

# MARTHA LAKE (MARTHA S.)

## 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 Martha Lake visit [www.lakes.surfacewater.info](http://www.lakes.surfacewater.info) or call Snohomish County Surface Water Management (SWM) at 425-388-3464.

## LAKE DESCRIPTION

Martha Lake is a 62-acre lake located just east of I-5 between Lynnwood and Mill Creek. It is fed by two small streams and drains south into Martha Creek and eventually to Swamp Creek. Martha Lake has a maximum depth of 14.6 (48 feet) meters and a mean depth of 7.3 meters (24 feet).

The Martha Lake watershed is less than 8 times the size of the lake, which should reduce the potential for pollution to impact the lake. However, the watershed is densely developed with urban uses, including I-5, and more growth is under way. These land uses may contribute nutrients that adversely affect the health of the lake.

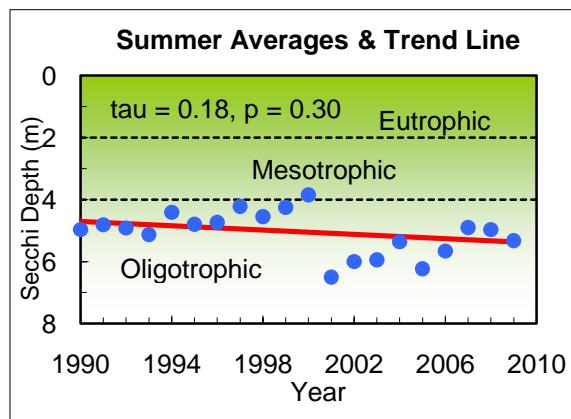
## LAKE CONDITIONS

The following graphs illustrate the summer averages and trend lines (in red) for water clarity, total phosphorus, and chlorophyll for Martha 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

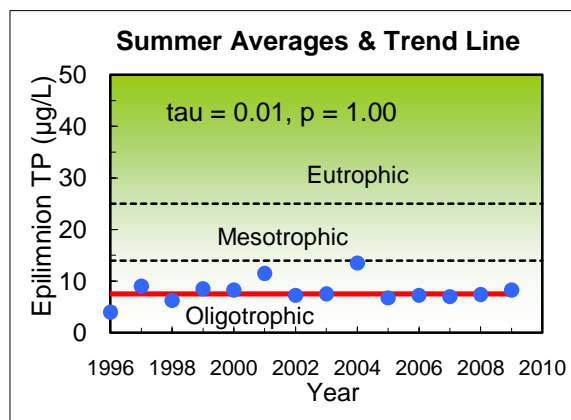
Water clarity in Martha Lake is moderately high, with a 1990 - 2009 long-term summer average of 5.1 meters. Over the entire monitoring period there has been no statistically significant trend in water clarity. However, between 1990 and 2000, water clarity was low and declining. Then, from 2001 to 2006, the summer averages were consistently higher. The reasons for this dramatic improvement are unclear. Nutrient levels do not show a corresponding change. There was also no change in volunteers that may have affected

the readings. It is possible that algal concentrations declined, but there are no chlorophyll a data prior to 2002 to confirm this.



### Total Phosphorus (key nutrient for algae)

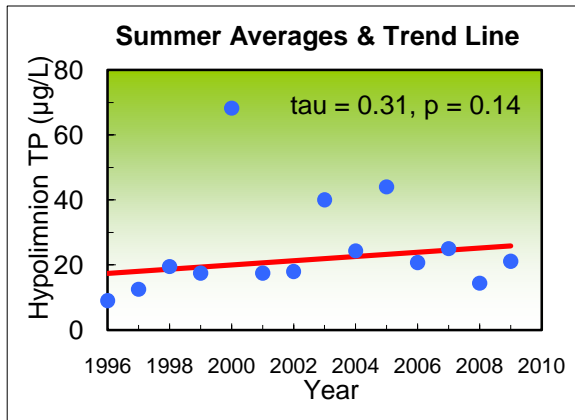
Total phosphorus concentrations in the epilimnion (upper waters) are low. The long-term 1996 - 2009 summer average is 8 µg/l. Except for 2001 and 2004, when the averages were somewhat higher, there has been little year-to-year variability in phosphorus levels. This corresponds with no changes in algae levels, as described below.



Summertime phosphorus concentrations in the hypolimnion (bottom waters) are higher and more variable than in the epilimnion. The long-term average is 25 µg/l for the 1996 - 2009 period. Averages in 2000, 2003, and 2005 were considerably higher than other years. Although there has not been a statistically

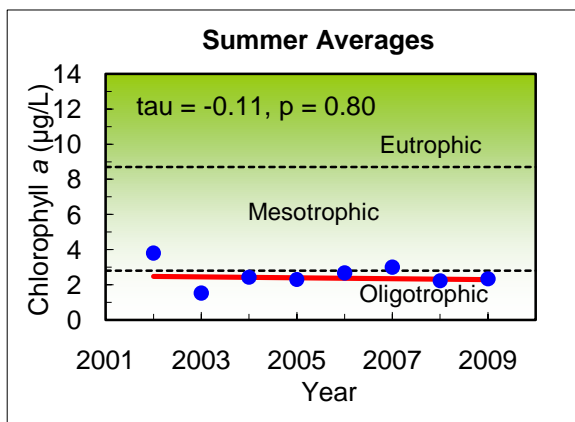
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significant trend toward increasing phosphorus in the hypolimnion, the summer averages in the 2000s are somewhat higher than they were in the 1990s. This reflects a possible release of phosphorus from the bottom sediments during periods of low dissolved oxygen. The build-up of phosphorus in the bottom waters through time may be a sign of accelerating eutrophication.



### Chlorophyll a (Algae)

Chlorophyll a measurements show low to moderate levels of algae in Martha Lake. The long-term average for the summers of 2002 - 2009 is 2.5 µg/l. Occasional algal blooms have been observed in Martha Lake, but do not appear to cause substantial impacts to the use of the lake.



### SHORELINE CONDITION

The Martha Lake shoreline was surveyed in 2009 (see map on page 3). The lake shoreline condition is important in understanding 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.

Martha Lake has one of the most densely developed shorelines in the county. The number of homes along the shoreline increased from 85 in 1973 to 97 by the mid-90s. Although homes were not surveyed in 2009, 90 docks were counted, covering 0.8 acres of the lake. The lake shoreline also has the second highest level of shoreline modifications in the County—72% of the 1.6 miles of shoreline are armored. The armoring primarily consists of wood or stone revetments (50% of the armoring) and bulkheads (48%).

The zone of vegetation immediately adjacent to the shoreline has also been greatly altered, with only 16% being classified as intact native vegetation. 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. Fortunately, there is still a moderate amount of large wood (about 101 pieces) still remaining in the lake. These old logs and branches are valuable for fish and wildlife habitat.

The large amount of shoreline modification at Martha Lake leaves the lake susceptible to pollution from the watershed, eliminates the buffer of native vegetation that can filter out pollution, and limits the amount of habitat available for fish and wildlife.

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### SUMMARY

#### Trophic State

Based on moderately high water clarity and low to moderate phosphorus and chlorophyll *a* levels, Martha Lake may currently be classified as oligo-mesotrophic. This means the lake has low to moderate productivity of algae and aquatic plants.

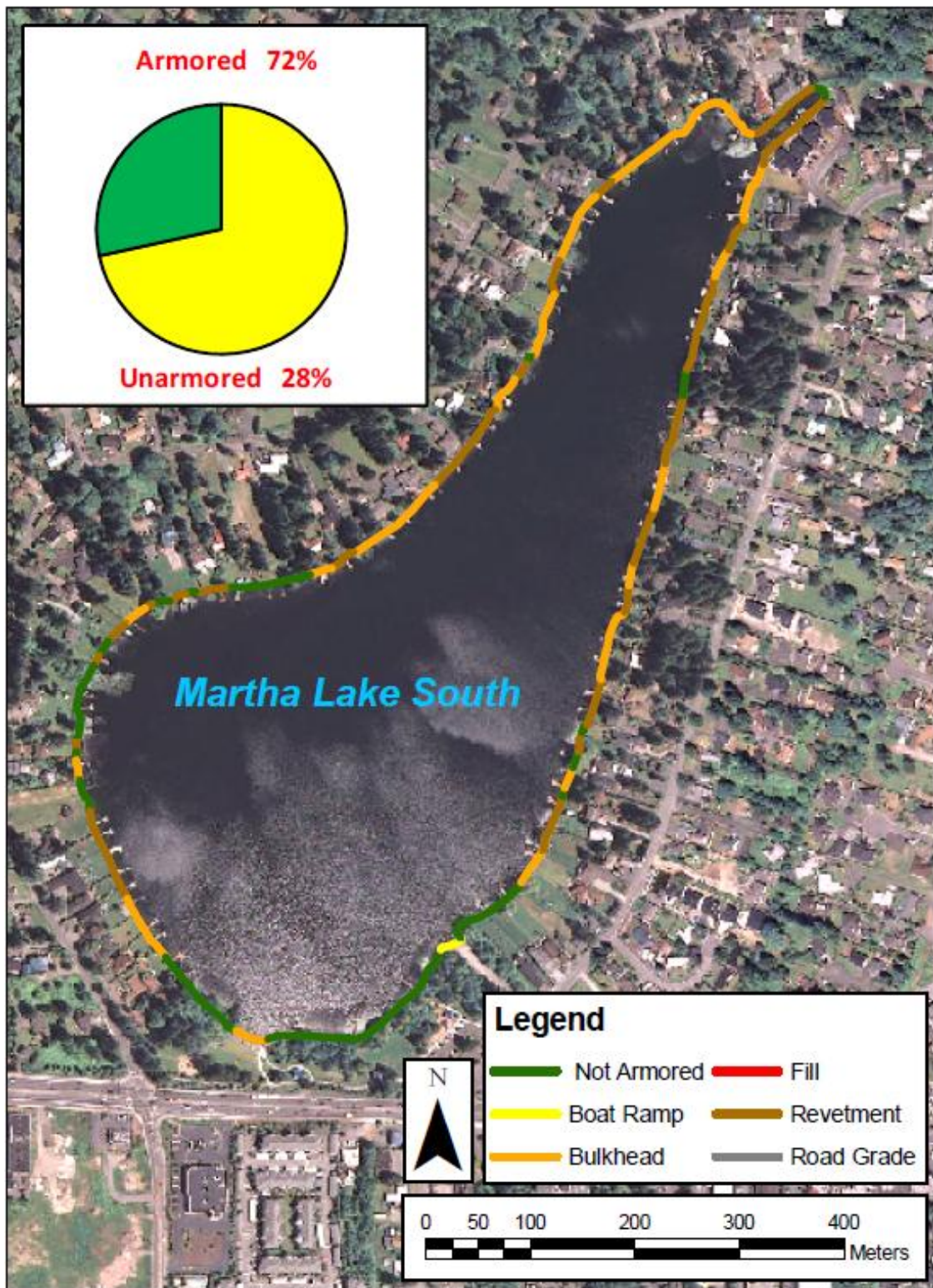
#### Condition and Trends

The water quality targets set forth in the 2003 State of the Lakes Report for Martha Lake were to maintain stable water clarity and total phosphorus levels in the lake. With the long-term average water clarity at 5.1 meters, and several years of improved water clarity, Martha Lake is exceeding the water clarity target.

Phosphorus levels in the epilimnion appear to be stable. However, the lake is not meeting the goal for phosphorus concentrations in the hypolimnion. The long-term summer average has increased from 23 µg/l to 25 µg/l in recent years, and there is some indication of a potential phosphorus build-up in the bottom waters.

Overall, Martha Lake is in satisfactory condition. But, the lake is at risk of future water quality declines. The potential for increasing phosphorus in the hypolimnion raises concerns about accelerated eutrophication that may lead to more algal growth and reduced water clarity in the future. The primary threat to lake water quality is an increase of nutrients entering the lake through new development and human activities in the watershed, particularly given the high amount of shoreline modification. Nutrients enter the lake through stormwater runoff from the watershed. Sources of nutrients include fertilizers, pet wastes, runoff from roofs and driveways, and erosion from construction and land clearing. 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 ways to protect lake water quality and information on the causes and problems of elevated lake nutrient levels please visit [www.lakes.surfacewater.info](http://www.lakes.surfacewater.info).

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DATA SUMMARY FOR MARTHA LAKE (S.)					
Source	Date	Water Clarity (Secchi depth in meters)	Total Phosphorus (ug/l)		Chlorophyll a (ug/l)
			Surface	Bottom	Epilimnion
Bortleson, et al, 1976	7/25/73	4.0	3	9	-
Entranco, 1991 or DOE	1990	3.3 - 6.3 (5.0) n = 22	3 - 12 (7) n = 11	3 - 28 (17) n = 11	2.3 - 7.5 (4.3) n = 11
DOE	1991	4.3 - 5.5 (4.8) n = 12	-	-	-
Volunteer or DOE	1992	4.3 - 5.8 (4.9) n = 11	-	-	0.4 - 1.1 (0.8) n = 2
Volunteer or DOE	1993	3.4 - 7.3 (5.1) n = 12	-	-	1.1 (1.1) n = 2
Volunteer or DOE	1994	2.9 - 6.0 (4.4) n = 10	-	-	1.8 - 2.5 (2.2) n = 2
Volunteer or DOE	1995	3.9 - 6.0 (4.8) n = 12	-	-	1.9 - 2.8 2.4 n = 2
Volunteer or DOE	1996	3.7 - 5.8 (4.7) n = 14	3 - 5 (4) n = 2	6 - 12 (9) n = 2	2.1 - 3.9 (3.0) n = 2
SWM Staff, Volunteer or DOE	1997	3.1 - 5.6 (4.2) n = 11	5 - 13 (9) n = 2	10 - 15 (13) n = 2	2.0
SWM Staff, Volunteer or DOE	1998	3.8 - 6.0 (4.5) n = 10	5 - 8 (6) n = 4	15 - 22 (20) n = 4	-
SWM Staff or Volunteer	1999	3.3 - 5.7 (4.3) n = 11	7 - 10 (9) n = 4	12 - 21 (18) n = 4	-
SWM Staff or Volunteer	2000	3.1 - 4.4 (3.9) n = 8	7 - 10 (8) n = 4	16 - 199 (68) <sup>a</sup> n = 4	-
Volunteer	2001	5.5 - 6.9 (6.5) n = 5	7 - 22 (12) n = 4	14 - 20 (18) n = 4	-
SWM Staff	2002	4.2 - 7.5 (6.0) n = 4	6 - 10 (7) n = 4	12 - 30 (18) n = 4	0.9 - 12 (3.8) n = 4
SWM Staff or Volunteer	2003	4.0 - 10.1 (5.9) n = 9	6 - 11 (8) n = 4	19 - 77 (40) n = 4	1.1 - 2.4 (1.5) n = 4

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			Surface	Bottom	Epilimnion
SWM Staff or Volunteer	<b>2004</b>	3.2 - 7.1 (5.4) <i>n</i> = 5	8 - 24 (14) <i>n</i> = 4	18 - 29 (24) <i>n</i> = 3	1.1 - 4.8 (2.4) <i>n</i> = 4
SWM Staff or Volunteer	<b>2005</b>	4.2 - 8.2 (6.2) <i>n</i> = 12	5 - 9 (7) <i>n</i> = 4	15 - 79 (44) <i>n</i> = 4	1.9 - 2.9 (2.3) <i>n</i> = 3
SWM Staff or Volunteer	<b>2006</b>	3.7 - 7.3 (5.7) <i>n</i> = 15	5 - 9 (7) <i>n</i> = 4	9 - 36 (21) <i>n</i> = 4	1.6 - 3.7 (2.7) <i>n</i> = 4
SWM Staff or Volunteer	<b>2007</b>	3.4 - 6.6 (4.9) <i>n</i> = 9	5 - 10 (7) <i>n</i> = 4	21 - 27 (25) <i>n</i> = 3	2.1 - 4.3 (3.0) <i>n</i> = 4
SWM Staff or Volunteer	<b>2008</b>	3.2 - 6.2 (5.0) <i>n</i> = 12	6 - 9 (7) <i>n</i> = 4	11 - 19 (14) <i>n</i> = 4	1.6 - 3.2 (2.2) <i>n</i> = 4
SWM Staff or Volunteer	<b>2009</b>	4.2 - 6.4 (5.3) <i>n</i> = 6	6 - 11 (8) <i>n</i> = 4	13 - 29 (21) <i>n</i> = 4	1.4 - 4.3 (2.3) <i>n</i> = 4
<b>Long Term Avg</b>		<b>5.1</b> (1990-2009)	<b>8</b> (1996-2009)	<b>25</b> (1996-2009)	<b>2.5</b> (2002-2009)
<b>TRENDS</b>		<b>None</b>	<b>None</b>	<b>None</b>	<b>None</b>

## 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.

<sup>a</sup> Average is influenced by one high TP value.