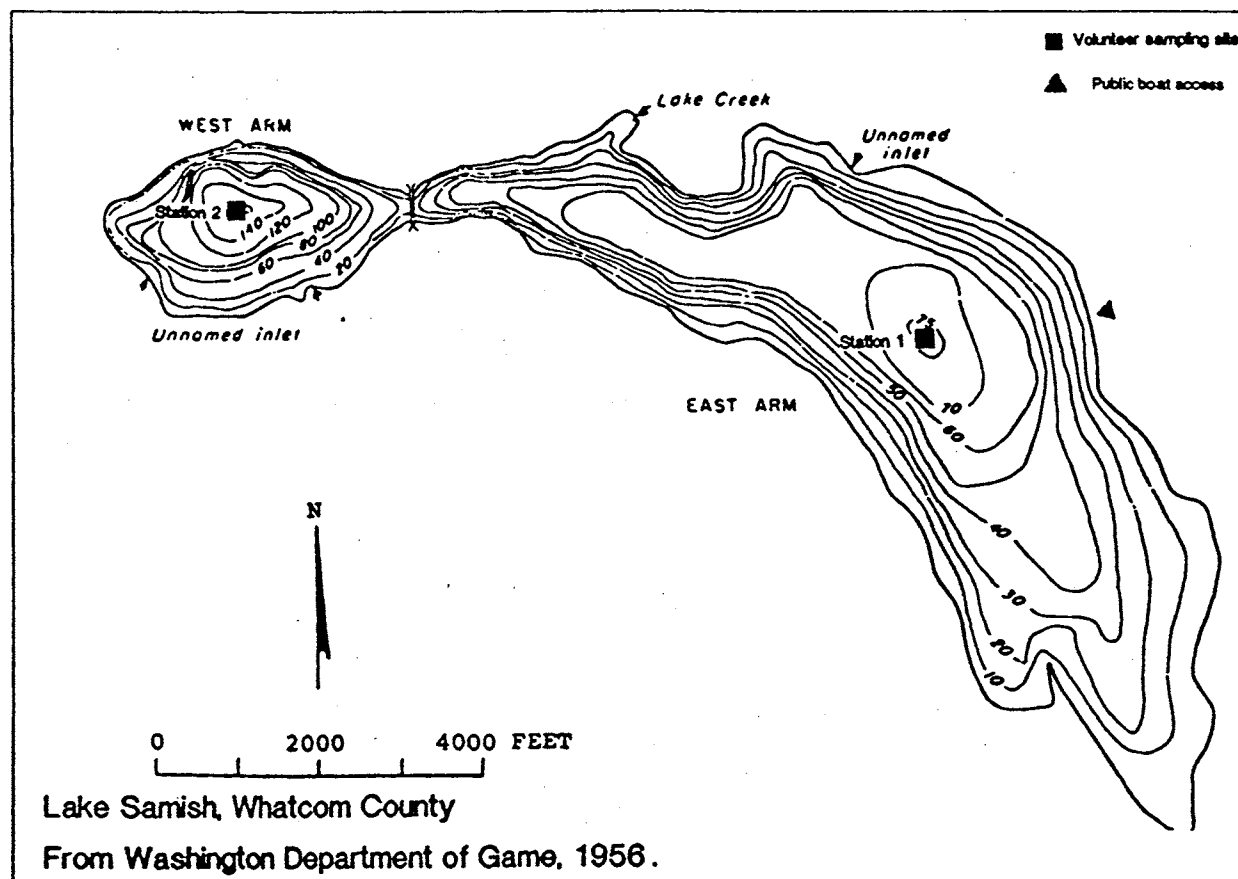


## Lake Samish -- Whatcom County

Lake Samish is located 6.5 miles southeast of Bellingham. It is comprised of two basins which are connected by a narrow strait. The west arm is a small deep bay, and the east arm is a larger shallow bay. There are several small inlets that flow into the lake, including Lake Creek and Barnes Creek. Lake Samish drains via Friday Creek to the Samish River.

	<u>East Arm</u>	<u>West Arm</u>
Size (acres)	680	130
Maximum Depth (feet)	75	140
Mean Depth (feet)	31	71
Lake Volume (acre-feet)	24,000	9,100
Drainage Area (miles <sup>2</sup> )	9.2	3.7
Altitude (feet)	273	273
Shoreline Length (miles)	6.3	1.8

Data From Bortleson *et al.* (1976)



## Lake Samish -- Whatcom County

### 1992 Trophic Status<sup>1</sup>

	East Arm	West Arm
Estimated Trophic State:	Oligo-mesotrophic	Oligo-mestrophic
Mean Trophic State Index (Secchi):	41	40
Mean Trophic State Index (Total Phosphorus):	32	--
Mean Trophic State Index (Chlorophyll <i>a</i> ):	33	--

### Volunteer-Collected Data

Date	Time	Temp (°C) (°F)	Secchi (ft)	pH	Lake Ht (ft)	Water Color	% Cloud Cover	Recent Rain	Wind	Abbreviated Comments
<u>East Basin</u>										
21-May			19.3							Onsite visit.
04-Jun	0925	19.0 66.2	17.3		268.30	Lt-Green	10	None	Light	
19-Jun	1415	20.0 68.0	17.0	7.6	268.30	Lt-Green	10	None	Breezy	Lake height in feet above sea level.
02-Jul	1330	21.0 69.8	12.0	8.5		Lt-Green	100	None	Breezy	
16-Jul	0945	21.0 69.8	13.0	8.3	268.00	Lt-Green	0	None	Calm	
29-Jul	0945	22.0 71.6	13.5	9.4	268.62	Lt-Green	0	None	Calm	
13-Aug	1345	23.0 73.4	11.0	8.5	267.82	Lt-Green	0	None	Calm	
24-Aug			9.0							Onsite visit.
02-Sep	0930	17.0 62.6	9.5	10.3	267.61	Lt-Green	100	None	Light	
17-Sep	1420	17.8 64.0	8.0	8.8	267.57	Lt-Green	0	None	Breezy	
01-Oct	1300	15.0 59.0	8.0	6.6	271.74	Lt-Green	0	None	Breezy	
23-Oct	1330	13.0 55.4	9.0	6.5	268.27	Lt-Green	100	Light	Light	
<u>West Basin</u>										
25-Feb		9.0 48.2	12.0		269.51	Lt-Green	10		Light	For your info.
04-Jun	0955	19.0 66.2	18.5	8.1	268.30	Lt-Green	0	None	Light	Lake height in feet above sea level.
19-Jun	1445	20.0 68.0	20.0	8.1	268.30	Lt-Green	10		Breezy	
02-Jul	1400	21.0 69.8	15.0	8.2	268.08	Lt-Green	100	None	Breezy	
16-Jul	1030	21.0 69.8	16.0	8.5	268.03	Lt-Green	0	None	Light	
29-Jul	1033	22.0 71.6	20.0	8.9	268.63	Lt-Green	0	None	Breezy	Second pH reading was 9.0.
13-Aug	1400	20.0 68.0	14.0	6.8	267.82	Lt-Green	0	None	Calm	
02-Sep	1000	17.0 62.6	10.0	10.3	267.61	Lt-Green	100		Light	pH ranged 10.2 - 10.3
17-Sep	1430	13.5 56.3	8.5	9.6	267.56	Lt-Green	0	None	Breezy	
01-Oct	1330	15.0 59.0	8.0	7.6	271.74	Lt-Green	0	None	Breezy	
23-Oct	1400	13.0 55.4	10.0	7.6	268.27	Lt-Green	100	Light	Light	

<sup>1</sup> Trophic State Indices calculated from Carlson's model (1977)

Lake Samish -- Whatcom County

1992 Onsite Visit Data - East Basin Profile Data

Date 1992	Depth (meters)	Temp (°C)	pH	Dissolved Oxygen (mg/L)	Conductivity (µmhos/cm)
05/21	0.0	16.9	7.8	10.9	55
	1.0	16.8	7.9	10.7	55
	2.0	16.8	7.9	10.7	55
	3.0	16.7	7.9	10.7	55
	4.0	16.7	7.9	10.7	55
	5.0	16.6	8.0	10.7	55
	6.0	14.8	8.1	11.5	55
	7.0	13.8	8.0	11.5	54
	8.0	12.4	7.8	11.0	54
	9.0	11.7	7.6	10.0	54
	10.0	10.7	7.2	8.4	54
	12.0	9.5	7.1	6.4	54
	14.0	8.5	7.0	5.4	53
	16.0	8.1	6.9	4.8	53
	08/24	0.0	21.8	8.8	10.1
1.0		21.8	9.1	10.0	72
2.0		21.8	9.2	10.0	72
3.0		21.8	9.3	10.0	72
4.0		21.8	9.4	10.0	71
5.0		21.7	9.4	9.8	71
6.0		20.9	9.3	9.5	70
7.0		19.5	8.6	6.9	68
8.0		17.1	8.5	3.9	70
9.0		15.7	8.3	2.9	69
10.0		13.9	8.2	0.7	70
12.0		11.4	8.1	0.1	70
14.0		9.3	7.9	0.1	69
15.0		9.0	7.9	0.1	68

Lake Samish -- Whatcom County

1992 Onsite Visit Data - East Basin Water Chemistry

Date	05/21/92		08/24/92	
	Epilimnion	Hypolimnion	Epilimnion	Hypolimnion
Composite Depths (m)	1, 2, 4	12, 14, 16	1, 2, 4	12, 14
Total Phosphorus ( $\mu\text{g/L}$ )	4	12	10	12
Total Nitrogen (mg/L)	0.66	0.69	0.25	0.53
Chlorophyll <i>a</i> ( $\mu\text{g/L}$ )	1.17	--	1.27	--

Historical Data From Ecology -- East Arm

Date	08/24/74 <sup>a</sup>	06/27/89 <sup>b</sup>	09/26/89 <sup>b</sup>	06/04/90 <sup>c</sup>	08/15/90 <sup>c</sup>	05/28/91 <sup>d</sup>
Secchi (ft)	10	13.8	11.8	--	9.6	17.0
Total Phosphorus, epilimnion ( $\mu\text{g/L}$ )	0.0	6	12	13	10	--
Total Nitrogen, epilimnion (mg/L)	--	0.62	0.40	--	0.36	0.58
Chlorophyll <i>a</i> ( $\mu\text{g/L}$ )	--	2.7	6.3	--	--	--
Dissolved Oxygen, surface (mg/L)	10.4	11.0	10.4	10.6	9.8	11.1
Dissolved Oxygen, bottom (mg/L)	1.1	4.5	0.1	4.7	0.2	0.4

- a. Bortleson *et al.* (1976)
- b. Brower and Kendra (1990)
- c. Rector (1991)
- d. Rector (1992)

## Lake Samish -- Whatcom County

### Monitoring Results/Summary of Other Available Information

#### Secchi Depths

Water clarity was good in both basins, particularly from May through July. Secchi depths decreased considerably from August through October; this pattern in water clarity was very similar to the pattern from data collected in 1989.

#### Total Phosphorus

Total phosphorus in the epilimnion was very low on both sampling dates. Except for the sample collected in June 1990 (13  $\mu\text{g/L}$ ; Brower and Kendra, 1990), all total phosphorus data from Lake Samish were low and characteristic of an oligotrophic lake.

#### Total Nitrogen

Although total nitrogen concentrations were low to moderate in comparison to other lakes monitored for the program, total nitrogen was higher during May (0.66 mg/L) than in August (0.25 mg/L). Data from 1989-1991 also indicate that total nitrogen tends to be lower in late summer.

#### Profile Data

The lake was stratified on both sampling dates, and both dissolved oxygen and pH decreased below the thermocline. Profile data from 1992 were very similar to data collected in 1991, 1990, and 1989. In 1992, the pH of the lake was rather high, particularly during August, when pH increased from 8.8 at the surface to 9.4 at 4 meters. When profile data were collected in 1990, pH was also much higher during August (around 8.5) than during May (Rector, 1991). Higher pH probably resulted from increased algal growth in the epilimnion. Data collected by the volunteers also indicate that high pH values occurred in late summer, with the highest value on September 2, 1992.

Dissolved oxygen in the hypolimnion was particularly low during August, when values were less than 1.0 mg/L in the bottom 5 meters of the lake. Similar values near the lake bottom were also measured for the program in 1989-1990. (In 1991, profile data were collected only during spring.) Low values in late summer were also reported in 1971 (0.0 mg/L at the bottom in September; Bortleson *et al.*, 1976) and 1968 (1.5 mg/L in October; Lee, 1969). Lower dissolved oxygen in the hypolimnion most likely results from bacterial decomposition of aquatic plants and algae in the water and sediments.

On the August 1990 and September 1989 sampling dates, dissolved oxygen decreased considerably below the thermocline (down to 0.2 mg/L at 19 meters in August 1990, and less than 0.5 mg/L from 14.0 to 20.0 meters in September 1989; Brower and Kendra, 1990). Profile data collected on May 24, July 14 and September 23, 1971 showed that dissolved oxygen at the lake bottom was approximately 6 mg/L on the May sampling date, 4 mg/L in July, and 0.0 mg/L in September (Bortleson *et al.*, 1974). In 1968, dissolved oxygen was 1.5 mg/L near the lake bottom, and the lake was described as oligotrophic (Lee, 1969).

## Lake Samish -- Whatcom County

### Plants

Algal growth was low on both sampling dates, as indicated by low concentrations of chlorophyll *a*.

Aquatic plants identified by Ecology staff during the August 24, 1992 onsite visit were tapegrass (also known as wild celery; *Vallisneria americana*), coontail (*Ceratophyllum demersum*), watershield (*Brasenia schreberi*), duckweed (*Lemna minor*), waterweed (*Elodea nuttali*), and white-flowering lily (*Nymphaea odorata*). A lot of pollen from the tapegrass was on the water surface near the south end of the lake. The volunteers noted that watershield was not as abundant this year compared to earlier years. Tapegrass was identified in the lake in 1971, when about 26-50% of the shoreline was covered by submerged plants (Bortleson *et al.*, 1974). In 1989, tapegrass was growing along approximately 90% of the shore of the east basin (Brower and Kendra, 1990).

### Other Available Information

From Johnson and Norton (1990): In 1989, Ecology staff collected sediment and largemouth bass samples from both basins, and analyzed the samples for selected heavy metals and organic pollutants. No unusual concentrations of metals, and no organochlorine pesticides or PCBs, were detected in the fish samples. Sediments contained arsenic (21.0  $\mu\text{g}/\text{Kg}$ ), 4-methylphenol (1500  $\mu\text{g}/\text{kg}$ ), and polyaromatic hydrocarbons (PAH; 81-110  $\mu\text{g}/\text{Kg}$ ). The concentrations found were not high enough to warrant further study. Possible sources of the 4-methylphenol are natural degradation of biological material, auto exhaust, asphalt, and domestic sewage. The most likely sources of PAH are urban runoff and combustion of fossil fuels.

From Larson (1990): Approximately 440 residences withdrew Lake Samish water for drinking and domestic use, and new construction of homes is expected to increase demand for water withdrawal. However, very low streamflow down the outlet (Friday Creek) during late summer affects fish habitat and has raised concern about additional water withdrawal from the lake. At present, the lake level is affected primarily by beaver dams along Friday Creek, which are periodically broken down to allow flow through the creek. To investigate the possible effects from additional water withdrawal from Lake Samish, computer models using lake stage and creek flow data were used. Results indicated that a control dam for storing additional water and supplementing creek flow, or pumping lake water to maintain streamflow (which would reduce the lake stage below the natural levels), may remedy the situation.

From A. Larson (Ecology, pers. comm.): In addition to the concern over limiting the amount of development around the lake by limiting the number of water withdrawal permits, Whatcom County Health Department generally does not encourage direct withdrawal from lakes for drinking water purposes. As a result, negotiations between the county (to permit direct withdrawal despite health concerns), Ecology (to allow additional water resource permits for direct withdrawal) and Department of Wildlife (to determine the amount of water needed in Friday Creek to provide adequate fish habitat) were initiated in 1990, following the findings reported in Larson (1990).

## Lake Samish -- Whatcom County

### Summary of Questionnaire Results and Information From the Volunteers

The following is a summary of the volunteer's remarks and responses to questionnaires completed from 1989 to 1992.

Lake Samish is used for fishing, boating, water skiing, swimming, rowing and jet skiing. Public recreational facilities on the lakeshore include a park, a picnic area, a beach, and one boat ramp. About 5 percent of the shoreline is publicly-owned. Currently the watershed is used for logging, and the lakeshore is being developed further for residences. In the past, the watershed was used for logging and animal grazing, and the lake was dredged. In 1990 there were about 60 culverts or stormdrains that drained into the lake.

There are 529 residences in the Lake Samish basin; 295 of these are on the lakeshore, and 11 of the 15 residences under construction in the basin are also located on the lakeshore. Lake water is withdrawn for drinking and other domestic uses. The lakeshore is fully sewerred and Water District #12 is responsible for sewage collection, and is currently gathering information about a community water system that will be voted on by residents in 1993. There is a lake management district and a community association for the lake.

Overall, the volunteer finds that Lake Samish had excellent water quality. Problems in the lake in 1992 were ranked as 1) excessive aquatic plant growth, and 2) algae. Possible sources of problems are weeds, sediment from streams, and algae. In comparison to 1991, weeds were spreading rapidly in 1992, especially along the shore in water up to 10 feet deep.

From 1990 to 1992, the predominant plants in the lake were tapegrass, watershield, and northern watermilfoil (*Myriophyllum exalbescens*). All three plants were reported to be growing or spreading rapidly in the lake. There is a wetland at the south end of the east basin, at the lake's outlet. Beaver dams at the outlet are periodically torn down; in 1990 the dams were torn down three times.

### Comments

All trophic state parameters (Secchi depth, total phosphorus, and chlorophyll *a*) indicated that Lake Samish was oligotrophic. In addition, concentrations of total phosphorus and chlorophyll *a* were lower than those measured during earlier surveys. Although the volunteers noted that algal growth was very bad this year, water clarity was not much worse in 1992 than in 1991-1989. Plant growth in areas of the lake remained heavy, and there was very low dissolved

## Lake Samish -- Whatcom County

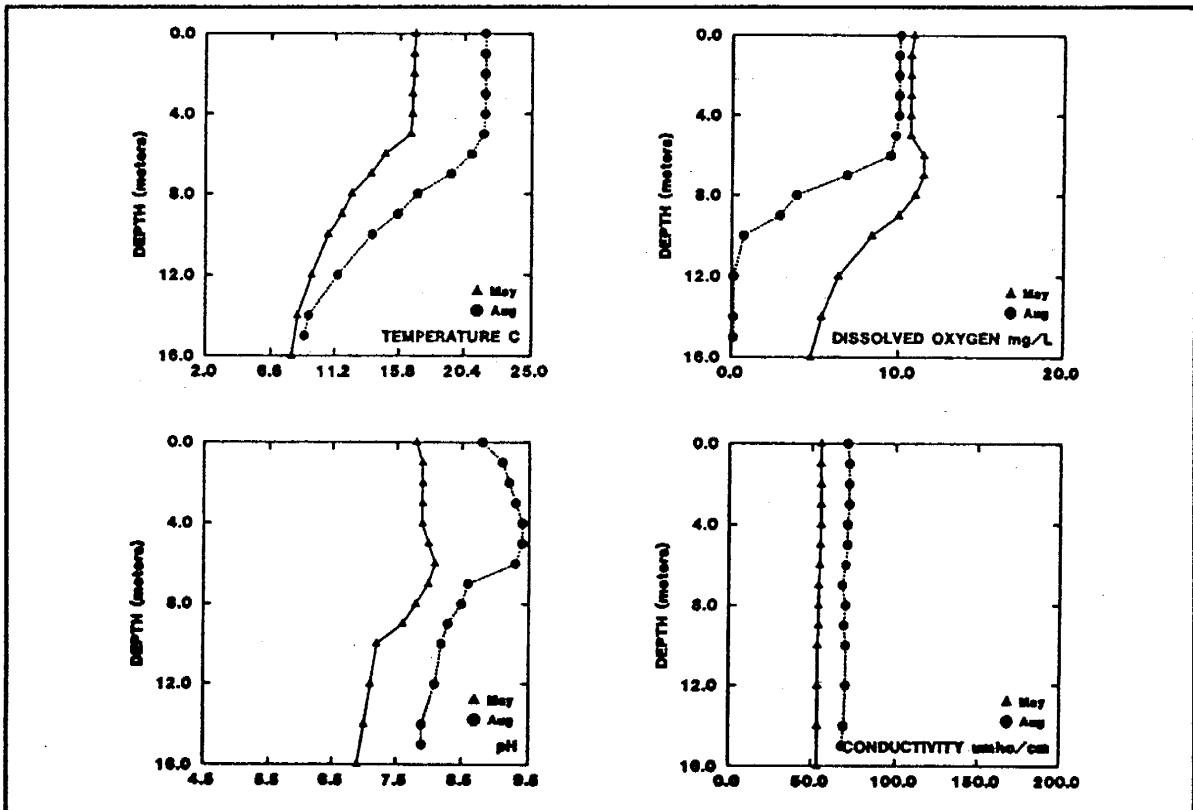
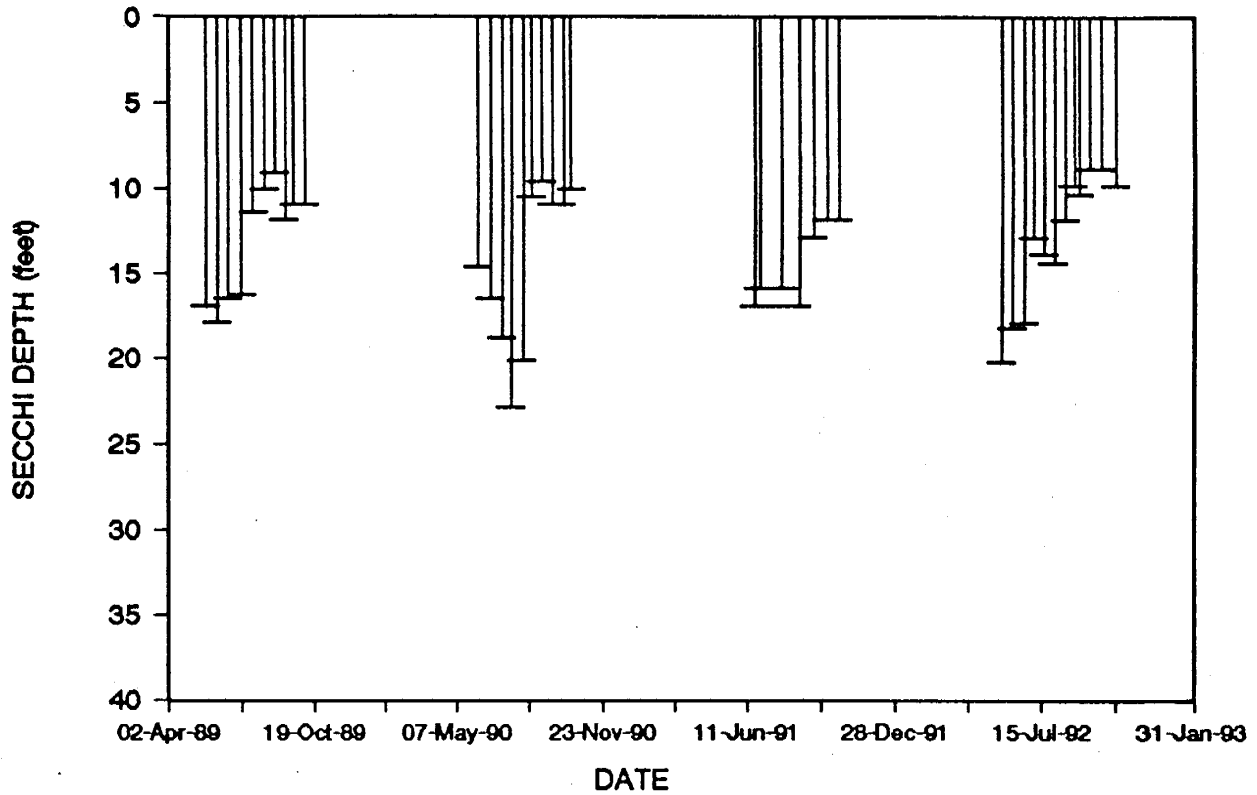
oxygen in the hypolimnion during August. Because the lake still exhibits both oligotrophic and mesotrophic characteristics, the lake was characterized as oligo-mesotrophic.

### **Acknowledgements**

I thank A.B. Davis and J. David Jenkins for volunteering their time to monitor the east and west basins of Lake Samish, respectively, during 1989-1992.

# LAKE SAMISH (WHATCOM COUNTY)

EAST ARM



# LAKE SAMISH (WHATCOM COUNTY)

WEST ARM

