

# Lake Cochran

Lake Cochran appears to be in healthy condition, with moderate water clarity, moderate nutrient concentrations, and low to moderate productivity of plants and algae. Maintaining the health of the lake will require careful development in the watershed and around the lake shore.



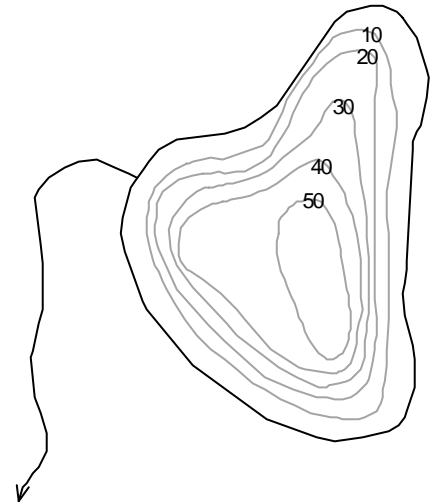
*State of the Lakes Report*  
*March 2003*

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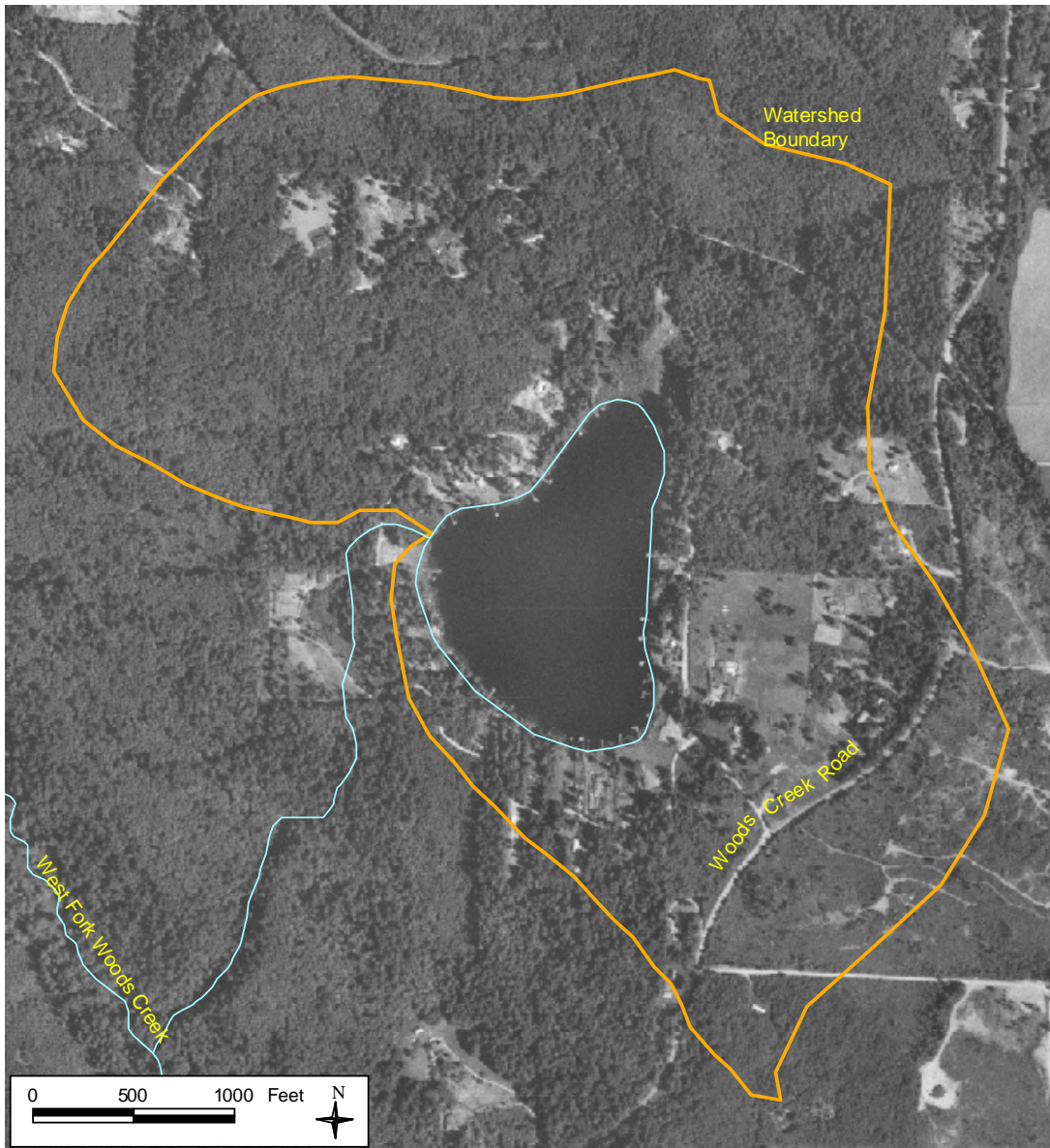
**Snohomish County Public Works  
Surface Water Management**

# LAKE AND WATERSHED DATA

Lake Area: 33 acres  
 Watershed Area: 323 acres  
 Watershed to Lake Area Ratio: 9.8  
 Maximum Depth: 54 feet (16.5 meters)  
 Average Depth: 26 feet (7.9 meters)  
 Lake Volume: 870 acre-feet  
 Length of Shore: 0.9 miles



	<u>1973</u>	<u>MID-90'S</u>
# of nearshore homes	17	41
# of homes/1000' of shoreline	3.5	8.5
% of homes with bulkhead or fill		22%
% of homes with some native vegetation near shore		49%
% of watershed developed (residential or commercial)	7%	10% (est.)



# LAKE ASSESSMENT

## DESCRIPTION

■ Location/Access – Lake Cochran is located approximately five miles northeast of Monroe near Woods Creek Road. This spring-fed lake drains to the west fork of Woods Creek, and ultimately to the Skykomish River. There is no developed public access to the lake.

■ Size/Shape – The lake covers 33 surface acres. For its small size, the lake is relatively deep, with a maximum depth of 16.5 meters and an average depth of 7.9 meters. The lake volume contains 870 acre-feet of water.

■ Watershed – The Lake Cochran watershed, including the lake, covers 323 acres. The watershed is 9.8 times the size of the lake, which is near the median for Snohomish County lakes. Much of the watershed is undeveloped. In 1973, approximately 7% of the watershed was used for residential purposes, and the remainder of the watershed was forested or undeveloped. By the mid-90s, residential development had increased slightly to 10% of the watershed.

■ Shoreline – The shoreline of the lake is 0.9 miles in length. Around the lake, there were 17 homes in 1973. Significant development of the shoreline occurred during the next two decades. By the mid-90s, there were 41 homes, making Cochran one of the fastest developing lake shores in the county. About 22% of the nearshore homes have modified the shoreline with bulkheads or fill. About half of the homes have retained some native vegetation along the shore. A zone of vegetation is important for filtering pollution. A small wetland is located on the west side of the lake.

## LAKE CONDITIONS

■ Water Clarity – Lake Cochran has moderate water clarity. Summer water clarity averages ranged from 3.2 to 4.1 meters during the period from 1993 to 2002, with a long-term average of 3.7 meters.



■ Color – The lake is lightly colored by dissolved organic (humic) material from the bottom sediments and surrounding wetlands, making the water light brown to almost clear.

■ Nutrients – Summer average total phosphorus concentrations in the epilimnion ranged from 4 to 9  $\mu\text{g/l}$  during most years from 1996 to 2002. The values were somewhat higher in 1999 and 2000, with one measurement of 52  $\mu\text{g/l}$  in 1999. Total phosphorus concentrations in the hypolimnion were higher, averaging from 14 to 31  $\mu\text{g/l}$  from 1996 to 2002, except for 2001 when all four samples were between 48 and 57  $\mu\text{g/l}$ . These values suggest a moderate release of phosphorus from the bottom sediments during times of oxygen depletion. Overall, phosphorus levels are moderate in Lake Cochran. Total nitrogen levels measured in 1973 were moderately low. However, nitrogen was abundant enough that its availability did not limit algal growth.

■ Alkalinity – Data from 1994 and 1995 indicate that Lake Cochran has a very low buffering capacity and is sensitive to nutrient pollution.

■ Oxygen/Temperature – Vertical profiles of dissolved oxygen and temperature for the summers of 1995 through 2002 show strong thermal stratification between the warm upper waters and the cool bottom waters. Even during late summer, dissolved oxygen is often still available in

moderate amounts throughout much of the water column. When oxygen depletion does occur, it is usually confined to the lowest 2 or 3 meters depth. This indicates that there is little oxygen demand from decomposing organic material on the lake bottom. The dissolved oxygen profiles on many occasions show spikes at 3 to 4 meters depth, suggesting vigorous algal growth at this level.

- *Algae* – Three chlorophyll *a* samples were taken during the summers of 1994 and 1995 and four in 2002. The values all ranged from 0.3 to 3.2 µg/l, except for one sample that was 8.3 µg/l. These values indicate low to moderate levels of algal productivity. Analysis of three algae samples collected the same years revealed low biovolumes with a mixed algal community. Blue-green algae were most abundant by count.

- *Aquatic Plants* – Aquatic plants grow in a fairly narrow band around the entire shoreline. Plant growth is sparse to moderate, dominated by watershield and ribbon-leaf pondweed (both native plants) and fragrant water-lily (a non-native).

## SUMMARY

- *Trophic State* – Based on moderate water clarity, moderate total phosphorus concentrations, and low to moderate productivity of plants and algae, Lake Cochran may be classified as mesotrophic.

- *Current Conditions/Trends* – Lake Cochran appears to be in healthy condition. Monitoring data have not revealed any statistically significant trends in water quality during the 1990s.

- *Future Concerns/Targets* – There is currently only limited development in the watershed, and the lake shows few signs of land use impacts. Should development accelerate, however, there will be more sources of nutrients that could increase blue-green algal blooms and accelerate the process of eutrophication. The one high reading of phosphorus in the epilimnion in 1999 and the four high hypolimnion phosphorus results in 2001 may also be warning signs of accelerating eutrophication. Maintaining current water clarity and phosphorus levels is the target for the lake.

- *Recommendations* – The lake should be monitored carefully to identify any changes in water clarity, nutrients, algae, or oxygen depletion in the hypolimnion. Future development in the watershed should take steps to control runoff and reduce nutrient pollution.

## CITIZEN VOLUNTEERS

Thanks to Don Foltz for many years of volunteer monitoring at Lake Cochran. Also, thanks to John Ruhnke and Mike Durick for volunteer monitoring.

## **DATA SUMMARY TABLE**

Source	Date	Secchi Depth (meters)	Total Phosphorus (ug/l)		Color (Pt-Co scale)	Chlorophyll a (ug/l)
			Surface	Bottom	Epilimnion	Epilimnion
Bortleson, et al, 1976	7/23/73	3.0	7	13	10	-
Volunteer	Summer 1992	2.8	-	-	-	-
Volunteer	Summer 1993	2.8 - 5.6 (4.1) <i>n</i> = 10	-	-	-	-
SWM Staff or Volunteer	Summer 1994	3.1 - 4.9 (3.8) <i>n</i> = 8			20 (20) <i>n</i> = 2	2 - 8.3 (5.2) <i>n</i> = 2
SWM Staff or Volunteer	Summer 1995	2.7 - 4.0 (3.3) <i>n</i> = 5			25	3.2
SWM Staff or Volunteer	Summer 1996	3.0 - 4.0 (3.4) <i>n</i> = 5	3 - 4 (4) <i>n</i> = 2	17 - 19 (18) <i>n</i> = 2	-	-
SWM Staff or Volunteer	Summer 1997	3.8 - 4.5 (4.1) <i>n</i> = 3	8 - 9 (9) <i>n</i> = 2	10 - 17 (14) <i>n</i> = 2	-	-
Volunteer	Summer 1998	3.3 - 4.5 (3.9) <i>n</i> = 7	5 - 8 (7) <i>n</i> = 4	13 - 65 (31) <i>n</i> = 4	-	-
Volunteer	Summer 1999	2.9 - 3.9 (3.2) <i>n</i> = 6	9 - 52 (17) <sup>a</sup> <i>n</i> = 4	13 - 31 (21) <i>n</i> = 4	-	-
SWM Staff or Volunteer	Summer 2000	3.1 - 4.2 (3.7) <i>n</i> = 5	9 - 20 (12) <i>n</i> = 4	5 - 25 (16) <i>n</i> = 4	-	-
SWM Staff or Volunteer	Summer 2001	4.0 - 4.4 (4.1) <i>n</i> = 5	4 - 13 (8) <i>n</i> = 4	48 - 57 (53) <i>n</i> = 4		
SWM Staff or Volunteer	Summer 2002	3.7 - 4.4 (4.0) <i>n</i> = 4	6 - 12 (9) <i>n</i> = 4	11 - 29 (21) <i>n</i> = 4	-	0.3 - 2.1 (1.3) <i>n</i> = 4

### 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.

<sup>a</sup> Median is shown for 1999 rather than average (mean) to avoid bias from one high TP value

## ***SUMMARY OF OTHER DATA***

■ ***Total Nitrogen*** – single samples in 1973 showed 0.20 mg/l in the epilimnion and 0.46 mg/l in the hypolimnion; which suggests that nitrogen was abundant enough to not limit algal growth.

■ ***Alkalinity*** – limited data from 1994 and 1995 ranged from 9.7 -- 12 mg/l CaCO<sub>3</sub>, which suggests that Cochran has a very low buffering capacity and is sensitive to nutrient pollution.

■ ***pH*** – readings from 1994 through 2000 averaged 6.8 near the surface and 6.2 near the bottom, which is within the normal range for Snohomish County lakes. 2002 readings were similar.

■ ***Conductivity*** – 1994-2000 data averaged 36 μmhos in the epilimnion and 50 μmhos near the lake bottom, indicating low levels of dissolved materials in the water compared to other Snohomish County lakes. 2002 data were similar.

■ ***Iron*** – limited 1994-95 data showed moderate levels in the epilimnion (avg. 88 μg/l) and low levels in the hypolimnion (avg. 86 μg/l), which indicates little release of iron and phosphorus from the bottom sediments under low oxygen conditions.

■ ***Algae*** – the following table shows the total biovolume and percent biovolume of the main types of algae from three samples collected in 1994-95. The data show that the total algal

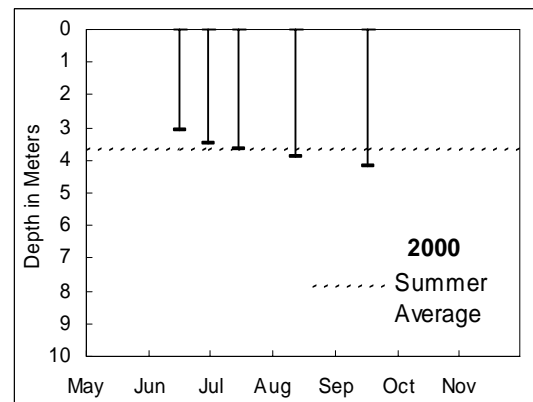
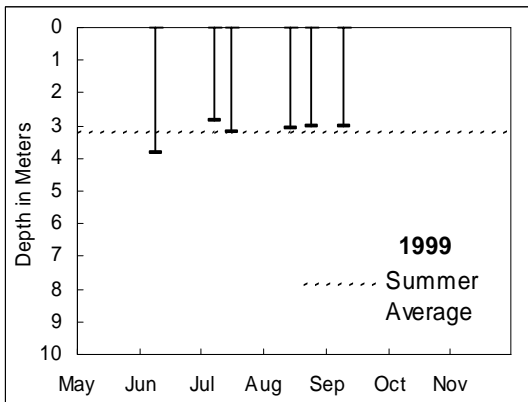
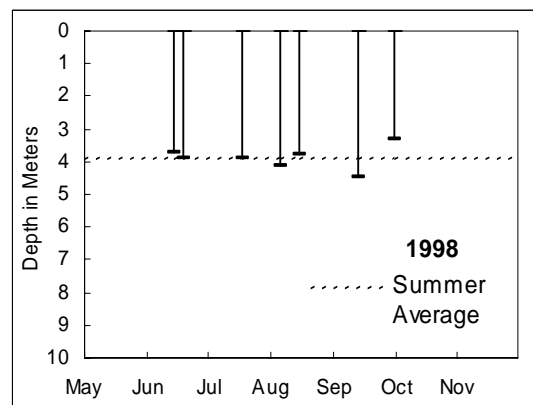
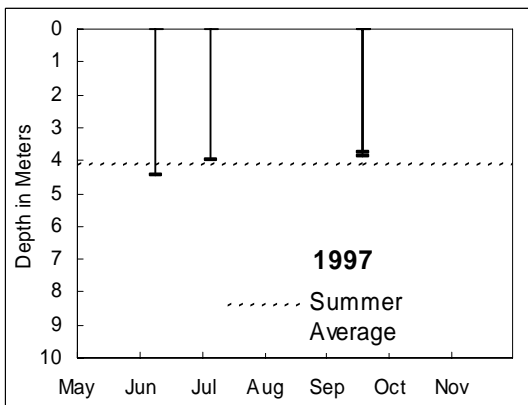
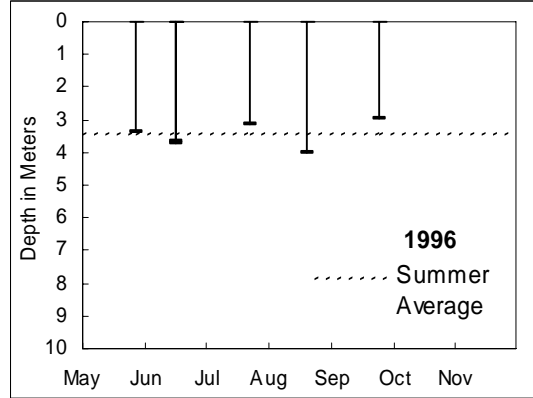
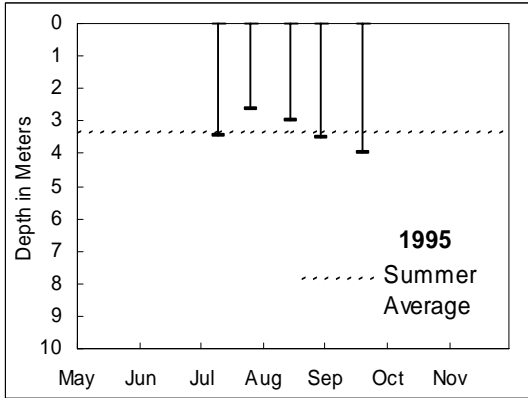
volumes were low and that the highest volumes were distributed among blue-greens, greens, gold-browns/diatoms, and dinoflagellates. Cell counts of the same samples revealed that blue-green algae were most abundant, ranging from 64% to 98%.

ALGAE TYPES	7/14/94	9/13/94	8/16/95
Cyanophyta (Blue-greens)	3%	23%	19%
Chlorophyta (Greens)	40%	29%	11%
Chrysophyta (Golden/diatoms)	26%	21%	4%
Cryptophyta (Cryptomonads)	28%	22%	27%
Euglenophyta (Euglenoids)	0%	4%	0%
Pyrrhophyta (Dinoflagellates)	3%	0%	38%
<b>TOTAL BIOVOLUME (mm<sup>3</sup>/l)</b>	0.185	0.198	0.405

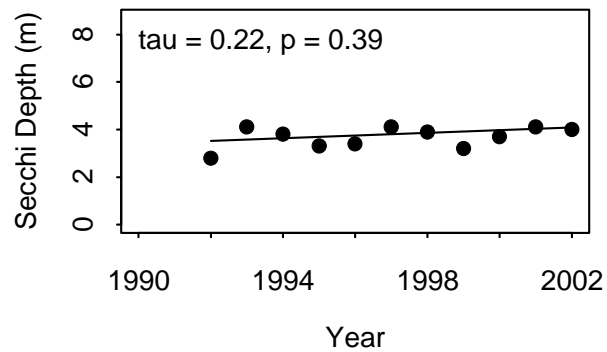
### **DATA SOURCES**

In addition to data from Snohomish County SWM staff and citizen volunteers, data for Lake Cochran are also available from: Bortleson, et. al., 1976. Please refer to the full list of references in the County-Wide Summary.

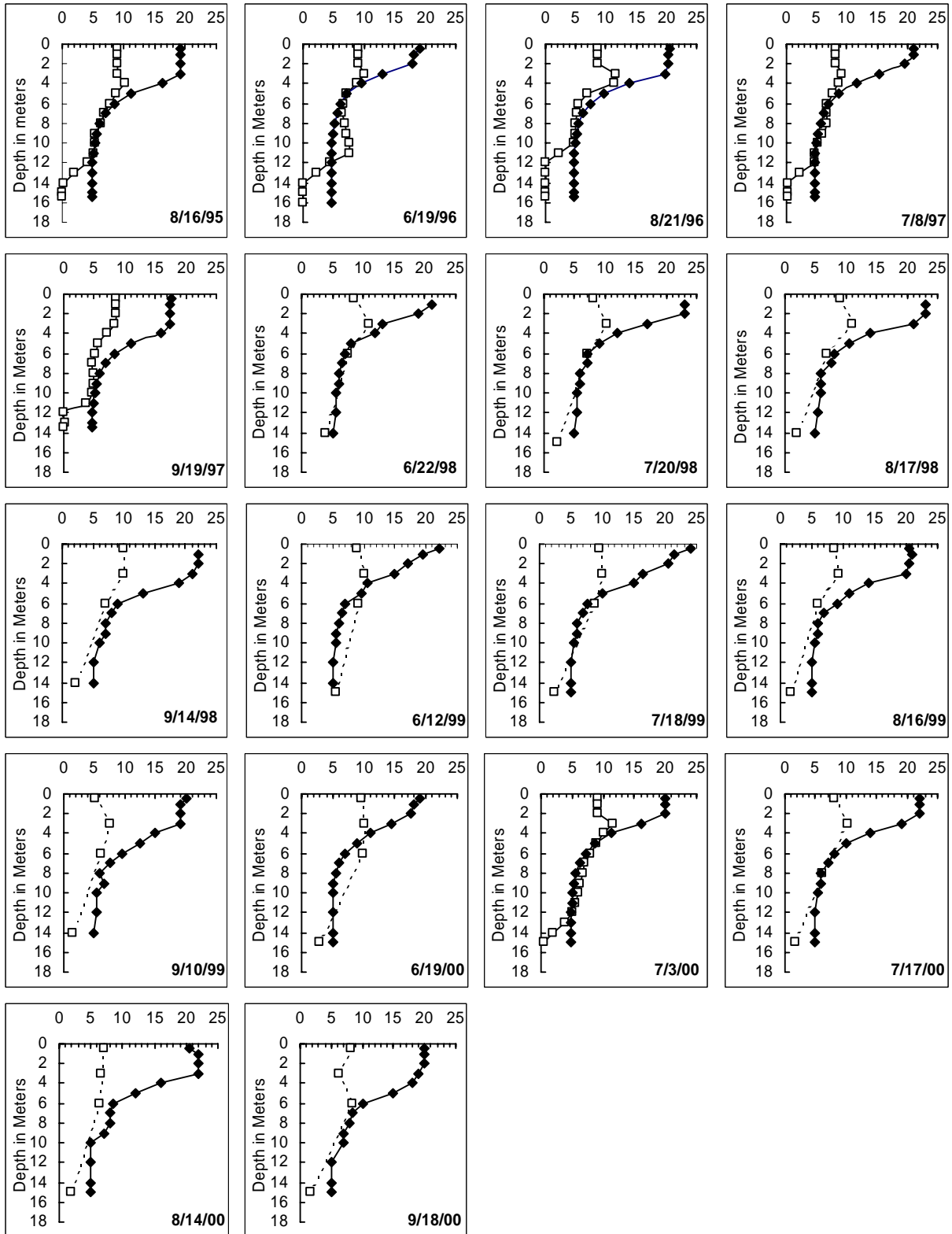
# WATER CLARITY



## TREND ANALYSIS



# DISSOLVED OXYGEN AND TEMPERATURE PROFILES (SELECTED YEARS)



—□— DO (mg/l)      —◆— Temp (°C)

# AQUATIC PLANTS



Area	Density	Dominant Plants	Other Plants
A	Sparse	<i>Brasenia schreberi</i> (Water shield) <i>Potamogeton epihydrus</i> (Ribbon-leaf pondweed) <i>Nymphaea odorata</i> (Fragrant water-lily)	<i>Elodea canadensis</i> (Common elodea) <i>Nuphar polysepalum</i> (Yellow water-lily) <i>Potamogeton sp.</i> (Thin-leaf pondweed)
B	Moderate	<i>Brasenia schreberi</i> (Water shield) <i>Potamogeton epihydrus</i> (Ribbon-leaf pondweed)	<i>Nymphaea odorata</i> (Fragrant water-lily) <i>Elodea canadensis</i> (Common elodea) <i>Nuphar polysepalum</i> (Yellow water-lily)

Note: *Menyanthes trifoliata* (Bogbean) is found in patches on the north shore; *Typha sp.* (Cattail) is common along the west shore; while *Equisetum fluviatile* (Water horsetail) is found scattered around the lake.

## BASIC MONITORING DATA

1995									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
7/12/95	3.5	18	22.5	8	10	none	breezy	ltbrown	Algae and aquatic plants slight.
7/28/95	2.7	21	26	9.5	50	none	light	ltbrown	Much development apparent on lakeshore.
*08/16/95	3.0				75	moderate	calm	ltgreen	
8/31/95	3.6	17	20.5	7.5	0	none	light	ltbrown	Algae and aquatic plants slight.
9/20/95	4.0	12	19.5	9	0	none	calm	ltbrown	Algae and aquatic plants slight.

1996									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
5/31/96	3.4	17	17	2	25	light	light	clear	0 geese/ducks. No algae, scum, aquatic plants, or odor.
*06/19/96	3.7				0	light	breezy	ltgrnbrn	
7/25/96	3.2	21	25	15	0	none	calm	ltbrown	No scum, odor; slight algae, plants.
*08/21/96	4.0				0	trace	calm	clear	
9/25/96	3.0	10.5	16	15	25	trace	calm	ltbrown	

1997									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
6/11/97	4.5	17	22	6	90	none	breezy	lt brown	No odor or scum; slight algae, plants. 1duck.
*07/08/97	4.0				100	mod	light	lt brown	
*09/19/97	3.9				0	mod	calm	grnbrown	
9/19/97	3.8	21	18	4	0	heavy	light	lt brown	Slight algae, plants, no scum, odor. 0 ducks/geese.

1998									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
6/17/98	3.7	13	18	3	100	light	light	lt brown	No algae, scum or odor; slight aquatic plants; no ducks or geese.
6/22/98	3.9	23	23	3	0	none	breezy	clear	No algae, scum or odor; slight aquatic plants; no ducks/geese.
7/20/98	3.9	18	23	6.75	0	none	light	clear	Slight algae; no scum; mod. plants; no odor. 1 duck or goose
8/7/98	4.1	19	25	9.25	10	none	light	clear	Slight algae & plants; no scum or odor; 0 ducks/geese.
8/17/98	3.8	19	22	10.3	100	light	light	clear	Slight algae & plants; no scum or odor; no ducks/geese.
9/14/98	4.5	26	22	14	0	none	calm	clear	No algae, scum or odor; slight plants; no ducks/geese.
10/1/98	3.3	16	18	15.8	100	none	breezy	clear	No algae, scum, or odor; slight plants. 18 ducks/geese.

\*Indicates data collected by Snohomish County staff.

1999									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
6/12/99	3.9	26	22	0	75	none	breezy	clear	Lake level measured from bottom of board at Ruhnke's.
7/10/99	2.9	22	24	1	25	none	breezy	clear	
7/18/99	3.2	19	24		25	light	light	clear	
8/16/99	3.1	21	20.5	5	90	moderate	calm	clear	
8/26/99	3.1	22	24	7	90	none	light	clear	
9/10/99	3	24	20	7.5	25	none	light	clear	

2000									
DATE	Secchi Depth (meters)	Air Temp (C)	Water Temp (C)	Lake Level (in)	Clouds (%)	Rain	Wind	Color	COMMENT
6/19/00	3.1	22	19	0	100	light	light	clear	3 ducks, slight algae, no algae scum, and moderate aquatic plants.
*07/03/00	3.5	14	19.5		100	light	calm	brown	No ducks, algae, or algae scum, and slight aquatic plants.
7/17/00	3.7	16	22	1	0	none	calm	clear	No ducks, slight algae, and no algae scum.
8/14/00	3.9	13.5	20.5	3.75	100	none	calm	clear	No ducks, slight algae and aquatic plants, and no algae scum.
9/18/00	4.2	20	20	4	100	trace	calm	clear	No ducks and slight algae, algae scum, and aquatic plants.

[Click here to view more recent data.](#)

## HOW YOU CAN HELP LAKE COCHRAN

- Educate yourself about lake ecology and the lake's health.
- Use lawn and garden fertilizers sparingly; test your soil first; choose low or no phosphorus fertilizers.
- Retain or plant native vegetation adjacent to the water to protect the shoreline and filter pollution.
- Infiltrate or filter the runoff from rooftops, patios, and driveways rather than piping it to the lake.



- Cover or mulch bare soil areas.
- Use pesticides, herbicides, and household chemicals sparingly and never near the water.
- Maintain your septic system—have it inspected every two years and pumped when needed.
- Conserve water both inside and outside.
- Clean up pet wastes and keep livestock away from the lake shore.

- Learn to identify non-native invasive aquatic plants and animals; check your boat and trailer for invaders; never empty an aquarium into the lake.
- Do not feed geese or ducks.
- Join with neighbors or the local property owners' association to work together to protect the lake.



Contact Snohomish County Surface Water Management at 425-388-3464 for information about these topics or if you have questions about Lake Cochran.

(TTY users call 425-388-3700)