2010 STATE OF THE LAKES UPDATE

LAKE GOODWIN

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 Lake Goodwin visit www.lakes.surfacewater.info or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

LAKE DESCRIPTION

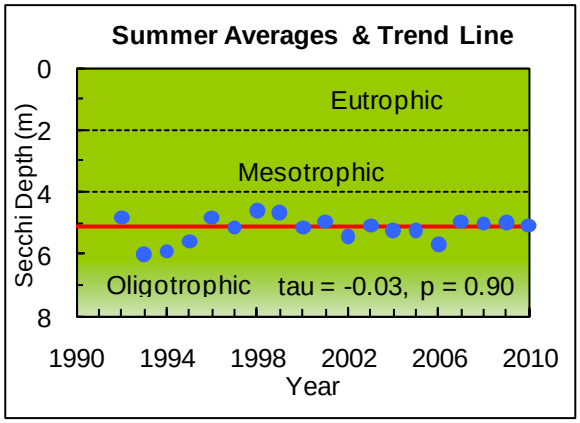
Lake Goodwin is the second largest natural lake in Snohomish County, covering 539 acres. The lake is relatively shallow for its size, with a maximum depth of 15.2 meters (50 feet) and a mean depth of 7.0 meters. It is located in the Seven Lakes area north of the Tulalip Reservation. Lake Goodwin is fed by Lake Loma and Lake Crabapple and drains to Lake Shoecraft. The total watershed, including the drainage from Lake Loma and Lake Crabapple, is small—only 6.1 times the size of the lake. However, the lake shore is fully developed with homes, and more development is occurring throughout the watershed. These activities could have future water quality impacts.

LAKE CONDITIONS

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

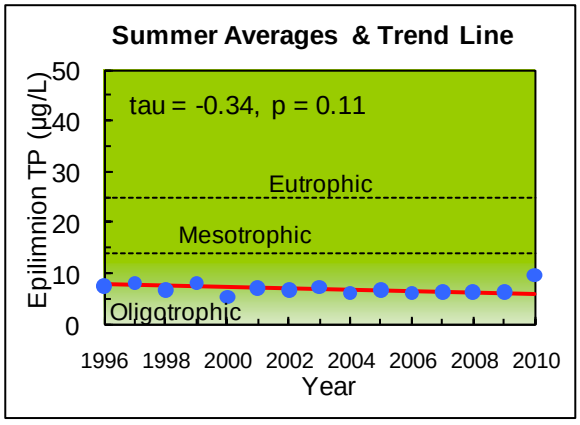
Water Clarity

The water clarity in Lake Goodwin is high, with a 1992 to 2010 long-term summer average of 5.2 meters. Although water clarity was slightly higher in the early 1990s, it has remained relatively stable over the sampling period. Between 1992 and 2010, there have been no significant changes in water clarity in Lake Goodwin.



Total Phosphorus (key nutrient for algae)

Total phosphorus concentrations in the epilimnion (upper waters) are low, with a 1996 - 2010 long-term summer average of 7 µg/l. Overall, phosphorus has shown little year-to-year variability. Until 2010, there appeared to be a very small trend toward declining total phosphorus levels in the epilimnion. That apparent trend is no longer statistically significant. The 2010 summer average of 10 µg/l, though quite low, was the highest on record. Any increase in phosphorus levels can lead to the growth of more algae in the lake.



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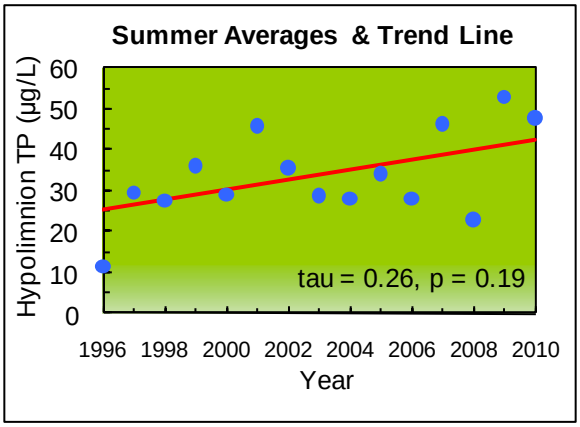
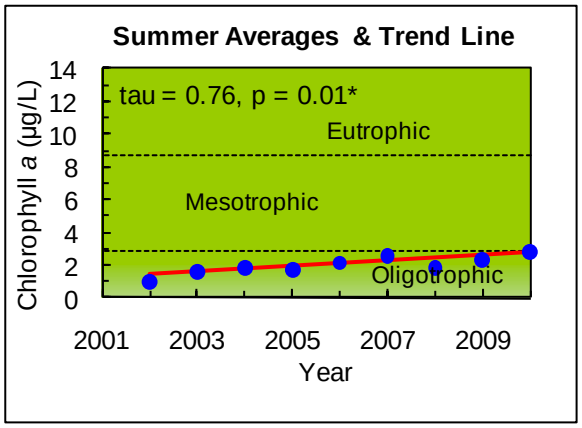
Phosphorus values in the hypolimnion (bottom waters) are higher and much more variable than in the epilimnion. The 1996 - 2010 long-term summer average in the hypolimnion is 34 µg/l. In 2009, the summer hypolimnetic phosphorus average jumped to 53 µg/l, the highest level on record. The 2010 average was 48 µg/l. These higher averages, as well as spikes in 2001 and 2007, could be warning signs of eutrophication. However, there is not yet statistical evidence to confirm a trend toward increasing total phosphorus values in the bottom waters of Lake Goodwin.



Chlorophyll a (Algae)

Chlorophyll *a* measurments showed low algae levels in the summers of 2002 through 2010, with a long-term summer average of 2.0 µg/l. However, the 2010 average of 2.8 µg/l was the highest on record. This corresponds to the highest average for phosphorus in the upper waters occurring in 2010. Between 2002 and 2010, there has been a small, but steady and statistically significant, trend towards increasing chlorophyll *a* in Lake Goodwin.

Increasing chlorophyll *a* is a sign of more algal growth and, as noted, typically corresponds with higher levels of phosphorus in the lake. Fortunately, there is no evidence of long-term increases in phosphorus levels in Lake Goodwin. Furthermore, there have been only limited observations of dense algal blooms in the lake, although there have been reports of occasional nuisance blooms in localized areas. If phosphorus levels do increase in Lake Goodwin, more frequent algal blooms may occur.



Aquatic Plants

Lake Goodwin continues to have localized infestations of Eurasian watermilfoil, an invasive aquatic plant. There are scattered locations with one to several individual milfoil plants and a few locations with small patches. These existing milfoil plants put the whole lake at risk of infestation because small fragments of milfoil can break off and potentially spread the plants to other areas of the lake. In 2008, one small area of milfoil plants near the outlet channel to Lake Shoecraft expanded into a dense patch with hundreds of plants. By the end of August 2009, most of the plants in this patch had been removed. However, more small patches of milfoil were found in 2010 in other parts of Lake Goodwin that likely came from this source, and Lake Shoecraft has now become re-infested by milfoil fragments from Lake Goodwin. Snohomish County and lake residents will continue to work on controlling and eliminating this plant using funds collected from the property owners around the lake.

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SHORELINE CONDITION

The Lake Goodwin shoreline was surveyed in 2008 (see map on page 4). The condition of the lake shoreline is important to understanding the overall lake health. As development on a lake increases, lake shorelines typically are modified either through removal of natural vegetation and/or the installation of bulkheads or other hardening structures. This type of alteration 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.

Lake Goodwin has the second most densely developed lake shoreline in the county. Surveys conducted in the mid-90s identified 381 homes bordering the lake with an average of 13.2 homes per 1000 feet of shoreline. Although homes were not counted in 2008, 367 docks were present covering nearly 5 acres of the lake. Seventy percent of the 5.7 miles of shoreline has been modified, with bulkheads comprising the majority of the modifications (62%) and rock or log revetments accounting for 6.6%. The zone of native vegetation immediately adjacent to the shoreline has also been dramatically altered, with only 4% now being classified as still intact. In addition, there is almost no large wood remaining in Lake Goodwin. These old logs and branches are valuable for fish and wildlife habitat.

The high level of shoreline modification leaves the lake susceptible to pollution inputs from the watershed, eliminates the buffer of vegetation that can filter out pollution, and limits the amount of aquatic habitat available to fish and wildlife. The loss of native vegetation along the shoreline could also lead to shoreline erosion.

SUMMARY

Trophic State

Based on high water clarity, low phosphorus concentrations, and low amounts of algae, Lake Goodwin may be classified as oligo-mesotrophic.

Condition and Trends

Overall, Lake Goodwin appears to be in healthy condition. The targets set forth in the 2003 State of the Lakes Report were to maintain long-term averages of 5.2 meters water clarity and phosphorus averages of 7 µg/l in the epilimnion and 31 µg/l in the hypolimnion. The target for water clarity is being met because there has been no change in the long-term average. The phosphorus target for the epilimnion has also been met because the long-term average is unchanged. However, the long-term phosphorus average in the bottom waters is now slightly higher at 34 µg/l. The slight increases in chlorophyll *a* values may be an early warning sign of future water quality problems and will need to be carefully tracked.

The primary threat to Lake Goodwin's water quality is the possibility of increases in nutrients from future development or from human activities in the surrounding watershed. The lake is particularly susceptible to watershed inputs given the high degree of shoreline modification and lack of natural vegetation bordering the lakeshore. In order to protect the healthy condition of the lake, measures to control nutrients in the watershed should be taken. Nutrients enter the lake through stormwater runoff or from 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 nutrient pollution and tips to improve lake water quality visit www.lakes.surfacewater.info.

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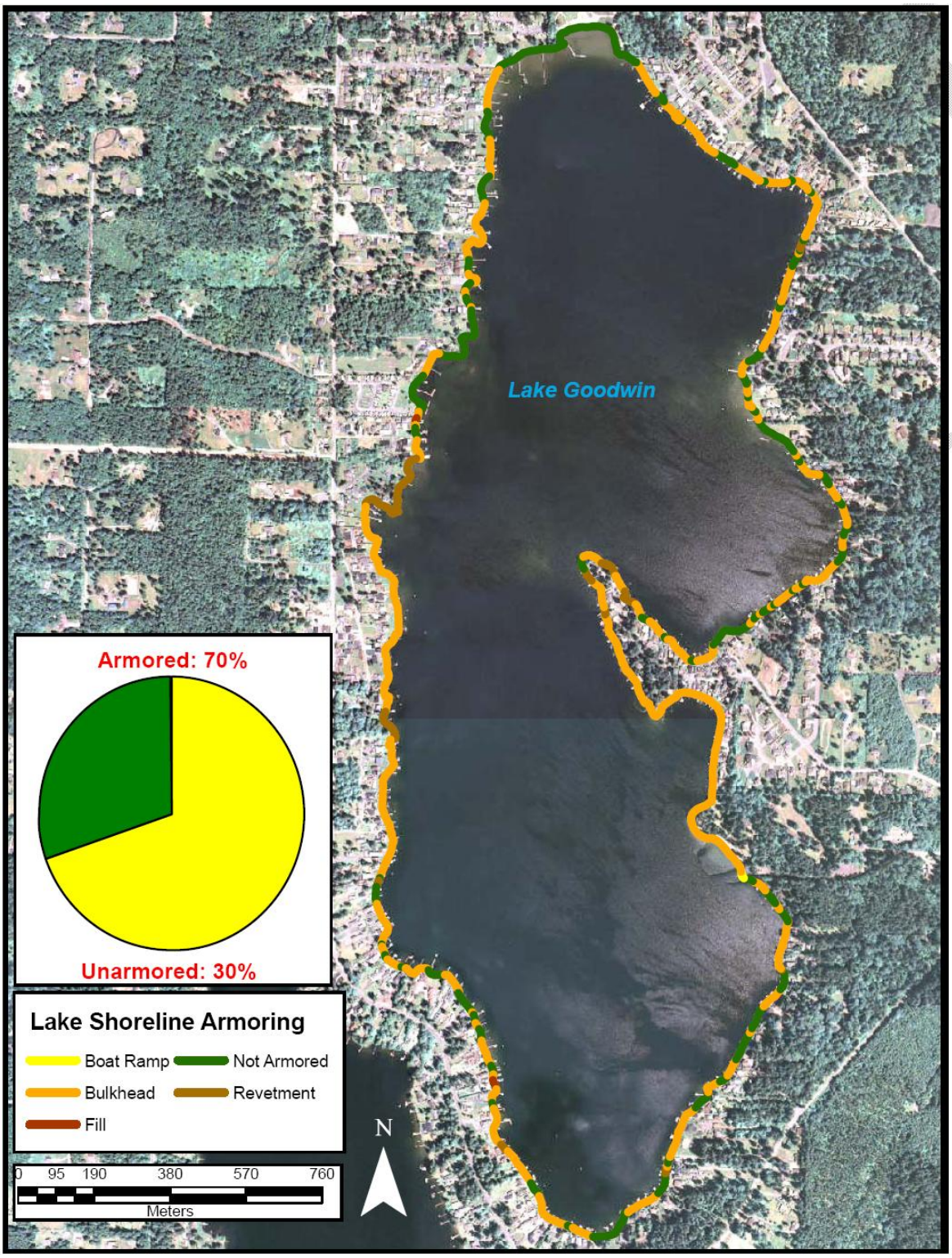

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DATA SUMMARY FOR LAKE GOODWIN					
		Water Clarity (Secchi depth	**Total Phosphorus (*ug*/l)**		**Chlorophyll *a* (*ug*/l)**
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
Bortleson, et al, 1976	**7/27/72**	4.0	5	16	-
Entranco, 1986	**1983**	4.1 - 6.0 (5.3) *n = 5*	<5 (<5) *n = 5*	7 - 20 (13) *n = 5*	1.1 - 2.3 (1.5) *n = 5*
DOE	**1989**	4.2 - 6.9 (5.0) *n = 8*	-	-	-
Volunteer	**1992**	3.6 - 6.8 (4.8) *n = 7*	-	-	-
Volunteer	**1993**	5.3 - 7.1 (6.0) *n = 5*	-	-	-
SWM Staff	**1994**	5.7 - 6.2 (5.9) *n = 2*	-	-	0.5 - 2.7 (1.6) *n = 2*
SWM Staff	**1995**	5.6	-	-	1.9
Volunteer	**1996**	4.0 - 6.5 (4.8) *n = 10*	<2 - 13 (8) *n = 2*	9 - 14 (12) *n = 2*	-
SWM Staff or Volunteer	**1997**	3.4 - 7.7 (5.2) *n = 14*	7 - 9 (8) *n = 2*	23 - 36 (30) *n = 2*	-
Volunteer	**1998**	3.4 - 7.2 (4.6) *n = 15*	4 - 8 (7) *n = 4*	20 - 39 (28) *n = 4*	-
SWM Staff or Volunteer	**1999**	3.4 - 5.9 (4.7) *n = 12*	5 - 14 (8) *n = 4*	16 - 44 (36) *n = 4*	-
SWM Staff or Volunteer	**2000**	3.3 - 7.0 (5.1) *n = 11*	3 - 7 (5) *n = 4*	2 - 47 (29) *n = 4*	-
Volunteer	**2001**	3.8 - 6.0 (5.0) *n = 12*	6 - 8 (7) *n = 4*	26 - 68 (46) *n = 4*	-
SWM Staff or Volunteer	**2002**	4.2 - 6.5 (5.5) *n = 10*	5 - 8 (7) *n = 4*	20 - 48 (36) *n = 4*	0.5 - 1.9 (1.0) *n = 4*
SWM Staff or Volunteer	**2003**	4.0 - 7.0 (5.1) *n = 13*	6 - 9 (7) *n = 4*	14 - 42 (29) *n = 4*	1.1 - 1.9 (1.6) *n = 4*
Volunteer	**2004**	4.3 - 6.7 (5.3) *n = 10*	5 - 7 (6) *n = 4*	19 - 37 (28) *n = 4*	1.3 - 2.7 (1.8) *n = 4*

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Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
Volunteer	**2005**	3.0 - 6.7 (5.2) *n = 13*	5 - 8 (7) *n = 4*	20 - 45 (34) *n = 4*	1.1 - 2.4 (1.7) *n = 4*
SWM Staff or Volunteer	**2006**	3.6 - 7.6 (5.7) *n = 14*	4 - 8 (6) *n = 4*	14 - 44 (28) *n = 4*	1.6 - 3.2 (2.1) *n = 4*
SWM Staff or Volunteer	**2007**	4.3 - 6.2 (5.0) *n = 11*	5 - 8 (6) *n = 4*	32 - 59 (46) *n = 4*	2.1 - 2.7 (2.6) *n = 4*
SWM Staff or Volunteer	**2008**	4.1 - 6.7 (5.0) *n = 11*	4 - 10 (6) *n = 4*	13 - 38 (23) *n = 4*	1.6 - 2.1 (1.8) *n = 4*
SWM Staff or Volunteer	**2009**	3.7 - 6.0 (5.0) *n = 10*	5 - 7 (6) *n = 4*	32 - 69 (53) *n = 4*	1.5 - 3.2 (2.3) *n = 4*
SWM Staff or Volunteer	**2010**	4.3 - 5.6 (5.1) *n = 10*	6 - 13 (10) *n = 4*	27 - 82 (48) *n = 4*	2.0 - 4.5 (2.8) *n = 4*
Long Term Avg		**5.2 (1992-2010)**	**7 (1996-2010)**	**34 (1996-2010)**	**2.0 (2002-2010)**
TRENDS		**None**	**None**	**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.
- DOE = Washington Department of Ecology
- "Surface" samples are from 1 meter depth and "bottom" samples are from 1-2 meters above the bottom.