STORM 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 2009. For additional background on the information provided here or to find out more about Storm Lake visit www.lakes.surfacewater.info or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

LAKE DESCRIPTION

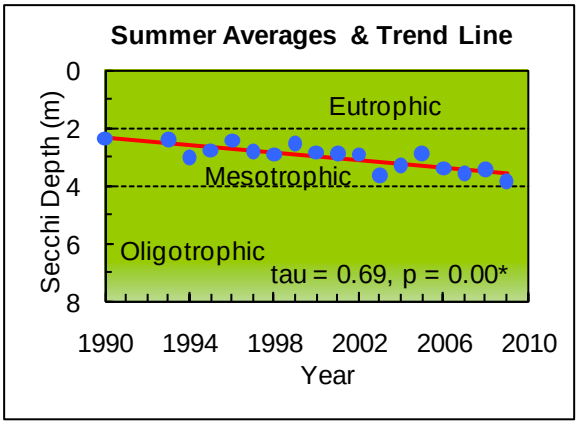
Storm Lake is a 76-acre lake located six miles north of Monroe. It sits at the headwaters of a three-lake chain. Storm Lake is fed by groundwater and drains into Flowing Lake, which in turn discharges into Panther Lake. Storm Lake has a maximum depth of 14 meters (46 feet) and an average depth of 6.7 meters (22 feet). The watershed for this lake is very small—less than three times the size of the lake. This means that there is less potential for pollution from activities in the watershed affecting the lake water quality compared to other lakes. Also, there is only scattered development in the watershed, except around the shoreline. Most of the lake shore is developed with single family homes.

LAKE CONDITIONS

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

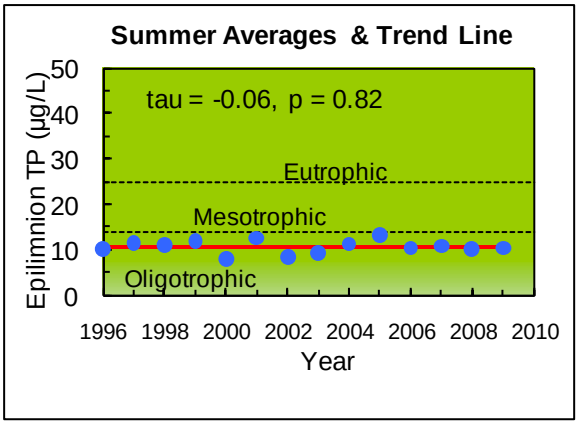
Water Clarity

Water clarity in Storm Lake is moderate, with a 1990 – 2009 long-term summer average of 3.0 meters. Natural humic substances color the water light brown and reduce the water clarity. However, this color does not affect water quality. In recent years, water clarity has been about a meter better than in the early 1990s. In fact, between 1990 and 2009 there has been a statistically significant trend toward improving water clarity. This is somewhat at odds with potential increases in phosphorus and algal growth described below. One potential explanation for improving clarity is that there is less color in the water than in past decades, but this is not substantiated. In any case, better water clarity is good news for the lake.



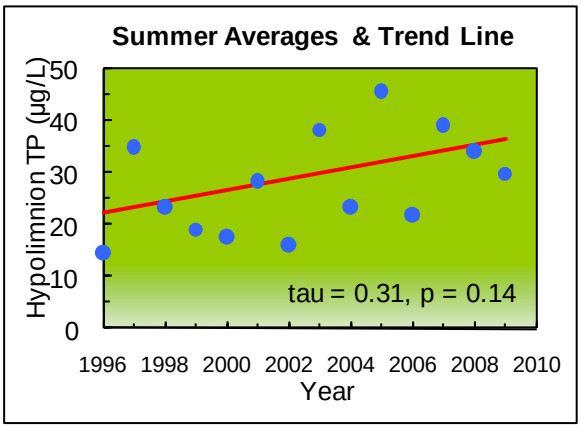
Total Phosphorus (key nutrient for algae)

Total phosphorus concentrations in the epilimnion (upper waters) are low, with a 1996 - 2009 long-term summer average of 11 µg/l. Summer phosphorus averages have shown little year to year variability. There is no evidence of any long-term trend in phosphorus concentrations in the epilimnion.



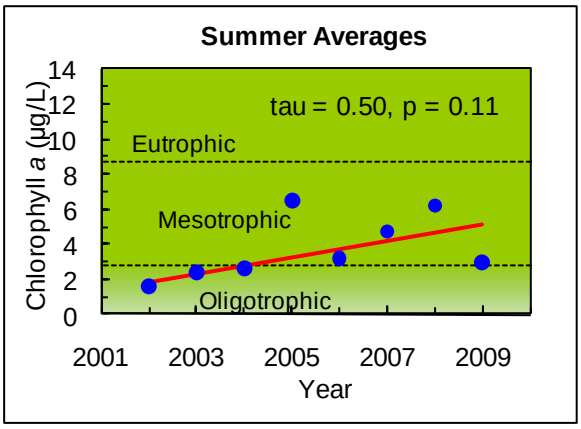
STORM LAKE

Phosphorus values in the hypolimnion (bottom waters) are higher and much more variable than in the epilimnion. The 1996 – 2009 long-term summer average is 28 µg/l. In recent years, phosphorus averages have been higher than in the 1990s, which indicates more release of phosphorus from bottom sediments during periods of low dissolved oxygen. High phosphorus levels in the bottom waters may also be a sign of accelerated eutrophication and may be leading to increases in algal growth. Although there is not a statistically significant trend toward increasing phosphorus in the hypolimnion, the potential for continuing increases in nutrients in the bottom waters is a concern.



Chlorophyll a (Algae)

Chlorophyll *a* values indicate moderate levels of algal growth in the lake. The long-term 2002 - 2009 summer average is 3.8 µg/l. Currently, there is no statistically significant trend toward increasing chlorophyll *a* concentrations, partly because there was no substantial algal bloom in the lake during 2009 as there had been in some recent years. However, the generally higher averages in recent years may indicate increasing eutrophication and may be a response to higher phosphorus levels in the bottom waters. More algal growth can eventually affect the use of the lake.



STORM LAKE

SHORELINE CONDITION

The Storm Lake shoreline was surveyed in 2008 (see map on page 4). The condition of the lake shoreline is important to understanding overall lake health. As development on a lake increases, the shorelines typically are modified either through removal of natural vegetation, the installation of bulkheads or other hardening structures, and/or the removal of large 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 Storm Lake shoreline is moderately developed. There were 26 homes or cabins around the lake in 1973. By the mid-90s, there were 38 homes bordering the lake. Although homes were not surveyed in 2008, 41 docks were counted. Fortunately, there have been limited modifications to the shoreline through the years. Only 7% of the shoreline has been armored with bulkheads, rock or log revetments, or fill. A sizeable portion (69%) of the shore immediately adjacent to the lake still contains a zone of intact native vegetation. On the other hand, this does mean that 31% of the vegetation has been altered. There is also a moderate amount of large wood (about 71 pieces) still remaining in the lake. These old logs and branches are valuable for fish and wildlife habitat.

These various forms of shoreline modification leave the lake susceptible to pollution from the watershed, eliminate the buffer of native vegetation that can filter out pollution, and limit the amount of habitat available for fish and wildlife. The loss of native vegetation along the shoreline could also lead to shoreline erosion.

SUMMARY

Trophic State

Storm Lake may be classified as mesotrophic based on moderate water clarity and low to moderate levels of phosphorus and algae. There are low amounts of aquatic plants in the lake, partly because the colored water and steep shoreline limit the amount of light and the area available for plant growth.

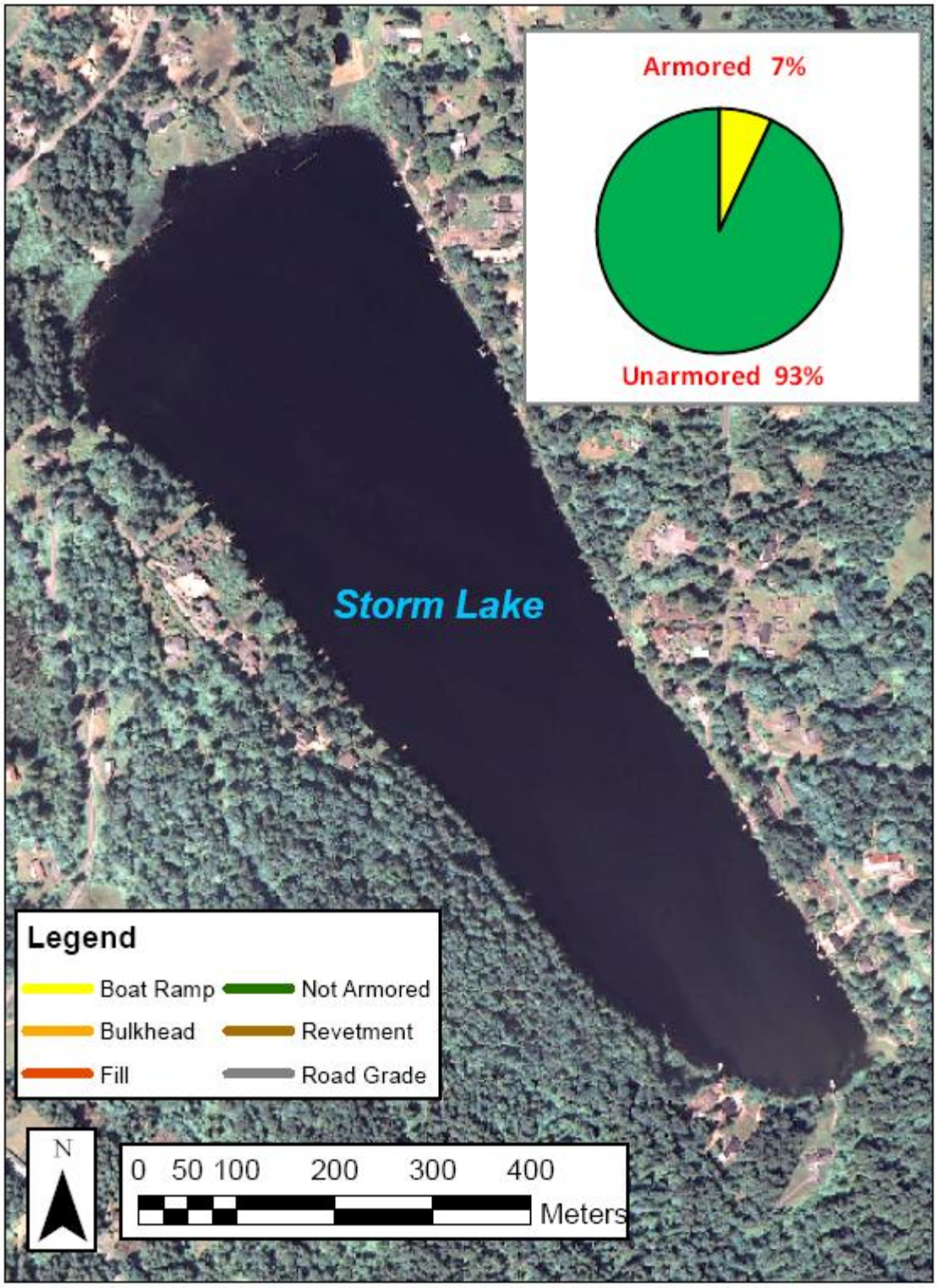
Condition and Trends

The water quality targets for Storm Lake set forth in the 2003 State of the Lakes Report were to maintain stable water clarity and phosphorus levels. The lake is exceeding the water clarity target. There is a statistically significant trend toward improving water clarity between 1990 and 2009. The lake is also meeting the phosphorus target for the upper waters. Levels of phosphorus in the epilimnion appear to be stable.

However, phosphorus levels in the bottom waters have been higher in recent years, which may point to more nutrients entering the lake. There also appears to be a corresponding increase in algal growth since 2002, but additional years of monitoring data are needed to see if these are significant trends.

Overall, Storm Lake is in satisfactory condition. However, the lake is at risk of future water quality declines because of potentially increasing nutrient pollution. The primary threat to lake water quality is the possibility of rapid development or other human activities that would increase the inflow of nutrients from the watershed. Nutrients enter the lake through stormwater runoff or small streams flowing into the lake. Sources of nutrients include fertilizers, pet wastes, runoff from roofs and driveways, and erosion from construction and land clearing. Nutrients may also directly enter the lake through poorly maintained septic systems. Measures to control nutrients in the watershed should be taken now to prevent any future negative impacts to the lake. To find out more about the causes and problems of elevated lake nutrient levels and learn about steps to improve lake water quality visit www.lakes.surfacewater.info.

STORM LAKE


Armored 7%
Unarmored 93%
Storm Lake
Legend
Boat Ramp
Not Armored
Bulkhead
Revetment
Fill
Road Grade
N
0 50 100 200 300 400
Meters

STORM LAKE

DATA SUMMARY FOR STORM LAKE					
		Water Clarity (Secchi depth	Total Phosphorus (*ug*/l)		Chlorophyll *a* (*ug*/l)
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
Bortleson, et al, 1976	**7/23/73**	2.1	13	37	-
DOE	**1990**	1.8 - 3.1 (2.4) *n = 6*	-	-	-
Volunteer	**1993**	1.7 - 3.1 (2.4) *n = 9*	-	-	-
SWM Staff or Volunteer	**1994**	2.2 - 4.5 (3.0) *n = 14*	-	-	1.9 - 9.8 (5.9) *n = 2*
SWM Staff or Volunteer	**1995**	2.0 - 3.9 (2.8) *n = 13*	-	-	6.7
Volunteer or DOE	**1996**	1.8 - 3.3 (2.4) *n = 14*	5 - 15 (10) *n = 2*	10 - 19 (15) *n = 2*	4.4 - 6.3 (5.4) *n = 2*
SWM Staff or Volunteer	**1997**	2.5 - 3.5 (2.8) *n = 15*	9 - 14 (12) *n = 2*	27 - 43 (35) *n = 2*	-
Volunteer	**1998**	2.3 - 3.9 (2.9) *n = 13*	7 - 20 (11) *n = 4*	20 - 28 (24) *n = 4*	-
Volunteer	**1999**	1.3 - 3.7 (2.6) *n = 14*	8 - 17 (12) *n = 4*	14 - 23 (19) *n = 4*	-
SWM Staff or Volunteer	**2000**	2.2 - 3.5 (2.9) *n = 12*	4 - 13 (8) *n = 4*	3 - 27 (18) *n = 4*	-
SWM Staff or Volunteer	**2001**	2.4 - 3.5 (2.9) *n = 12*	9 - 19 (13) *n = 4*	26 - 30 (29) *n = 4*	-
SWM Staff or Volunteer	**2002**	2.3 - 3.6 (2.9) *n = 13*	4 - 11 (8) *n = 4*	15 - 19 (16) *n = 4*	0.1 - 3.7 (1.6) *n = 4*
SWM Staff or Volunteer	**2003**	2.4 - 5.2 (3.7) *n = 4*	6 - 12 (9) *n = 4*	29 - 54 (38) *n = 4*	1.6 - 4.3 (2.4) *n = 4*
SWM Staff or Volunteer	**2004**	2.1 - 4.4 (3.3) *n = 4*	7 - 13 (11) *n = 4*	8 - 35 (24) *n = 4*	0.8 - 4.5 (2.7) *n = 4*
SWM Staff or Volunteer	**2005**	2.3 - 3.3 (2.9) *n = 4*	10 - 17 (13) *n = 4*	26 - 65 (46) *n = 4*	4.3 - 9.1 (6.5) *n = 4*
SWM Staff or Volunteer	**2006**	2.8 - 4.4 (3.4) *n = 10*	8 - 12 (10) *n = 4*	20 - 25 (22) *n = 4*	1.6 - 5.3 (3.2) *n = 4*

STORM LAKE

DATA SUMMARY FOR STORM LAKE					
		Water Clarity (Secchi depth	**Total Phosphorus (*ug*/l)**		**Chlorophyll *a* (*ug*/l)**
Source	**Date**	**in meters)**	**Surface**	**Bottom**	**Epilimnion**
SWM Staff or Volunteer	**2007**	3.2 - 4.0 (3.6) *n = 9*	8 - 13 (11) *n = 4*	23 - 54 (39) *n = 4*	3.2 - 7.2 (4.7) *n = 4*
SWM Staff or Volunteer	**2008**	2.6 - 4.3 (3.5) *n = 11*	7 - 13 (10) *n = 3*	23 - 47 (34) *n =3*	2.4 - 16 (6.2) *n = 4*
SWM Staff or Volunteer	**2009**	3.0 - 4.5 (3.9) *n = 12*	8 - 12 (10) *n = 4*	23 - 34 (30) *n = 4*	1.6 - 5.1 (3.0) *n = 4*
Long Term Avg		**3.0** **(1990-2009)**	**11** **(1996-2009)**	**28** **(1996-2009)**	**3.8** **(2002-2009)**
TRENDS		**Increasing**	**None**	**None**	**None**

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.