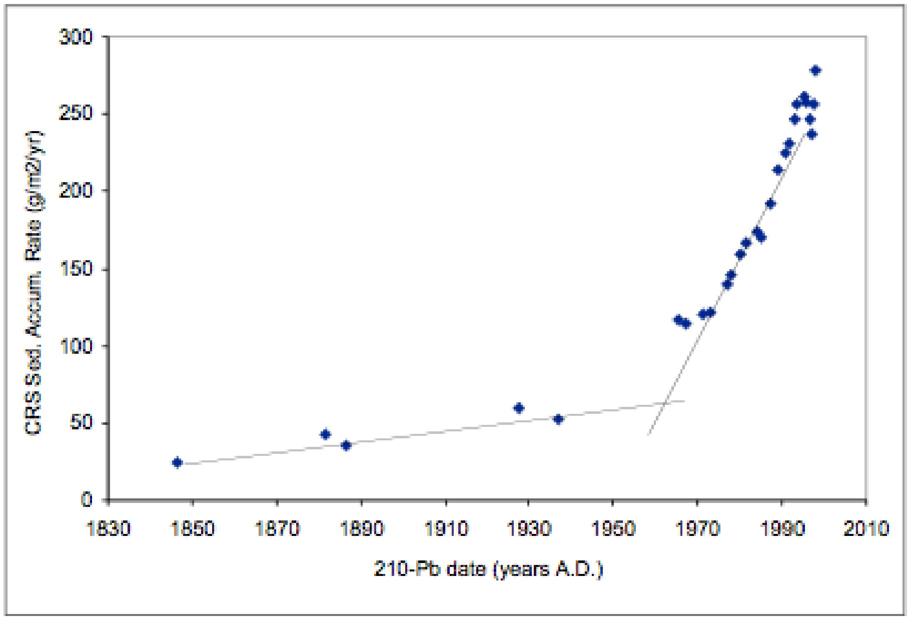


Figure 5.4: The sediment accumulation rate in Elk Lake over the past 160 years.

Another indicator of change is the concentration of phosphorus in the lake sediments. In the period before European settlement (before 1850), phosphorous concentrations were in the 800-900 µg/g range but began to increase after that and at present are approximately double what they were in the pre-settlement period. This increase in the sediment phosphorus is a reflection of the phosphorus in the water column and of the loading of phosphorus from the watershed, indicating both have increased significantly.

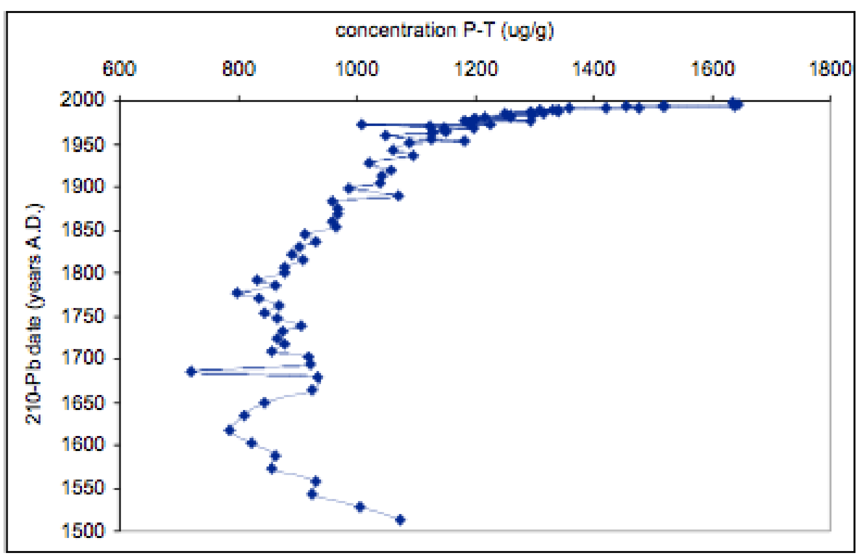


Figure 5.6: The total phosphorus concentration in the sediment core.

A third supporting piece of evidence for eutrophication of Elk Lake from Groeneveld's study uses measurement of carbon and phosphorus in the lake sediments and the ratio between them as an indicator of change. The graph below shows a marked increase in the ratio after 1850 and European settlement and a second change beginning in about 1950. This is a similar pattern to the sediment deposition rate graph shown above and reinforces the interpretation that there seem to be two major changes in the time period one about 1850 and another in the 1950s and 60s. Both would indicate that the lake had gone through a major change and that it is quite different today than it was in the undisturbed conditions before European settlement. The implication of the change in the C:P ratio is that either the amount of carbon from algal and plant growth in the sediments has drastically decreased (which seems unlikely) or the amount of phosphorus being deposited in the sediments has greatly increased over the period of record. The latter seems more likely.

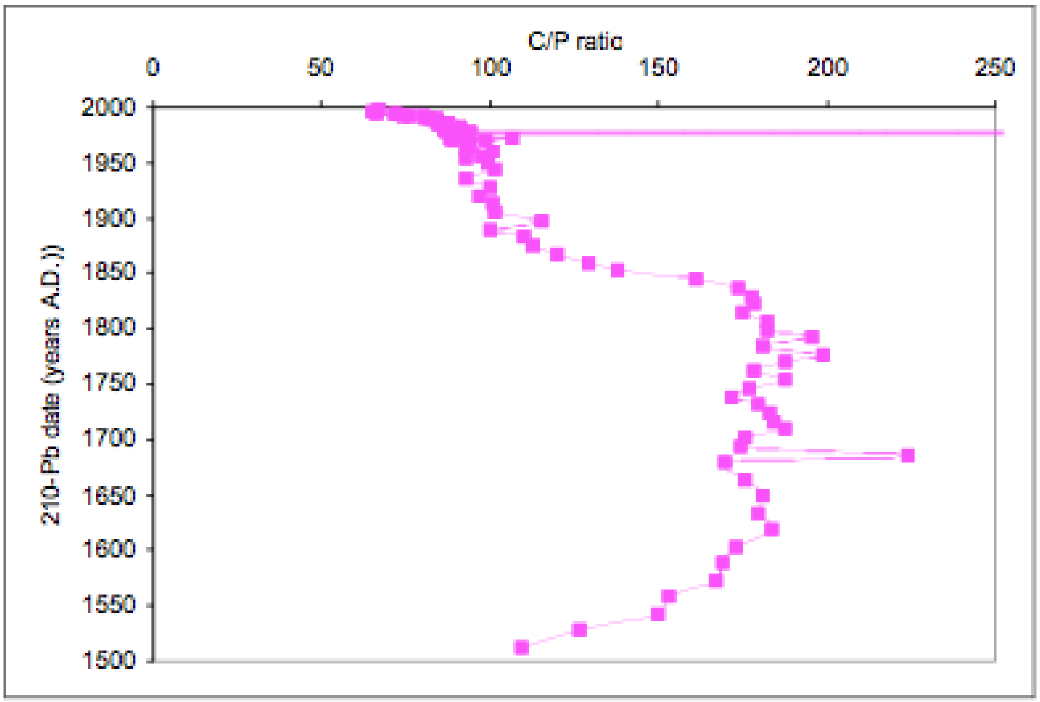


Figure 5.7: The C:P ratio in the Elk Lake core.

Background

Lakes show a variety of annual temperature patterns based on their location and depth. Most BC interior lakes form layers (thermally stratify), with the cold water at the bottom and a warm layer floating on top. Because colder water is more dense, it resists mixing into the warmer upper layer for much of the summer. In spring and fall, these lakes usually mix from top to bottom (overturn) as wind energy overcomes the reduced temperature and density differences between surface and bottom waters. In the winter, lakes re-stratify under ice with the densest water (4 °C) near the bottom. These lakes are called dimictic lakes because they turn over twice per year. They are the most common type of lake in British Columbia and Canada in general.

Coastal lakes in BC are more often termed warm monomictic lakes because they turn over once per year. These lakes have temperatures that do not fall below 4°C. Warm monomictic lakes generally do not freeze and circulate freely in the winter at or above 4°C, and stratify only in the summer. Elk Lake (and most lakes on southern Vancouver Island) is classified as a warm monomictic lake.

Elk Lake as a coastal lake, differs from most lakes in British Columbia in some very important aspects. As noted above, most interior lakes freeze in winter and so have a very different temperature stratification pattern than coastal lakes that are ice free and well mixed during the winter. Coastal lakes are often very biologically productive through the winter where ice covered lakes show little productivity. Elk Lake in 2011 through 2014 has had cyanobacterial (blue-green algae) blooms in January and February. Low elevation lakes on southern Vancouver Island and the Gulf islands (for example St Mary Lake, Prospect, Langford, Swan, Florence, Glen, Quennell) , tend to be quite productive (producing high amounts of algae and aquatic plants) because they are in areas with rich soils as well as nutrients from sources like agriculture, septic tanks, storm runoff and soil disturbance.

Coastal lakes also are distinctive in their hydrology. Coastal lakes receive most of their water inputs from October through March from winter rains and have very minimal inflows from April through September. Interior lakes are fed largely by spring snow melt which occurs in May through August. Along with the water inputs, nutrients (nitrogen and phosphorus) are supplied with the higher flows so loadings in coastal lakes occur in winter which is a reason why biological production can be high in the winter period.

Defining a watershed's size and characteristics is very important – especially land use. A watershed is defined as the entire area of land that moves the water it receives into a common waterbody. The term watershed is misused when describing only the land immediately around a water- body or the waterbody itself. The true definition represents a much larger area than most people normally consider. Elk Lake has a very small watershed in proportion to the lake. McKean (1992) indicated that the watershed size was "approximately 8 km^2" (800 ha, 8×10^6 m^2) however it is not clear if this included the lake area itself. The lake area is 246 ha so the area that supplies water to the lake is small – about three times the area of the lake – which in comparison to many lakes is very small. One of the consequences of this is that the "flushing rate" (water exchange time or filling time) is quite long in relative terms at 4.4 years on average but much longer in dry years (McKean 1992). In general lakes that have longer water exchange times tend to be much more vulnerable to water quality deterioration. A clear definition of the watershed boundaries of Elk Lake is a key piece of information needed for managing the watershed. One area of concern is climate change that which might reduce the amount of rainfall and thus make water exchange times even longer.

Watersheds are where much of the hydrologic cycle occurs and play a crucial role in the purification of water. Although no "new" water is ever made, it is continuously recycled as it moves through watersheds and other hydrologic compartments. The quality of the water resource is largely determined by a watershed's capacity to buffer impacts and absorb pollution.

Every component of a watershed (vegetation, soil, wildlife, etc.) has an important function in maintaining good water quality and a healthy aquatic environment. It is a common misconception that detrimental land use practices will not impact water quality if they are kept away from the area immediately surrounding a waterbody. Poor land use practices in a watershed can eventually impact the water quality of the downstream lake environment. The major inflow to the lake, supplying a significant proportion of the water (and some nutrients) to the lake is O'Donnel Creek which was the subject of a major restoration effort about 20 years ago by the Golden Rods and Reels Society.

Elk Lake is located north of the Victoria metropolitan area in the municipality of Saanich, and is a very high value community resource for recreation (swimming, boating, rowing), fishing and general sightseeing and enjoyment. A 10 km walking / running path around the lake is heavily used. In 1992 it was estimated that the lake received 250,000 recreational visits and hosted 11,000 angler days (McKean 1992). In 2011 the Vancouver Island Lakes Questionnaire estimated 15,774 angler days (Kehler 2014 draft) making it the lake receiving the most fishing effort on Vancouver Island.

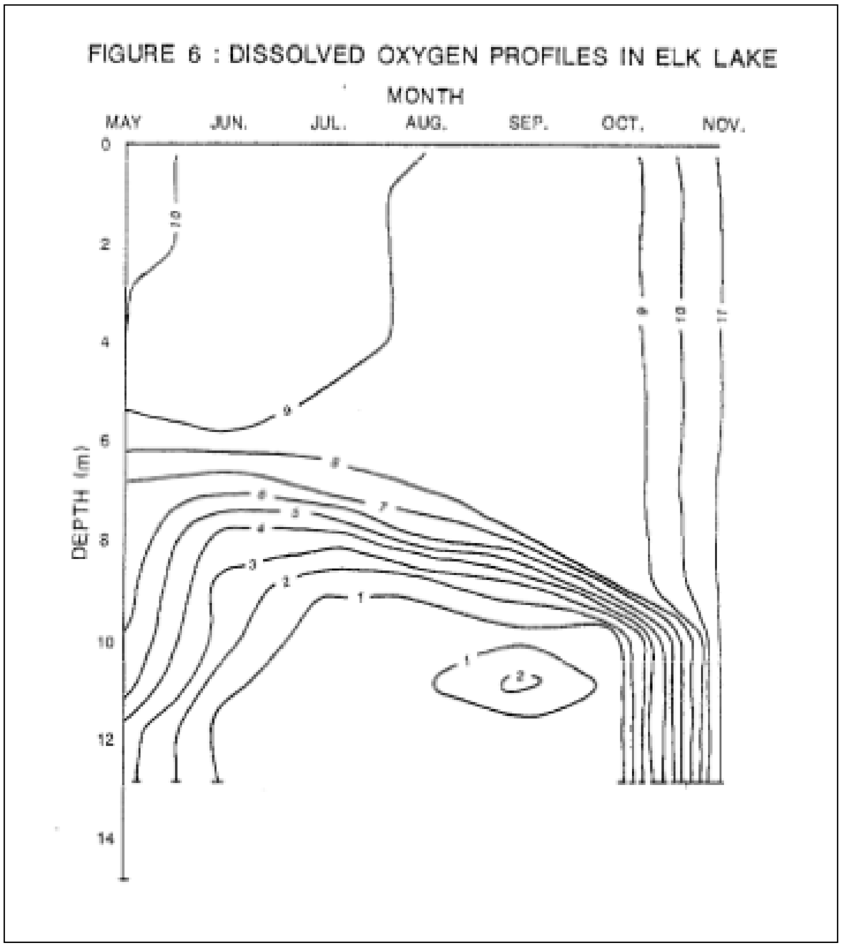
What's Going on Inside Elk Lake?

Water column temperature readings serve as an important ecological indicator. The vertical temperature profile and the thermal stratification depth and strength determine much of the seasonal oxygen, phosphorus, and algal conditions. Elk Lake in the winter period (November to February or early March) is completely mixed top to bottom by the wind and is typically 4-6 degrees. In March the lake begins to thermally stratify with the surface temperatures increasing and the lake developing into thermally distinct layers – 7-8 degrees at the surface and 4-5 degrees in the deep waters. By April, a thermocline (a zone of rapidly changing temperature, normally defined as greater than one degree per metre) has developed and the lake has become separated into a warm surface layer and a deep cold layer with the centre of the thermocline is at about 4 meters. By June the surface water has warmed to 12-15 degrees, the thermocline is centered at about 6 meters, and there is a cold layer below at 6-7 degrees. By August surface waters are 20-25 degrees, the thermocline at 8 m and the deep water is 7-8 degrees. By October, the lake surface has cooled to 10-12 degrees and the thermocline is at 10 m. With autumn cooling, the lake is cooled to the temperature of the deeper water and usually by November the lake mixes (overturns) and cools and mixes through December and January.

The consequence of the thermal stratification in the summer is that no oxygen can be supplied to the deeper waters and oxygen is consumed by decomposition and respiration. The loss of oxygen in the deeper water has consequence for fish habitat (fish cannot use the deeper cooler waters) and for chemical processes (often, low oxygen facilitates the release of nitrogen and phosphorus from the rich bottom sediments).

The graph below from McKean (1992) shows the data for dissolved oxygen in 1988, and indicates that by the beginning of June there is less than 1 μg/L in the bottom waters and the depth below 9 meters are without significant oxygen until the lake mixes in October. Having no oxygen in a large portion of the volume of the lake from June to October is very significant for fish and invertebrate production and is likely greatly constraining fish production. The low dissolved oxygen is also a major factor in the process of internal loading (the release of phosphorus from lake sediments into the water column).

The graph requires some explanation for the non- technical reader. The horizontal axis shows time (May to September 1988) and the vertical axis shows the lake depth. What is then displayed are lines joining equal concentrations of dissolved oxygen. Note that in the surface waters, concentrations are 9 to 11 mg/L and the deeper water shows much lower concentrations and concentrations decrease in the bottom water over the summer. The deeper water below 9 meters indicates less than 1 mg/L for most of the summer.



There are no data for temperature and dissolved oxygen in the Ministry EMS data base but the graph below shows some of the data collected by the Ministry 1993 to 1995 and included in Groenevelt (2002). It shows (despite being displayed in a different format showing individual oxygen profiles on individual days) a similar pattern of low oxygen in the deeper water in summer. It is difficult to discern if any changes or trends are apparent between 1988 and 1995.

There are several other reports which have water quality data for Elk Lake which was collected in the 1970s and 1980s (Vuori 1971, Crane and Salmond 1971, Oliver 1972 and

Handley 1974, Holms 1996, Regier 1998) and topic areas such as inflow stream flows and groundwater (Kenny 2004). These are best examined and integrated after the 2014 sampling is complete. Other major needs such as mapping are presently in progress.

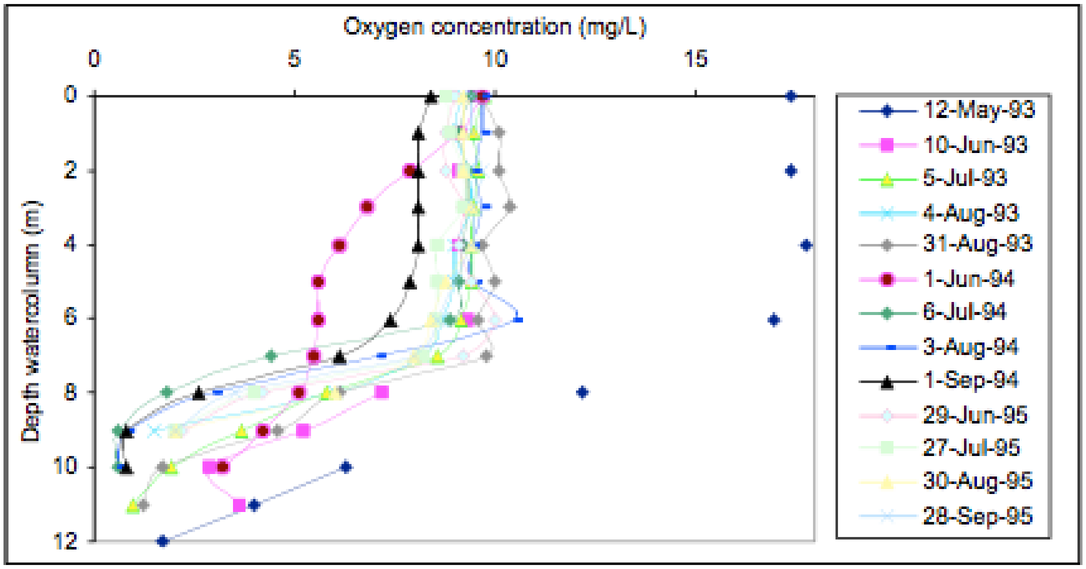


Figure 5.12: Oxygen profiles for Elk Lake over the period May 1993 – September 1995.

Trophic Status

The term *trophic status* is used to describe a lake's level of productivity and depends on the amount of nutrients available for plant growth, including the tiny floating algae called phytoplankton. Algae are important to the overall ecology of the lake because they are food for zooplankton, which in turn are food for other organisms, including fish. In most lakes, phosphorus is the nutrient in shortest supply and thus acts to limit the production of aquatic life and is generally the key to the lakes biological productivity (trophic status). When in excess, phosphorus accelerates plant growth and may artificially age a lake (cultural eutrophication – caused by human activities). Phosphorus inputs to a lake can be greatly influenced by human activities.

There are three measurements generally used to assess trophic state (biological productivity): water clarity (Secchi disc depth), chlorophyll a (algal pigments) and phosphorus concentration (assuming phosphorus is the limiting nutrient – which it clearly is in Elk Lake). In most freshwater aquatic ecosytems, generally one nutrient – usually phosphorus, is the element that controls biological production by being present in the lowest relative quantity for algae and bacteria. In some rare cases, nitrogen can be the limiting major nutrient. The ratio of nitrogen to phosphorus is used as an indicator of relative limitation and in the case of Elk Lake, it is phosphorus that the most important nutrient and determines trophic status.

Water clarity is measured using a Secchi disc. The more productive a lake, the higher the algal growth and, therefore, the less clear the water becomes. The clarity of the water is measured by using a Secchi disc, a 20 cm black and white disc that measures the depth of light penetration.

Natural variation and trends in Secchi depth and temperature not only occur between years, but also throughout one season. In general, as temperatures increase during the summer months, Secchi depth decreases. As the temperature of the lake increases, so do some species of algae. Due to the increase in algae, the water clarity decreases. McKean (1992) reported Secchi data for 1988 (see below) and recommended a water quality objective for Secchi not to be less than 1.9 m. The seasonal average from the table below is 4.5 meters for 1988. As a basis of comparison, annual average Secchi depths for Prospect Lake (a moderately productive lake similar to Elk Lake) is 4.2 m for 2000-2011 (BCLSS 2012), for Langford Lake 3.7 m for 1983-2004 (BCLSS 2005) and for Cowichan Lake (a larger oligotrophic (unproductive) lake) the average Secchi was 11.2 m for 2008-2011 for the South Arm (BCLSS 2014).

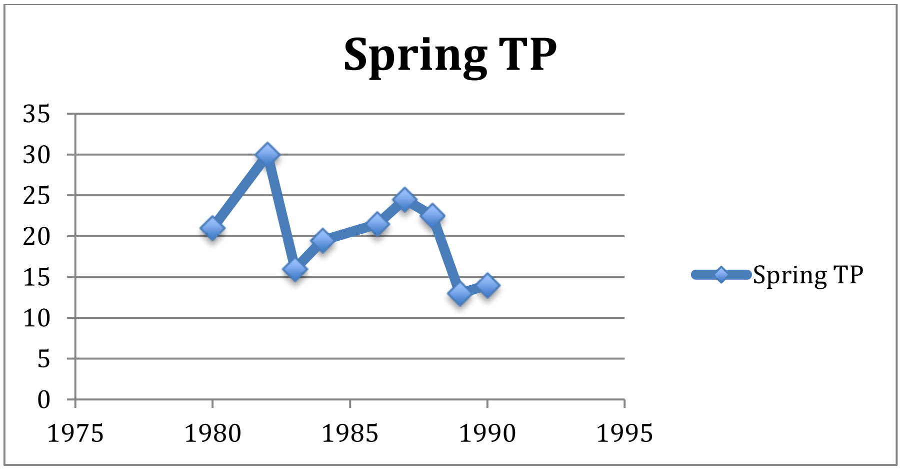
Table 8
1988 Secchi Disc Depths from Elk and Beaver Lakes

	Elk Lake		Beaver Lake
Sample Date	Centre (1100844)	West of Boat House (E207469)	Centre (E207470)
May 14, 1988	2.6 m	2.5 m	4.5 m
June 11, 1988	2.8 m	3.6 m	5.4 m
July 16, 1988	4.4 m	4.7 m	2.4 m
August 20, 1988	7.4 m	7.0 m	2.8 m
September 24, 1988	5.0 m	4.9 m	2.0 m
October 15, 1988	4.8 m	4.7 m	1.7 m

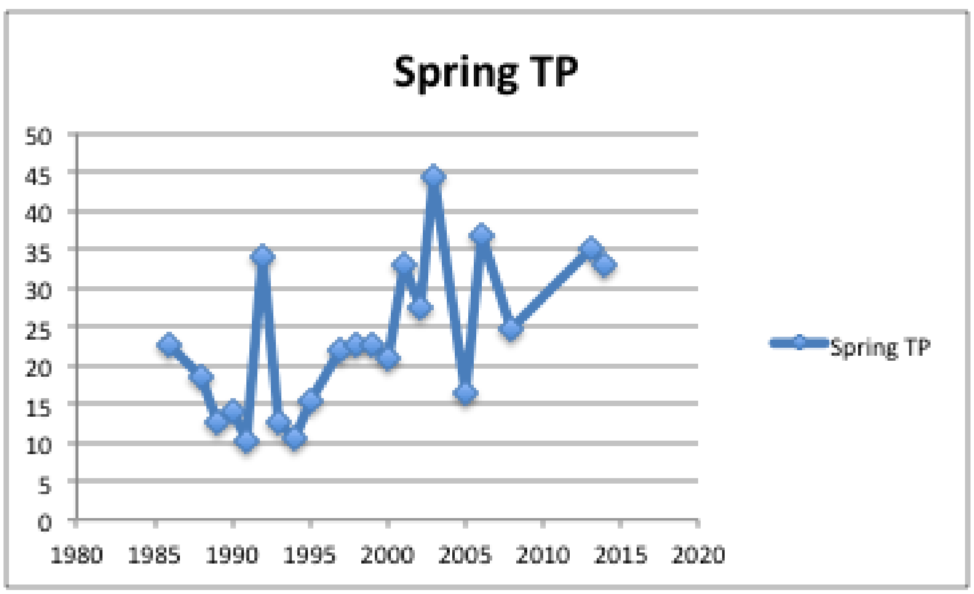
Secchi depths for 2014 are not reported in the EMS data base (or for any other year) but will be available at the end of the sampling season.

The second indicator of biological productivity is chlorophyll. McKean reported data for 1988 but only limited data for 2014 is available at this time for comparison.

The third trophic indicator for lakes is phosphorus. Phosphorus is THE key element that controls the water quality in the lake – its importance must be emphasized and much effort in the past and in the present is focus on quantifying phosphorus concentrations and phosphorus sources. A key measurement is phosphorus taken in early spring while the lake is mixed and this spring overturn concentration can be used as an indicator of what the biological productivity in the summer might be as it is a reasonable representation of the summer nutrient supply. McKean reported Total Phosphorus (TP) spring overturn data for the period 1980 to 1990 and the mean for that period is 20 µg/L (parts per billion). The data from his report are graphed below.

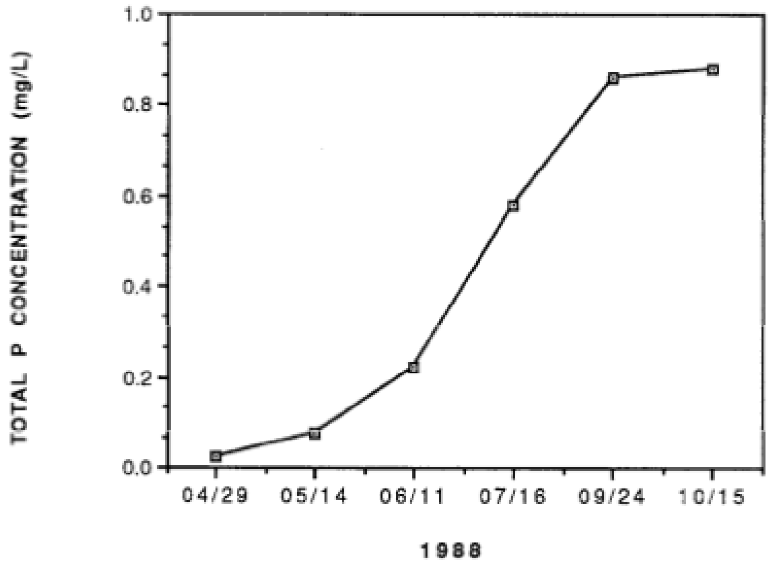


On the EMS database, there are only data from 1986 to present and the data as a simple time graph shows the following pattern and there seems to be a trend of increasing concentration over time. The mean spring phosphorus concentration for 1986-2014 is 23 µg/L and a significant change from the 1980s data presented by McKean. Spring overturn the last two years have been 35 and 33 µg/L. Note the different scales on the graphs the 1980-1990 graph has phosphorus concentration on the vertical axis with a maximum of 35 µg/L whereas the 1986-2014 data set has a scale of 0-50 µg/L phosphorus. There can be variation from year to year depending on weather conditions – particularly temperature and rainfall. Years with high rainfall tend to result in higher nutrients being supplied to the lake.

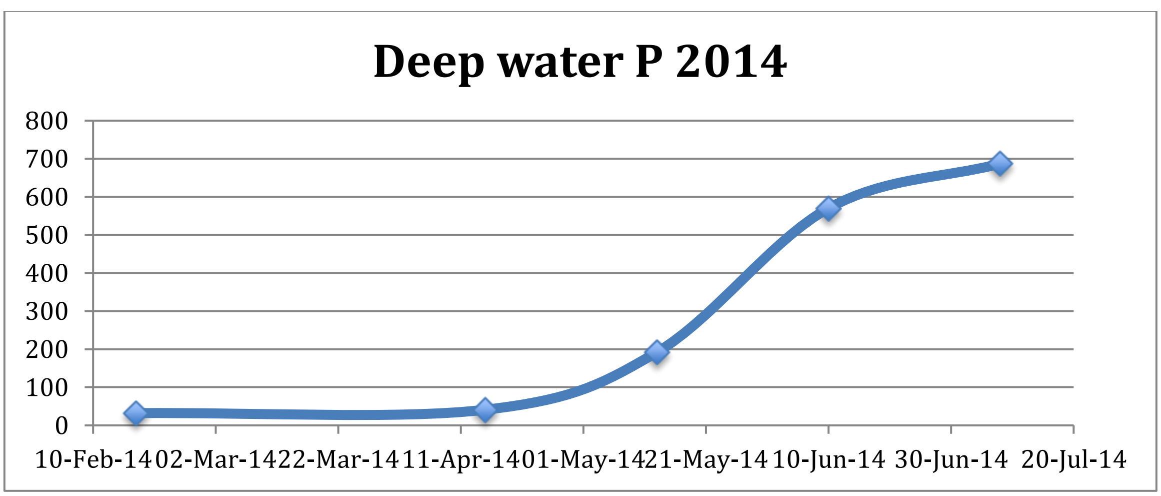


Also of concern is the concentration of TP in the deep water as an indicator of potential internal loading (phosphorus from deep water sediments released during the summer low oxygen period). McKean (1992) provided the graph below showing the increase in phosphorus in the deep waters of the lake in 1988. By October 15 in that year, phosphorus in bottom waters was 0.880 mg/L (880 µg/L). This is an extraordinary increase considering the concentration in the deep water in the spring was 15 ug/L.

FIGURE 9: 1988 HYPOLIMNETIC PHOSPHORUS CONCENTRATIONS
FROM THE CENTRE OF ELK LAKE



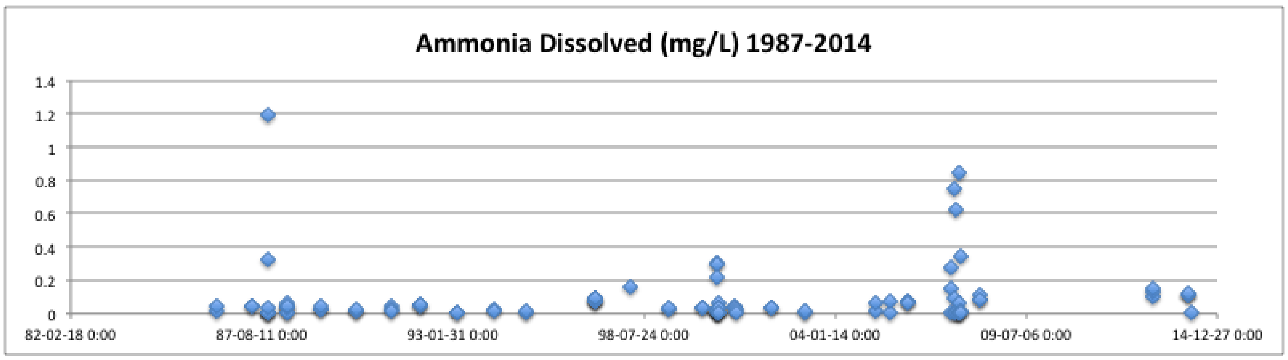
From the Ministry data base there are few data for autumn deep water phosphorus concentrations. In 1987 in October the concentration was 635 µg/L. The graph below shows the 2014 data analysed to present with samples for 8 July at 687 µg/L – similar or slightly higher than the 1988 data. Until all the 2014 data are available it is not possible to determine changes - if any. These data are also important for calculating the amount of internal phosphorus loading in comparison to other contributions.



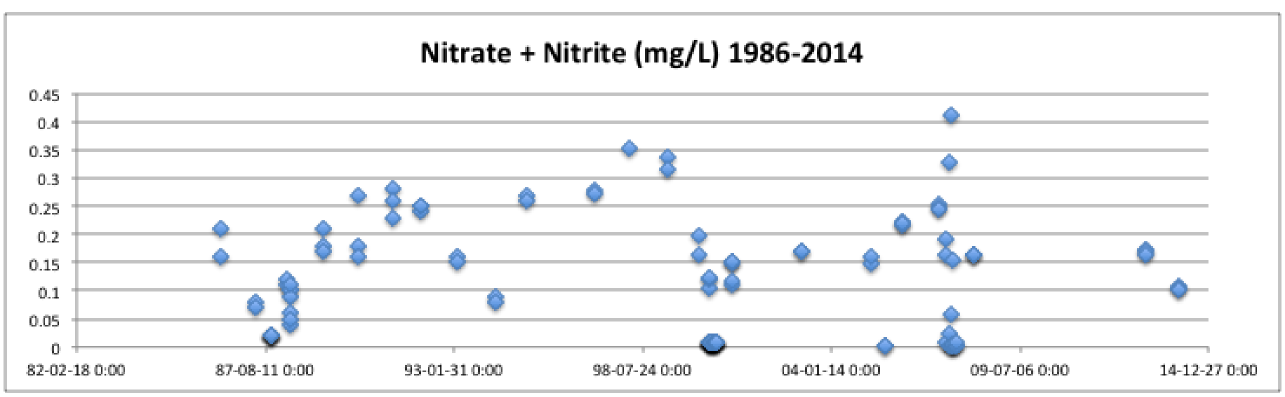
One of the important goals of the present project is to provide a phosphorus budget for the lake – to determine what the sources of phosphorus to the lake are in quantified terms as a means of deciding what restoration efforts are appropriate and how resources to restore and protect the lake are to be allocated. McKean (1992) identified six sources of phosphorus of which by far the largest was internal loading from bottom sediments (950 kg). Other sources were septic inflows (246 kg), O'Donnel Creek (87 kg), atmospheric deposition (38 kg), smaller creeks (36 kg) and birds (9 kg).

There are other important parameters in addition to phosphorus that may be useful in evaluating trends. A second important nutrient is nitrogen and it is measured as several different forms. Ammonia is the reduced inorganic form and is an indicator of decomposition and is only present in high concentrations in very rich environments and usually at low oxygen levels. Nitrate is the oxidized inorganic form of nitrogen and is also readily taken up by plants and algae. It is usually reported with nitrite nitrogen which is rarely of significance in lakes. Kjeldahl nitrogen is the organic nitrogen fraction and reported with ammonia (Kjeldahl=organic N + ammonia). Total nitrogen when reported is calculated as the sum of organic N +ammonia +nitrate + nitrite.

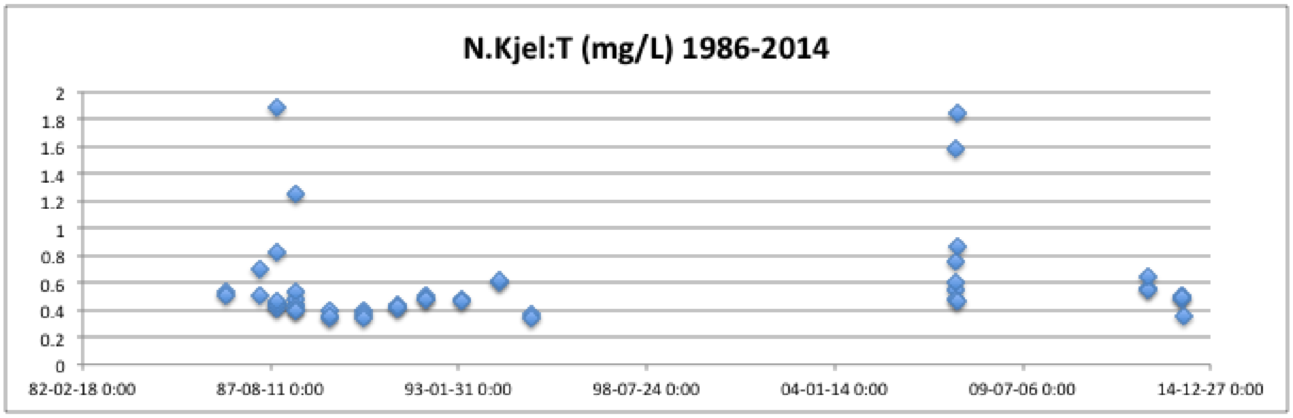
The first graph below shows the concentrations of ammonia reported in the EMS data base for all depths. They show no obvious trend but high concentration in the autum of some years.



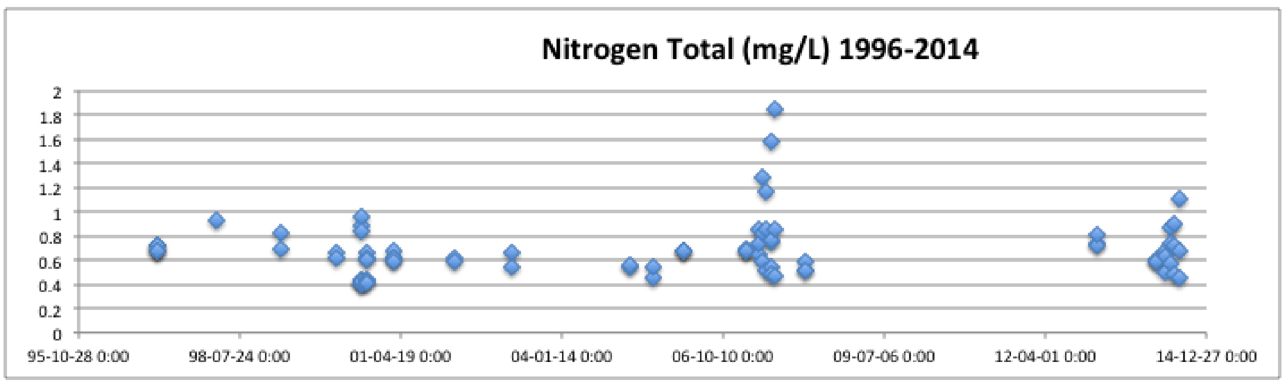
The second nitrogen parameter shown is nitrate-nitrite (all depths shown). Again no obvious trend is apparent. One data point from 14 March 2014 was removed from the graph as it seemed implausibly high at 2.24 mg/L. A value for total nitrogen from the same day (2.59 mg/L) was also very high as well since it incorporated the nitate value and was removed in creating the graph for total nitrogen below. The analytical values from the same sample for sulphate and specific conductance were also very high but they were left in the data set and are obvious in the graphs for these two parameters. What may be the reason for this anomolous sample is that the sample may have inadvertanly been taken too close to the bottom and includes some bottom sediments.



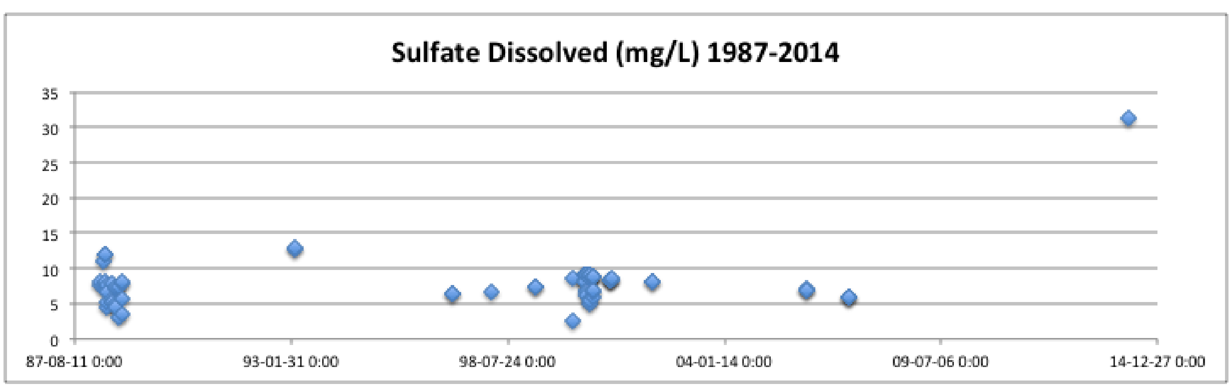
Kjeldahl nitrogen (all depths) is shown below. Again no obvious trend is apparent.



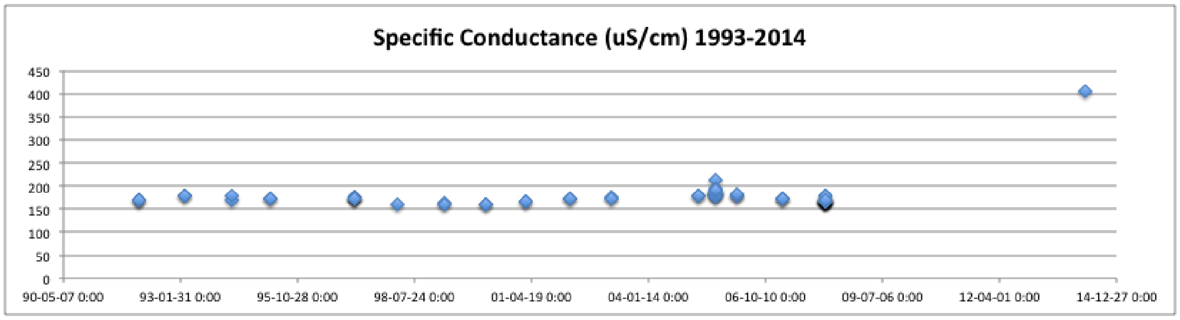
Total nitrogen data for all depths are graphed below.



Two other parameters that can be used to assess water quality trends are sulphate and specific conductance. Sulphate is a key element in the phosphorus cycle and is present in anoxic bottom waters as hydrogen sulphide which is extremely toxic to fish and other organisms. Most values shown are in a similar range except for the notable sample of 14 March 2013 at 16 m depth (close to the bottom).



Specific conductance is a measurement of all dissolved ions in water and has been shown to be a good indicator of land disturbance. The trend line for this parameter shows perhaps a marginal increase but the 2014 spring value (14 March at 16 m depth) seems to out of normal range for this measurement.



Overall there seems some evidence of further deterioration in Elk Lake water quality – certainly no strong evidence of improvement. However the data set is quite discontinuous. There are good data for some years (1988) and periods (1993-95) but it is difficult to interpret trends due to the variability between years and some periods when over several years no data were collected.

The 2014 data when complete will provide a new baseline on which to judge trends and a better understanding of the options that are available for lake management and restoration.

Thank you to Mick Collins and Michelle Kehler for reviewing the report and offering many helpful suggestions.

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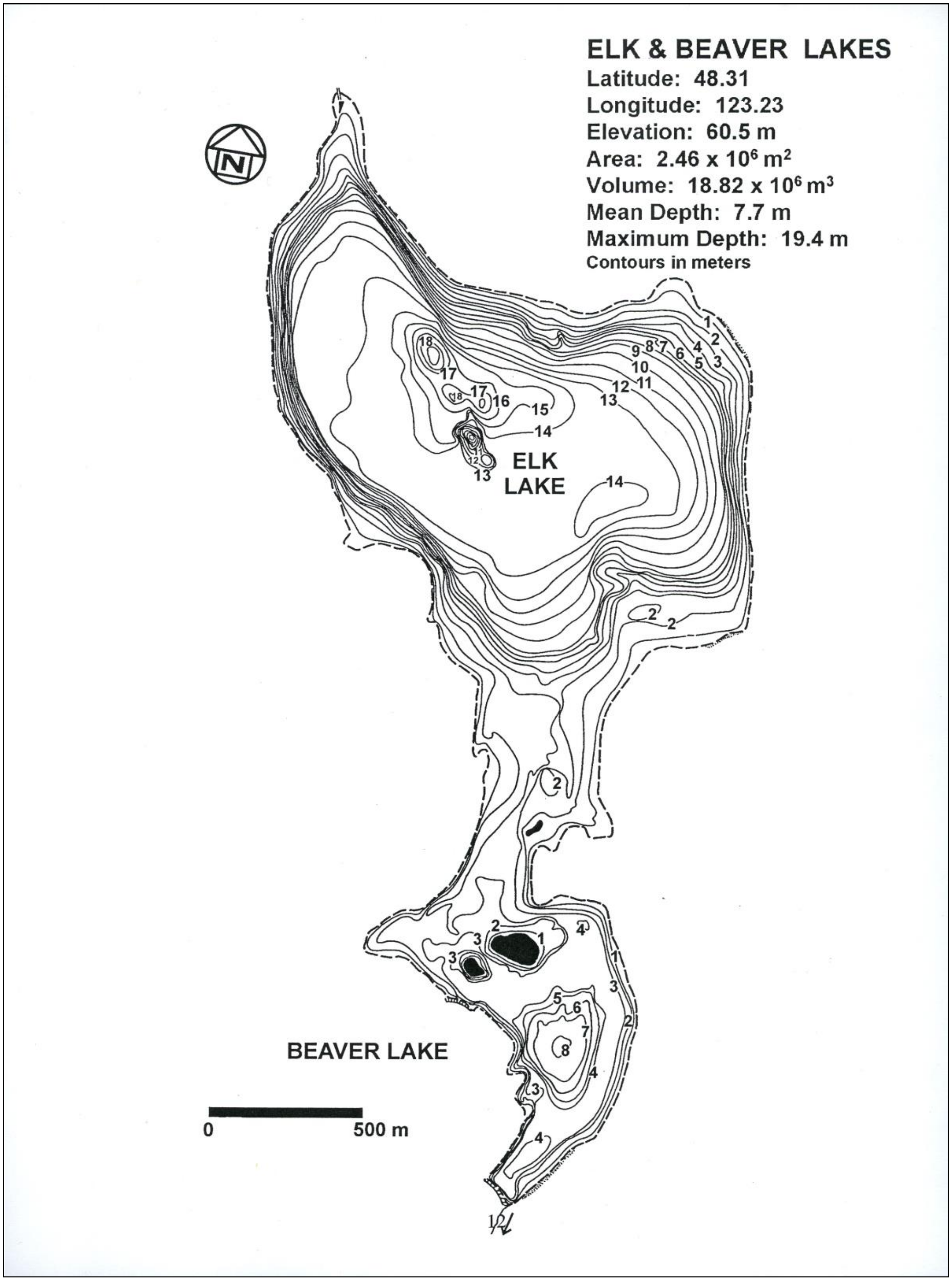

Bathymetric map from Spafard et al 2002

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TABLE 2

ELK AND BEAVER LAKES WATER QUALITY OBJECTIVES - 1995

VARIABLE & OBJECTIVE	MEASUREMENT				CONCLUSION
	SITE	DATE	n	VALUE	
Temperature 15°C max in hypolimnion	Elk Lake 1100844 at centre	Jun 29 - Sep 28	4	9.5 - 14.4 °C at 7 to 9 m (start of hypolimnion)	Objective met
	Beaver Lake E207470 at centre	Jun. 29	1 1	16.2 °C at 5 m 13.2 °C at 6 m	Obj. not met Obj. met
		Jul. 27	1	17.6 °C at 5 m	Obj. not met
		Aug. 30	1 1	17.8 °C at 5 m 15.0 °C at 6 m	Obj. not met Obj. met
		Sep. 28	1	17.8 °C at 5 m 15.0 °C at 6 m	Obj. not met Obj. met
Dissolved Oxygen 5 mg/L min 1 m above sediment May - August	Elk Lake 1100844 at centre	Jun 29 - Aug 30	3	< 2 - 2.2 mg/L at 9 m	Objective not met
	Beaver Lake E207470 at centre	Jun 29 - Aug 30	3	1 - 4 mg/L at 5 to 6 m	Objective not met
Chlorophyll-a 1.5 - 2.5 ug/L av of duplicates at 0,2,4,6 m May - August	Elk Lake 1100844 at centre	Jun 29 - Sep 28	16	< 0.5 - 4.2 ug/L duplicates at 0,2,4,6 m av = 2.2 ug/L	Objective met
	Beaver Lake E207470 at centre	Jun 29 - Sep 28	12	2.3 - 19.9 ug/L duplicates at 0,2,4 m av = 9.6 ug/L	Objective not met
Water Clarity 1.9 m min Secchi disc reading	Elk Lake 1100844 at centre	Jun 29 - Sep 28	4	4.6 - 5.5 m	Objective met
	Beaver Lake E207470 at centre	Jun. 29 Jul 27 - Sep 28	1 3	3.8 m 1.1 - 1.7 m	Obj. met Obj. not met
Phytoplankton Community < 50 % Cyanophytes (cells/mL at surface) May - August	Elk Lake 1100844 at centre	Jun. 29 Jul. 27 Aug. 30 Sep. 28	1 1 1 1	53.5 % Cyanophytes 6.3 % Cyanophytes 24.9 % cyanophytes 68.3 % Cyanophytes	Obj. not met Obj. met Obj. met Obj. not met
	Beaver Lake E207470 at centre	Jun. 29 Jul. 27 Aug. 30 Sep. 28	1 1 1 1	83.4 % Cyanophytes 37.3 % Cyanophytes 81.7 % cyanophytes 42.9 % Cyanophytes	Obj. not met Obj. met Obj. not met Obj. met

Table the Ministry of Environment 1995 Water Quality Objectives Attainment report published 1997.