2010 STATE OF THE LAKES UPDATE

ECHO LAKE

REPORT DESCRIPTION

This report is an annual update to the 2003 State of the Lakes Report and includes water quality data collected from 2003 through 2010. For additional background on the information provided here or to find out more about Echo Lake visit www.lakes.surfacewater.info or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

LAKE DESCRIPTION

Echo Lake is a 21.5 acre lake located about four miles southeast of Maltby. It is spring-fed, and the outlet drains west to Bear Creek. Echo Lake is relatively deep for its size, with a maximum depth of 15 meters and a mean depth of 5.2 meters.

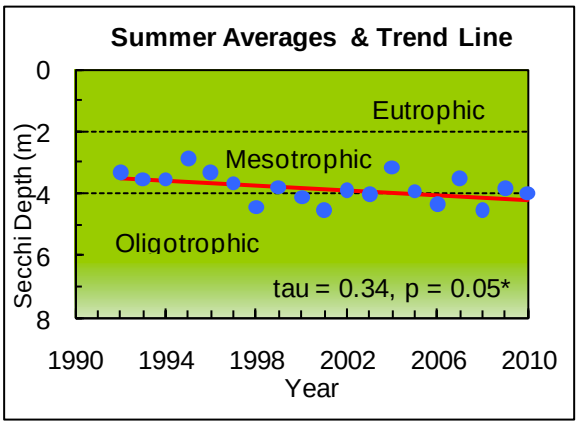
The lake watershed, the land area draining to the lake, is small—only 7 times the size of the lake. This means that there is less potential for watershed pollution to affect the lake. However, Echo Lake is located in one of the fastest growing areas in the county. Therefore, the water quality impacts from future growth are a potential concern for Echo Lake.

LAKE CONDITIONS

The following graphs illustrate the summer averages and trend lines (in red) for water clarity, total phosphorus, and chlorophyll *a* for Echo Lake. Please refer to the table at the end of this report for long-term averages and for averages and ranges for individual years.

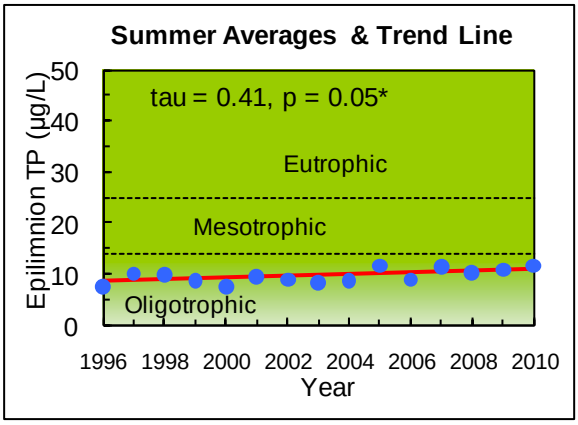
Water Clarity

The water clarity in Echo Lake is moderate and variable, with a long-term summer average of 3.8 meters. Between 1992 and 2010, there has been a small but statistically significant trend toward improving water clarity in the lake. However, there is significant year-to-year variability in the summer averages, so more years of monitoring are necessary to confirm that this trend persists. In addition, the trend toward improving water clarity is at odds with the trends toward increasing phosphorus in the upper waters and increasing chlorophyll *a* averages discussed below. It is possible that changes in the amount of natural water color or in the types of algae in the lake may have some influence on the improving water clarity.



Total Phosphorus (key nutrient for algae)

Total phosphorus concentrations in the epilimnion (upper waters) are low. The 1996 – 2010 long-term summer average for phosphorus is 10 µg/l. Although there has been low variability in phosphorus levels over this time period, between 1996 and 2010 there has been a very small, but statistically significant, trend toward higher phosphorus in the upper waters. More phosphorus can lead to more algal growth, which corresponds with the trend in chlorophyll *a* described below.



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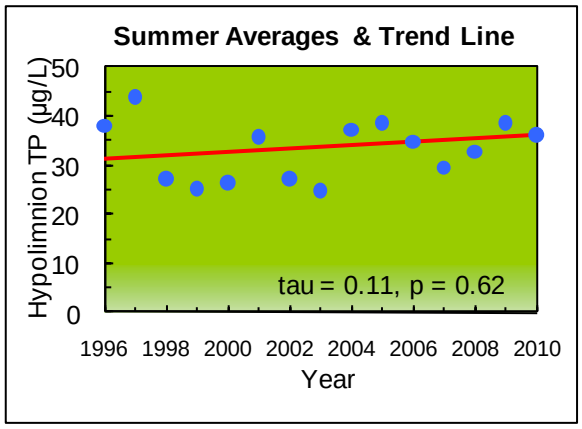
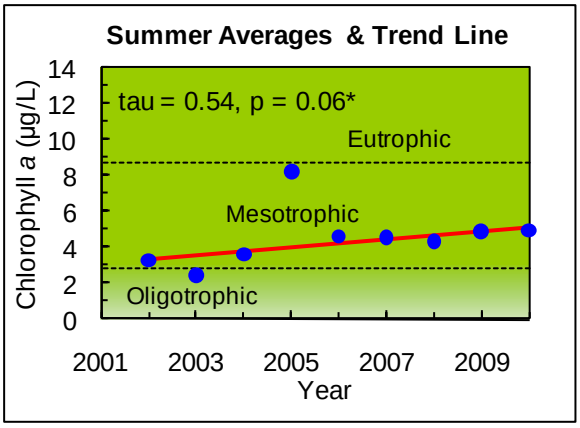
Phosphorus values in the hypolimnion (bottom waters) are higher and more variable than in the epilimnion. The long-term summer average is 33 µg/l. Summer phosphorus averages have ranged from 25 µg/l in 1999 and 2003 to 44 µg/l in 1997. There is no statistical evidence of a significant trend in total phosphorus levels in the bottom waters between 1996 and 2010. Any increases in phosphorus concentrations in the bottom waters would indicate a build-up of nutrients in the bottom sediments that might be a sign of accelerating eutrophication.



Chlorophyll a (Algae)

Chlorophyll *a* values showed moderate algal levels in Echo Lake in the summers of 2002 - 2010. The long-term summer average over these years is 4.6 µg/l. The average for 2005 was substantially higher, mainly because of one very high measurement in September taken during a dense algal bloom. The chlorophyll *a* averages show a statistically significant trend toward increasing chlorophyll *a* between 2002 and 2010. This corresponds with an increasing trend in phosphorus levels in the upper waters, but is at odds with improvements in water clarity.



AQUATIC PLANTS

Echo Lake has a diversity of emergent and submersed aquatic plants typical of other lakes in Snohomish County. Most of the aquatic plants are native to this area. However, in September 2010, the citizen volunteer lake monitor at Echo Lake reported a new plant growing near the public boat launch. The plant was identified as *Marsilea mutica*, a water clover from Australia. This plant is beautiful, but is an aggressive invader that can spread rapidly in the lake and cause problems with boating and fishing. The plant likely came from someone's aquarium dumped in the lake. Snohomish County will explore methods to eradicate this invasive plant in 2011.

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SHORELINE CONDITION

The Echo Lake shoreline was surveyed in 2009 (see map on page 4). The lake shoreline condition is important in understanding the overall lake health. Frequently, lake shorelines are modified through removal of natural vegetation, the installation of bulkheads or other hardening structures, and/or removal of partially submerged logs and branches. These types of alterations can be harmful to the lake ecosystem because natural shorelines protect the lake from harmful pollution, prevent bank erosion, and provide important habitat for fish and wildlife.

The Echo Lake shoreline is moderately developed with residential uses. There were 29 homes or cabins around the lake in 1973. By the mid-90s, there were 44 homes bordering the lake. Although homes were not surveyed in 2009, there were 37 docks counted. Fortunately, there have been limited structural modifications to the shoreline. Only 33% of the shoreline has been modified with bulkheads, rock or log revetments, or fill. However, a large majority (87%) of the native vegetation immediately adjacent to the shoreline is no longer intact. In most cases, the native vegetation has been replaced by lawns down to the water. Lawns can be a source of nutrients and do not protect the lake as well as a buffer of native vegetation. Also, there are only a few pieces of large wood (about 10) still remaining in the lake. These old logs and branches are valuable for fish and wildlife habitat.

SUMMARY

Trophic State

Based on moderate water clarity, low to moderate phosphorus, and moderate chlorophyll *a* concentrations, Echo Lake may be classified as mesotrophic.

Condition and Trends

Overall, Echo Lake is in satisfactory condition. The lake is close to the water quality targets established in the 2003 State of the Lakes Report. The targets called for maintaining stable water clarity and total phosphorus levels. For water clarity, the long-term average has increased from 3.7 meters to 3.8 meters, and there is a statistically significant trend toward improving water clarity.

However, the long-term averages for total phosphorus have increased slightly from 9 µg/l to 10 µg/l in the upper waters and from 32 µg/l to 33 µg/l in the bottom waters. And, there is a statistically significant trend toward increasing phosphorus levels in the upper waters. There is also a trend toward increasing chlorophyll *a* values, which indicates more algal growth in the lake.

For these reasons, Echo Lake is considered at risk of future water quality declines. The primary threat to maintaining good water quality in the lake is increases in nutrients from future development and from other human activities in the watershed. In order to protect the condition of the lake, measures to control nutrients in the watershed should be taken now. Nutrients enter the lake through water runoff or streams flowing into the lake. Sources of nutrients include fertilizers, pet wastes, and erosion from construction and land clearing. Nutrients may also directly enter the lake through poorly maintained septic systems. To find out more about the causes and problems of elevated lake nutrient levels and tips to improve lake water quality visit www.lakes.surfacewater.info.

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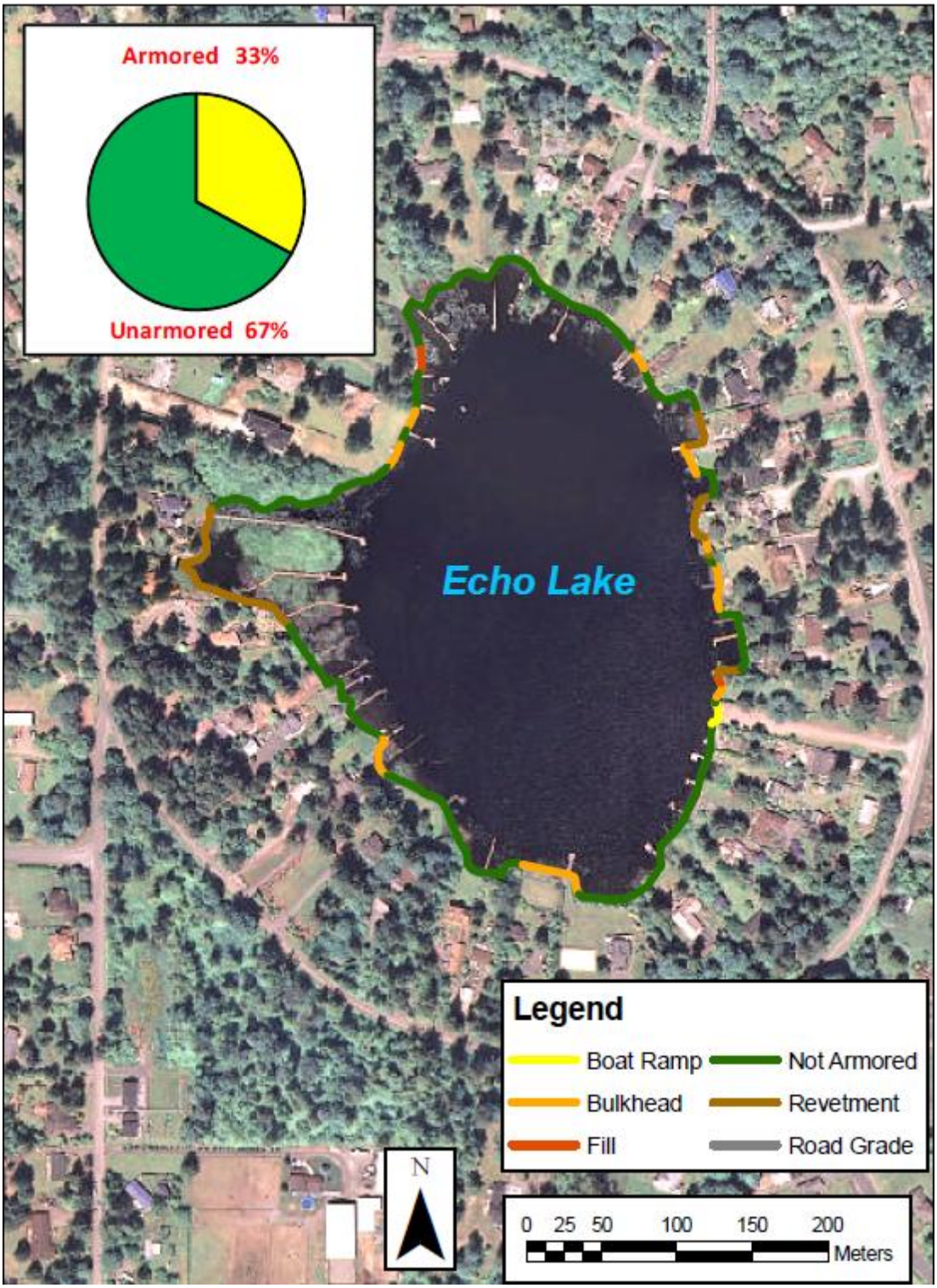
2009 Shoreline Survey Results



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DATA SUMMARY FOR ECHO LAKE

Source	Date	Water Clarity (Secchi depth in meters)	Total Phosphorus (*ug*/l) Surface	Total Phosphorus (*ug*/l) Bottom	Chlorophyll *a* (*ug*/l) Epilimnion
Menasveta, 1961	**7/59**	2.9	-	-	-
Bortleson, et al, 1976	**8/3/73**	2.1	15	31	-
Volunteer	**1992**	2.8 - 3.8 (3.3) *n = 8*	-	-	-
Volunteer	**1993**	2.3 - 4.8 (3.6) *n = 12*	-	-	-
SWM Staff or Volunteer	**1994**	2.6 - 4.6 (3.6) *n = 12*	-	-	2.4 - 5.9 (4.2) *n = 2*
SWM Staff or Volunteer	**1995**	2.2 - 3.4 (2.9) *n = 8*	-	-	9.9
Volunteer	**1996**	3.1 - 3.7 (3.3) *n = 3*	6 - 9 (8) *n = 2*	36 - 40 (38) *n = 2*	-
SWM Staff or Volunteer	**1997**	2.6 - 5.2 (3.7) *n = 8*	10 (10) *n = 2*	30 - 58 (44) *n = 2*	-
SWM Staff or Volunteer	**1998**	3.2 - 5.3 (4.5) *n = 7*	7 -13 (10) *n = 4*	21 - 40 (27) *n = 4*	-
SWM Staff or Volunteer	**1999**	3.5 - 4.0 (3.8) *n = 4*	7 - 9 (9) *n = 4*	24 - 26 (25) *n = 4*	-
SWM Staff	**2000**	3.9 - 4.3 (4.1) *n = 3*	7 - 8 (7) *n = 3*	21 - 32 (26) *n = 3*	-
SWM Staff	**2001**	3.8 - 5.5 (4.6) *n = 4*	7 - 13 (10) *n = 4*	31 - 41 (36) *n = 4*	-
SWM Staff	**2002**	3.2 - 5.0 (3.9) *n = 4*	7 - 11 (9) *n = 4*	24 - 32 (27) *n = 4*	1.3 - 4.8 (3.3) *n = 4*
SWM Staff	**2003**	3.5 - 5.4 (4.0) *n = 4*	8 - 9 (8) *n = 4*	23 - 28 (25) *n = 4*	0.8 - 5.3 (2.5) *n = 4*
Volunteer	**2004**	2.6 - 4.9 (3.2) *n = 8*	7 - 10 (9) *n = 4*	27 - 50 (37) *n = 4*	1.9 - 4.8 (3.6) *n = 4*
Volunteer	**2005**	2.8 - 5.1 (3.9) *n = 7*	10 - 13 (12) *n = 4*	23 - 59 (39) *n = 4*	3.7 - 20 (8.3)[a] *n = 4*

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DATA SUMMARY FOR ECHO LAKE					
		Water Clarity (Secchi depth	**Total Phosphorus (*ug*/l)**		**Chlorophyll *a* (*ug*/l)**
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
SWM Staff or Volunteer	**2006**	3.7 - 52 (4.4) *n = 9*	7 - 10 (9) *n = 4*	31 - 37 (35) *n = 4*	3.5 - 6.4 (4.6) *n = 4*
SWM Staff or Volunteer	**2007**	3.1 - 4.0 (3.5) *n = 5*	9 - 15 (11) *n = 4*	21 - 36 (30) *n = 4*	3.2 - 6.4 (4.6) *n = 4*
SWM Staff or Volunteer	**2008**	3.5 - 6.0 (4.6) *n = 6*	8 - 11 (10) *n = 4*	22 - 45 (33) *n = 4*	1.9 - 11 (4.4) *n = 4*
SWM Staff or Volunteer	**2009**	3.4 - 4.4 (3.8) *n = 4*	9 - 13 (11) *n = 4*	30 - 50 (39) *n = 4*	2.4 - 8.8 (4.9) *n = 4*
SWM Staff or Volunteer	**2010**	3.2 - 5.0 (4.0) *n = 7*	9 - 16 (12) *n = 4*	34 - 39 (36) *n = 4*	2.7 - 8.0 (5.0) *n = 4*
Long Term Avg		**3.8 (1992-2010)**	**10 (1996-2010)**	**33 (1996-2010)**	**4.6 (2002-2010)**
TRENDS		**Increasing**	**Increasing**	**None**	**Increasing**

NOTES

- Table includes summer (May-Oct) data only.
- Each box shows the range on top, followed by summer average in ( ) and number of samples (*n*).
- Total phosphorus data are from samples taken at discrete depths only.
- "Surface" samples are from 1 meter depth and "bottom" samples are from 1-2 meters above the bottom.

[a] Average is influenced by one high value.