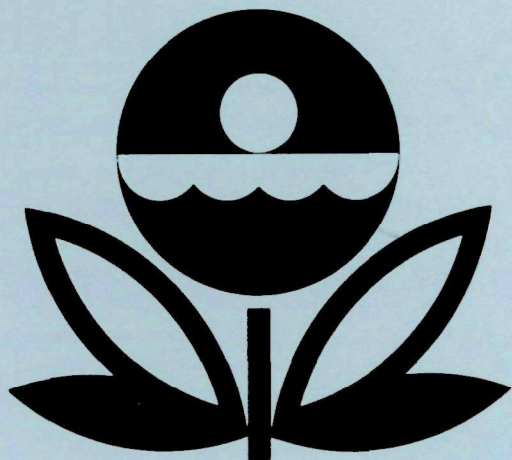


**U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY
WORKING PAPER SERIES**



REPORT
ON
KEECHELUS LAKE
KITTITAS COUNTY
WASHINGTON
EPA REGION X
WORKING PAPER No. 869

**CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON
and
ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA**

REPORT
ON
KEECHELUS LAKE
KITTITAS COUNTY
WASHINGTON
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WITH THE COOPERATION OF THE
WASHINGTON DEPARTMENT OF ECOLOGY
AND THE
WASHINGTON NATIONAL GUARD
JULY, 1977

REPORT ON KEECHELUS LAKE
KITTITAS COUNTY, WASHINGTON
EPA REGION X

by

National Eutrophication Survey

Water and Land Quality Branch
Monitoring Operations Division
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Special Studies Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 869

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

July 1977

CONTENTS

	<u>Page</u>
Foreword	ii
List of Washington Study Lakes	iv
Lake and Drainage Area Map	v
<u>Sections</u>	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	3
III. Lake Water Quality Summary	5
IV. Nutrient Loadings	11
V. Literature Reviewed	16
VI. Appendices	17

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

- a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.
- b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.
- c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Washington Department of Ecology for professional involvement, to the Washington National Guard for conducting the tributary sampling phase of the Survey, and to those Washington wastewater treatment plant operators who provided effluent samples and flow data.

Ms. Barbara Blau, Lake Restoration Program, and the staff of the Washington Department of Ecology, Lake Restoration Program, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

Major General Howard S. McGee, Adjutant General of Washington, and Project Officer Colonel Clinton C. Johnson, who directed the volunteer efforts of the Washington National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF WASHINGTONLAKE NAMECOUNTY

American Lake

Pierce

Banks Lake

Grant, Douglas

Chelan Lake

Chelan

Diamond Lake

Pend Oreille

Green Lake

King

Keechelus Lake

Kittitas

Mayfield Lake

Lewis

Medical Lake

Spokane

Moses Lake

Grant

Ozette Lake

Clallam

Sammamish Lake

King

Lake Whatcom

Whatcom

Lower Granite Reservoir

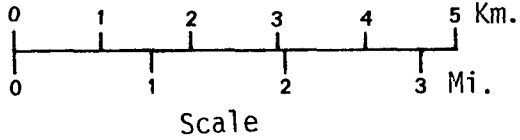
Garfield, Whatcom

KEECHELUS LAKE

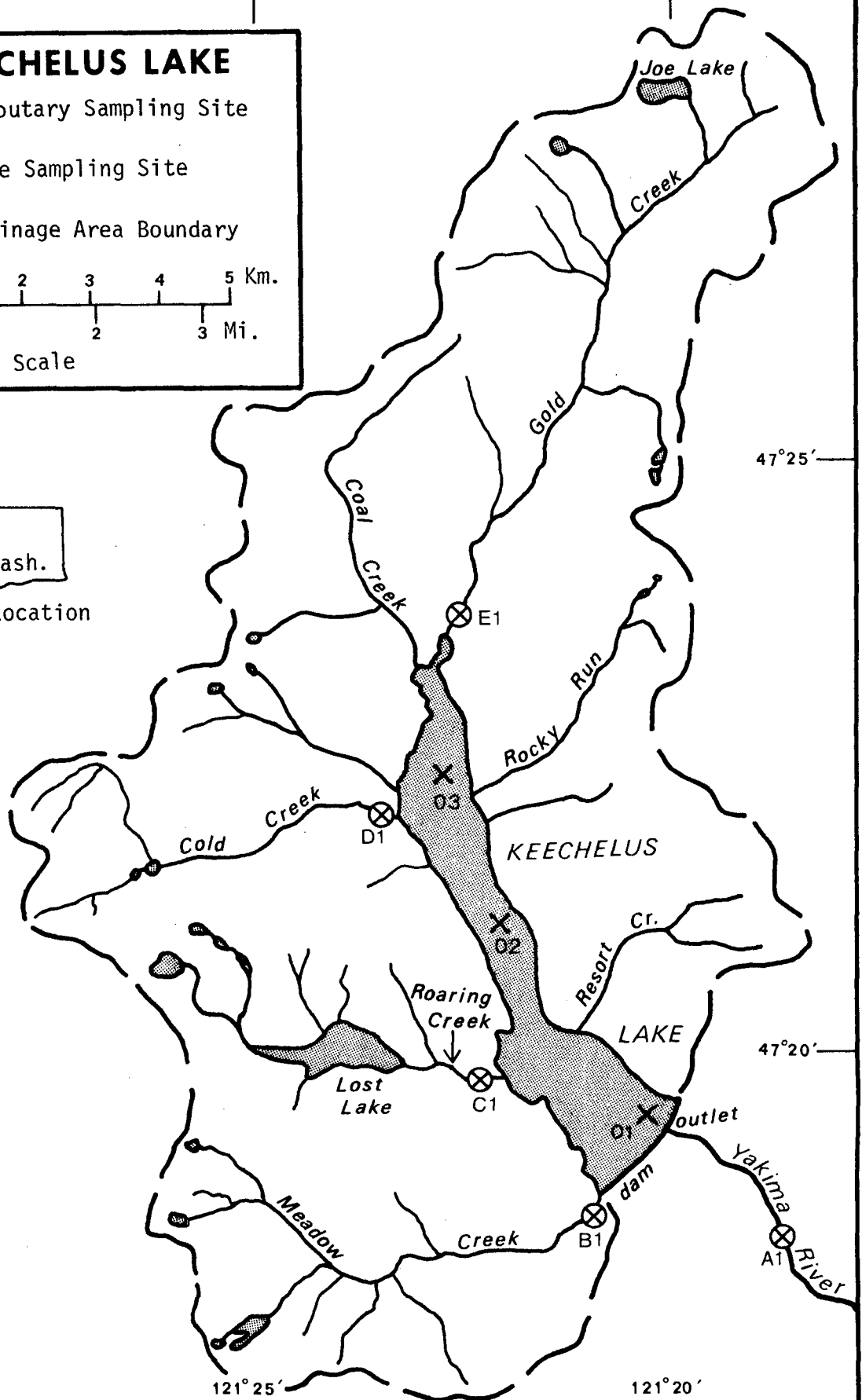
⊗ Tributary Sampling Site

× Lake Sampling Site

⌞ Drainage Area Boundary



Map Location



REPORT ON KEECHELUS LAKE, WASHINGTON

STORET NO. 5306

I. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Keechelus Lake is oligotrophic. Chlorophyll a values in the lake ranged from 0.5 $\mu\text{g/l}$ in July to 2.1 $\mu\text{g/l}$ in October, with a mean of 1.4 $\mu\text{g/l}$. Potential for primary production as measured by algal assay control yields was low on all three sampling occasions. Lake water transparency was excellent. Of the 13 Washington lakes sampled in 1975, 11 had higher median total phosphorus and inorganic nitrogen values, and all had higher median orthophosphorus levels than Keechelus Lake.

Survey limnologists did not report any problem algal blooms or macrophytes during their visits to the lake.

*See Appendix E.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Keechelus Lake was limited by available phosphorus on all three sampling dates (07/21/75, 09/12/75, 10/28/75). Lake data suggest nitrogen limitation during the July sampling and phosphorus limitation during September and October.

C. Nutrient Controllability:

1. Point sources -

There were no known municipal or industrial point sources impacting Keechelus Lake during the sampling year. The present phosphorus loading of $0.44 \text{ g P/m}^2/\text{yr}$ is less than that proposed by Vollenweider (1975) as an "oligotrophic" level. Unless this loading rate is substantially increased, the excellent trophic condition of Keechelus Lake should be maintained.

2. Nonpoint sources -

Meadow Creek contributed 17.4% of the total phosphorus loading to Keechelus Lake. Gold Creek contributed 22.6% and the minor tributaries and immediate drainage contributed 56.0%.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS:

Lake and drainage basin characteristics are itemized below. Lake morphometry data were provided by Wolcott (1965). Tributary flow data were provided by the Washington District Office of the U.S. Geological Survey (USGS). Outlet drainage area includes the lake surface area. Mean hydraulic retention time was obtained by dividing the lake volume by mean flow of the outlet. Precipitation values are estimated by methods as outlined in National Eutrophication Survey (NES) Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 10.36 km^2 .
2. Mean depth: 18.7 meters.
3. Maximum depth: 27.4 meters.
4. Volume: $193.658 \times 10^6 \text{ m}^3$.
5. Mean hydraulic retention time: 220 days.

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

<u>Name</u>	<u>Drainage area (km²)</u>	<u>Mean flow (m³/sec)</u>
B-1 Meadow Creek	20.4	1.47
E-1 Gold Creek	36.3	2.61
Minor tributaries and immediate drainage -	<u>74.6</u>	<u>6.12</u>
Totals	131.3	10.20

2. Outlet - A-1 Yakima River 141.7 10.18

C. Precipitation:

1. Year of sampling: 218.2 cm.
2. Mean annual: 167.2 cm.

III. LAKE WATER QUALITY SUMMARY

Keechelus Lake was sampled three times during the open-water season of 1975 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration, and 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 29.0 meters at Station 01, 58.2 meters at Station 02, and 4.3 meters at Station 03. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix C and are summarized in III-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in III-B. Results of the limiting nutrient study are presented in III-C.

PHYSICAL AND CHEMICAL CHARACTERISTICS

(7/21/75)					(9/12/75)					(10/28/75)				
S*** = 3					S*** = 3					S*** = 3				
PARAMETER	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)		
TEMPERATURE (DEG C/FMT)														
0.-1.5 M DEPTH	6	11.4- 13.8	12.8	0.0- 1.5	6	16.3- 17.3	17.0	0.0- 1.5	6	8.3- 9.4	9.2	0.0- 1.5		
MAX DEPTH**	3	0.7- 11.3	2.7	4.3- 58.2	3	4.9- 17.2	5.5	4.3- 50.3	3	4.8- 8.6	5.3	4.0- 47.2		
DISSOLVED OXYGEN (MG/L)														
0.-1.5 M DEPTH	6	5.8- 10.0	9.0	0.0- 1.5	6	8.8- 9.0	8.8	0.0- 1.5	6	9.8- 10.2	10.0	0.0- 1.5		
MAX DEPTH**	3	10.0- 11.0	10.6	4.3- 58.2	3	9.2- 10.8	10.2	4.3- 50.3	3	10.0- 10.4	10.0	4.0- 47.2		
CONDUCTIVITY (UMHOS)														
0.-1.5 M DEPTH	6	18.- 28.	22.	0.0- 1.5	6	24.- 33.	33.	0.0- 1.5	6	1.- 29.	17.	0.0- 1.5		
MAX DEPTH**	3	15.- 22.	15.	4.3- 58.2	3	25.- 37.	29.	4.3- 50.3	3	1.- 22.	11.	4.0- 47.2		
PH (STANDARD UNITS)														
0.-1.5 M DEPTH	6	7.4- 8.3	7.6	0.0- 1.5	6	6.8- 7.1	7.0	0.0- 1.5	6	6.6- 7.0	6.9	0.0- 1.5		
MAX DEPTH**	3	7.1- 7.4	7.1	4.3- 58.2	2	6.5- 7.0	6.8	21.6- 50.3	3	6.7- 7.0	6.9	4.0- 47.2		
TOTAL ALKALINITY (MG/L)														
0.-1.5 M DEPTH	6	11.- 19.	16.	0.0- 1.5	6	14.- 19.	15.	0.0- 1.5	6	12.- 23.	18.	0.0- 1.5		
MAX DEPTH**	3	14.- 16.	14.	4.3- 58.2	3	13.- 15.	14.	4.3- 50.3	3	15.- 27.	16.	4.0- 47.2		
TOTAL P (MG/L)														
0.-1.5 M DEPTH	6	0.006-0.013	0.007	0.0- 1.5	6	0.006-0.010	0.006	0.0- 1.5	6	0.006-0.008	0.007	0.0- 1.5		
MAX DEPTH**	3	0.006-0.013	0.007	4.3- 58.2	3	0.005-0.009	0.007	4.3- 50.3	3	0.005-0.007	0.006	4.0- 47.2		
DISSOLVED ORTHO P (MG/L)														
0.-1.5 M DEPTH	6	0.002-0.015	0.002	0.0- 1.5	6	0.002-0.010	0.002	0.0- 1.5	6	0.002-0.005	0.002	0.0- 1.5		
MAX DEPTH**	3	0.002-0.013	0.011	4.3- 58.2	3	0.002-0.002	0.002	4.3- 50.3	3	0.002-0.004	0.003	4.0- 47.2		
NO2+NO3 (MG/L)														
0.-1.5 M DEPTH	6	0.020-0.030	0.020	0.0- 1.5	6	0.020-0.060	0.020	0.0- 1.5	6	0.020-0.020	0.020	0.0- 1.5		
MAX DEPTH**	3	0.020-0.070	0.040	4.3- 58.2	3	0.020-0.070	0.020	4.3- 50.3	3	0.020-0.080	0.070	4.0- 47.2		
AMMONIA (MG/L)														
0.-1.5 M DEPTH	6	0.020-0.040	0.020	0.0- 1.5	6	0.020-0.020	0.020	0.0- 1.5	6	0.020-0.030	0.020	0.0- 1.5		
MAX DEPTH**	3	0.020-0.030	0.030	4.3- 58.2	3	0.020-0.020	0.020	4.3- 50.3	3	0.020-0.020	0.020	4.0- 47.2		
KJELDAHL N (MG/L)														
0.-1.5 M DEPTH	6	0.200-0.600	0.200	0.0- 1.5	6	0.200-0.200	0.200	0.0- 1.5	6	0.200-0.200	0.200	0.0- 1.5		
MAX DEPTH**	3	0.200-0.200	0.200	4.3- 58.2	3	0.020-0.200	0.200	4.3- 50.3	3	0.200-0.200	0.200	4.0- 47.2		
SECCHI DISC (METERS)														
	2	6.9- 6.9	6.9		3	3.4- 6.4	6.4		3	4.6- 5.3	4.9			

* N = NO. OF SAMPLES

** MAXIMUM DEPTH SAMPLED AT EACH SITE

*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

<u>Sampling Date</u>	<u>Dominant Genera</u>	<u>Algal Units per ml</u>
07/21/75	1. <u>Cyclotella</u>	466
	2. <u>Chroomonas</u>	89
	3. <u>Melosira</u>	89
	4. <u>Cryptomonas</u>	22
	Other genera	--
	Total	666
09/12/75	1. Chlorophytan Cell	195
	2. <u>Dinobryon</u>	195
	3. <u>Melosira</u>	130
	4. <u>Cryptomonas</u>	22
	Other genera	--
	Total	542
10/28/75	1. <u>Chroomonas</u>	24
	2. <u>Dinobryon</u>	24
	Other genera	--
	Total	48

2. Chlorophyll a -

<u>Sampling Date</u>	<u>Station Number</u>	<u>Chlorophyll <u>a</u> (μg/l)</u>
07/21/75	01	0.5
	02	1.4
	03	1.0
09/12/75	01	1.2
	02	1.5
	03	1.4
10/28/75	01	1.7
	02	1.8
	03	2.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 07/21/75

<u>Spike (mg/l)</u>	<u>Ortho P Conc. (mg/l)</u>	<u>Inorganic N Conc. (mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	<0.005	0.083	0.3
0.05 P	<0.055	0.083	3.5
0.05 P + 1.0 N	<0.055	1.083	23.4
1.00 N	<0.005	1.083	0.4

b. 09/12/75

<u>Spike (mg/l)</u>	<u>Ortho P Conc. (mg/l)</u>	<u>Inorganic N Conc. (mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	0.005	0.040	0.3
0.05 P	0.055	0.040	3.5
0.05 P + 1.0 N	0.055	1.040	21.3
1.00 N	0.005	1.040	0.3

c. 10/28/75

<u>Spike (mg/l)</u>	<u>Ortho P Conc. (mg/l)</u>	<u>Inorganic N Conc. (mg/l)</u>	<u>Maximum Yield (mg/l-dry wt.)</u>
Control	0.005	0.035	0.2
0.05 P	0.055	0.035	0.9
0.05 P + 1.0 N	0.055	1.035	25.9
1.00 N	0.005	1.035	0.2

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary productivity in Keechelus Lake was moderately low during the three sample collection times (07/21/75, 09/12/75, 10/28/75). In each assay a significant increase in yield over that of the control occurred when phosphorus was added alone and in combination with nitrogen, indicating phosphorus limitation. The addition of nitrogen alone did not stimulate growth significantly beyond the control yields.

The mean inorganic nitrogen to orthophosphorus ratios in the lake samples were approximately 9/1, 17/1, and 18/1 on the July, September, and October sampling dates, respectively, suggesting nitrogen limitation during the July sampling period and phosphorus limitation during September and October.

IV. NUTRIENT LOADINGS (See Appendix D for data)

For the determination of nutrient loadings, the Washington National Guard collected near-surface grab samples from each of the tributary sites indicated on the map (page v). Sampling was begun in September 1974, and was completed in August 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Washington District Office of the USGS for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a USGS computer program for calculating stream loadings. Nutrient loads indicated for tributaries are those measured minus known point source loads, if any.

Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of USGS) were estimated by using the mean annual nutrient loads, in $\text{kg}/\text{km}^2/\text{yr}$, in Meadow Creek and Gold Creek at Stations B-1 and E-1 and multiplying the means by the ZZ area in km^2 .

A. Waste Sources:

1. Known municipal - None
2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg P/yr</u>	<u>% of total</u>
a. Tributaries (nonpoint load) -		
B-1 Meadow Creek	785	17.4
E-1 Gold Creek	1,025	22.6
b. Minor tributaries and immediate drainage (nonpoint load) -	2,535	56.0
c. Known municipal STP's - None		
d. Septic tanks* - None		
e. Known industrial - None		
f. Direct precipitation**-	<u>180</u>	<u>4.0</u>
Totals	4,525	100.0
2. Outputs - A-1 Yakima River	1,685	
3. Net annual P accumulation -	2,840	

*Dion, N.P. et al., 1976.

**Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

<u>Source</u>	<u>kg N/yr</u>	<u>% of total</u>
a. Tributaries (nonpoint load) -		
B-1 Meadow Creek	8,240	8.6
E-1 Gold Creek	30,305	31.6
b. Minor tributaries and immediate drainage (nonpoint load) -	46,250	48.2
c. Known municipal STP's - None		
d. Septic tanks* - None		
e. Known industrial - None		
f. Direct precipitation** -	<u>11,185</u>	<u>11.6</u>
Total	95,980	100.0
2. Outputs - A-1 Yakima River	40,835	
3. Net annual N accumulation -	55,145	

*Dion, N.P. et al., 1976.

**Estimated (See NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

<u>Tributary</u>	<u>kg P/km²/yr</u>	<u>kg N/km²/yr</u>
Meadow Creek	39	404
Gold Creek	28	835

E. Mean Nutrient Concentrations in Ungaged Streams:

<u>Tributary</u>	<u>Mean Total P (mg/l)</u>	<u>Mean Total N (mg/l)</u>
C-1 Roaring Creek	<0.007	<0.248
D-1 Cold Creek	<0.007	<0.265
1-F Cedar Creek*	<0.008	0.228
1-G S. Fork Cedar River*	<0.008	<0.227
1-H Rix River*	<0.010	0.323
1-J Boulder Creek*	<0.011	0.319
1-K Smay Creek*	0.010	0.328
1-L Friday Creek*	0.022	<0.225
1-M Greer River*	<0.010	<0.116

*Special interest streams outside the watershed of Keechelus Lake.

F. Yearly Loadings:

In the following table, the existing phosphorus annual loading is compared to the relationship proposed by Vollenweider (1975). Essentially, his "eutrophic" loading is that at which the receiving waters would become eutrophic or remain eutrophic; his "oligotrophic" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A "mesotrophic" loading would be considered one between "eutrophic" and "oligotrophic".

Note that Vollenweider's model may not apply to lakes with short hydraulic retention times or in which light penetration is severely restricted by high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading (g/m ² /yr)
Estimated loading for Keechelus Lake	0.44
Vollenweider's "eutrophic" loading	1.08
Vollenweider's "oligotrophic" loading	0.54

V. LITERATURE REVIEWED

- Dion, N.P., G.C. Bortleson, J.B. McConnell and L.M. Nelson. 1976. Reconnaissance Data on Lakes in Washington, Volume 5, (Chelan, Ferry, Kittitas, Klickitat, Okanogan, and Yakima Counties). Washington State Department of Ecology, Water Supply Bulletin 43, Volume 5.
- U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center, Las Vegas, Nevada, and Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon.
- Vollenweider, R.A. 1975. Input-Output Models With Special Reference to the Phosphorus Loading Concept in Limnology. Schweiz. Z. Hydrol. 37:53-84.
- Wolcott, E.E. 1965. Lakes of Washington, Volume II. Washington Division of Water Resources, Water Supply Bulletin, 14 and 15.

VI. APPENDICES

APPENDIX A CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B
TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR WASHINGTON

11/16/76

LAKE CODE 5306 KEECHELUS

TOTAL DRAINAGE AREA OF LAKE (SQ KM) 141.7

TRIBUTARY	SUB-DRAINAGE AREA (SQ KM)	NORMALIZED FLOWS (CMS)												MEAN
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
5306A1	141.7	5.21	4.47	4.96	6.74	11.07	16.54	18.75	21.32	17.24	7.02	2.94	5.47	10.14
5306A1	141.7	8.69	8.33	6.63	12.57	23.73	20.53	8.35	2.42	2.80	6.91	10.96	10.53	10.20
5306B1	20.4	1.25	1.20	0.95	1.81	3.43	2.94	1.20	0.35	0.40	1.00	1.58	1.53	1.47
5306E1	36.3	2.23	2.13	1.70	3.23	6.06	5.27	2.14	0.62	0.72	1.77	2.80	2.72	2.61
5306XX	85.0	5.21	4.98	3.96	7.53	14.24	12.32	5.01	1.44	1.67	4.13	6.57	6.40	6.12
5306Z7	85.0	5.21	4.98	3.96	7.53	14.22	12.32	5.01	1.45	1.68	4.13	6.57	6.37	6.12

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 141.7
SUM OF SUB-DRAINAGE AREAS = 226.6

TOTAL FLOW IN = 195.94
TOTAL FLOW OUT = 244.18

MEAN MONTHLY FLOWS AND DAILY FLOWS (CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW
5306A1	9	74	13.989	22	11.950		
	10	74	13.790	19	2.322		
	11	74	2.274	16	2.294		
	12	74	0.903	4	4.644		
	1	75	8.042				
	2	75	16.056				
	3	75	4.531				
	4	75	4.191	15	6.173		
5306B1	5	75	11.553				
	6	75	14.611	4	33.414		
	7	75	24.919	30	4.332		
	8	75	25.230				
	9	74	0.320	22	0.133		
	10	74	0.255	19	0.099		
	11	74	0.813	16	0.357		
	12	74	2.064	4	0.470		
5306E1	1	75	1.994				
	2	75	0.807				
	3	75	0.697				
	4	75	0.852	15	0.691		
	5	75	3.766				
	6	75	4.021	4	6.145		
	7	75	1.787	30	0.303		
	8	75	0.637				

TRIBUTARY FLOW INFORMATION FOR WASHINGTON

11/16/76

LAKE CODE 5306 KEECHELUS

MEAN MONTHLY FLOWS AND DAILY FLOWS (CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW
5306F1	9	74	0.569	22	0.680		
	10	74	0.453	19	0.283		
	11	74	1.441	16	0.920		
	12	74	3.681				
	1	75	3.540				
	2	75	1.436				
	3	75	1.240				
	4	75	1.515	15	2.163		
	5	75	6.683				
	6	75	7.164	4	10.222		
	7	75	3.171	30	1.906		
530677	9	74	1.337				
	10	74	1.062				
	11	74	3.370				
	12	74	8.608				
	1	75	8.297				
	2	75	3.370				
	3	75	2.917				
	4	75	3.540				
	5	75	15.688				
	6	75	15.065				
	7	75	7.447				
	8	75	2.650				

APPENDIX C
PHYSICAL AND CHEMICAL DATA

STORET DETRIEVAL DATE 76/11/16
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

530601
47 19 30.0 121 20 45.0 3
KEECHELUS LAKE
53037 WASHINGTON

130492

11EPALES 2111202
0070 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CAC03 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KjEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/07/21	08 55	0000	13.8	8.8	270	28	8.30	19	0.040	0.600	0.030	0.015K
	08 55	0005	13.8	9.0		27	7.90	16	0.020K	0.200K	0.020K	0.011K
	08 55	0020	13.2	8.6		20	7.55	17	0.020	0.200K	0.020K	0.009K
	08 55	0035	7.4	10.6		17	7.50	15	0.030	0.200K	0.020K	0.013K
	08 55	0066	2.7	11.0		15	7.15	16	0.030	0.200K	0.040	0.013K
75/09/12	13 55	0000	16.4	8.8	252	29	7.00	14	0.020K	0.200K	0.060	0.002
	13 55	0005	16.3			31	7.10	15	0.020K	0.200K	0.060	0.002
	13 55	0015	16.2	9.6		31	6.95	14	0.020K	0.200K	0.060	0.002
	13 55	0030	15.6	9.2		29	7.00	14	0.020K	0.200K	0.020K	0.002K
	13 55	0050	9.3	10.6		25	6.85	14	0.020K	0.200K	0.020K	0.002K
	13 55	0071	5.5	10.8		25	7.00	13	0.020K	0.200K	0.020K	0.002K
75/10/28	10 40	0000	9.3	10.0	210	28	6.90	13	0.020K	0.200K	0.020	0.002K
	10 40	0005	9.4	10.0		29	7.00	12	0.020K	0.200K	0.020K	0.002
	10 40	0027	9.4	10.8		24	6.90	12	0.020K	0.200K	0.020K	0.002K
	10 40	0050	8.4	10.2		24	6.90	16	0.020K	0.200K	0.030	0.002K
	10 40	0095	5.3	10.0		22	6.95	16	0.020K	0.200K	0.070	0.002K

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/07/21	08 55	0000	0.013	0.5	
	08 55	0005	0.008		
	08 55	0020	0.007		
	08 55	0035	0.008		
	08 55	0066	0.006		
75/09/12	13 55	0000	0.006	1.2	
	13 55	0005	0.006		
	13 55	0015	0.007		
	13 55	0030	0.006		
	13 55	0050	0.006		
	13 55	0071	0.005		
75/10/28	10 40	0000	0.007	1.7	
	10 40	0005	0.005		
	10 40	0027	0.006		
	10 40	0050	0.006		
	10 40	0095	0.007		

K VALUE KNOWN TO BE LESS
THAN INDICATED

STOPET RET-IEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

530602
 47 20 55.0 121 22 05.0 3
 KEECHELUS LAKE
 53037 WASHINGTON

11EPALES 2111202
 0195 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CAC03 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
75/07/21	09 35	0000	12.5	10.0	270	24	7.80	19	0.020	0.400	0.020K	0.002
	09 35	0005	13.1	9.0		20	7.50	16	0.020	0.200K	0.020K	0.002K
	09 35	0025	12.8	9.2		18	7.60	17	0.020	0.200K	0.020K	0.002K
	09 35	0050	5.0	11.0		6	7.00	12	0.030	0.200K	0.030	0.002K
	09 35	0100	1.5	11.2		11	7.00	12	0.030	0.300	0.060	0.002K
	09 35	0150	0.9	10.8		12	7.00	16	0.030	0.200K	0.070	0.002K
	09 35	0141	0.7	10.6		15	7.10	14	0.030	0.200K	0.070	0.002K
75/09/12	15 10	0000	17.1	8.8	252	33	7.00	15	0.020	0.200K	0.020K	0.003
	15 10	0005	17.0	8.8		33	7.00	19	0.020	0.200K	0.020K	0.003
	15 10	0015	16.9	9.4		33	7.00	15	0.020	0.200K	0.020K	0.003
	15 10	0030	15.7	8.9		31	7.00	16	0.020	0.200K	0.020K	0.003
	15 10	0045	9.0	10.2		29	6.85	15	0.020K	0.200K	0.020	0.004
	15 10	0085	5.2	10.8		27	6.70	14	0.020K	0.200K	0.060	0.003
	15 10	0125	4.9	10.6		29	6.55	15	0.020	0.200K	0.060	0.002
	15 10	0165	4.9	10.2		29	6.50	15	0.020	0.020K	0.070	0.002
75/10/28	09 55	0000	9.2	9.8	192	12	7.00	22	0.030	0.200K	0.020K	0.002
	09 55	0005	9.4	10.2		22	7.00	14	0.020K	0.200K	0.020	0.004
	09 55	0028	9.2	10.0		20	7.00	16	0.020K	0.200K	0.020	0.004
	09 55	0055	8.3	11.0		17	6.90	16	0.020K	0.200K	0.040	0.002
	09 55	0090	5.3	10.2		17	6.80	17	0.020K	0.200K	0.070	0.002
	09 55	0120	4.7	10.0		14	6.70	16	0.020K	0.200K	0.080	0.002
	09 55	0155	4.8	10.0		11	6.70	15	0.020K	0.200K	0.080	0.003

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STOPET RETRIEVAL DATE 75/11/16
 NATL EUTROPHICATION SURVEY
 EPA-LAS VEGAS

530602
 47 20 55.0 121 22 05.0 3
 KFECHELUS LAKE
 53037 WASHINGTON

11EPALES 2111202
 0195 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLORPHYL A UG/L	00031 INCDT LT PENNING PERCENT
75/07/21	09 35	0000	0.007	1.4	
	09 35	0005	0.006		
	09 35	0025	0.006		
	09 35	0050	0.006		
	09 35	0100	0.007		
	09 35	0150	0.006		
	09 35	0141	0.013		
75/09/12	15 10	0000	0.006	1.5	
	15 10	0005	0.006		
	15 10	0015	0.009		
	15 10	0030	0.008		
	15 10	0045	0.019		
	15 10	0085	0.008		
	15 10	0125	0.008		
	15 10	0155	0.009		
75/10/28	09 55	0000	0.006	1.8	
	09 55	0005	0.007		
	09 55	0020	0.008		
	09 55	0055	0.013		
	09 55	0090	0.006		
	09 55	0120	0.005		
	09 55	0155	0.005		

STOPEX RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA-LAS VFGAS

530603
 47 22 35.0 121 22 50.0 3
 KEECHELUS LAKE
 53037 WASHINGTON

130422

11EPALES 2111202
 0017 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CONDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CAC03 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-OIS O-THO MG/L P
75/07/21	10 30	0000	11.7	5.6		18	7.45	14	0.020K	0.500	0.020K	0.002
	10 30	0005	11.4	9.0		18	7.40	11	0.020K	0.200K	0.020K	0.002K
	10 30	0014	11.3	10.0		22	7.40	14	0.020K	0.200K	0.020K	0.011
75/09/12	14 40	0000	17.3	8.8	132	33	6.80	14	0.020K	0.200K	0.020K	0.002K
	14 40	0005	17.3	9.0		33	6.80	17	0.020	0.200	0.020K	0.010
	14 40	0014	17.2	9.2		37		14	0.020K	0.200K	0.020K	0.002K
75/10/28	09 35	0000	8.3	9.8	180	1K	6.65	22	0.020	0.200K	0.020K	0.005
	09 35	0005	8.8	10.0		1K	6.90	23	0.020K	0.200K	0.020K	0.003
	09 35	0013	8.6	10.4		1K	7.05	27	0.020K	0.200K	0.020K	0.004

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLORPHYL A UG/L	00031 INCDT LT PEMNING PERCENT
75/07/21	10 30	0000	0.008	1.0	
	10 30	0005	0.007		
	10 30	0014	0.007		
75/09/12	14 40	0000	0.007	1.4	
	14 40	0005	0.010		
	14 40	0014	0.007		
75/10/28	09 35	0000	0.008	2.1	
	09 35	0005	0.007		
	09 35	0013	0.006		

K VALUE KNOWN TO BE LESS
 THAN INDICATED

APPENDIX D
TRIBUTARY AND WASTEWATER
TREATMENT PLANT DATA

STORET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

530641
 47 18 20.0 121 19 45.0 4
 YAKIMA RIVER
 53 KITTITAS CO HWY
 O/KEECHELUS LAKE 130492
 BRDG ON GRAVEL RD 13 MI NW OF ELLENSBURG
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2+N03 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTH0 MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/22	11	30	0.020	0.100K	0.010	0.005K	0.005K
74/10/19	15	40	0.024	0.100K	0.020	0.015	0.015
74/11/16	11	35	0.016	0.100	0.016	0.008K	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 76/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

530681
 47 18 40.0 121 21 00.0 4
 MEADOW CREEK
 53 KITTITAS CO HWY
 T/KECHELUS LAKE 130492
 BRDG ON GRAVEL RD 15 MI NW OF ELLENSBURG
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO ₃ -N N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH ₃ -N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/22	10	45	0.160	0.100K	0.005	0.010	0.010
74/10/19	15	50	0.008	0.100K	0.010	0.005	0.005
74/11/16	11	45	0.008	0.100K	0.024	0.008K	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

530601
 47 19 40.0 121 22 25.0 4
 ROARING CREEK
 53 KITTITAS CO HWY
 T/KEECHELUS LAKE 130492
 BRDG ON UNIMPR RD 17 MI NW OF ELLENSBURG
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00530 NO ₂ +NO ₃ N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH ₃ -N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/22	11	05	0.064	0.100K	0.015	0.005	0.005
74/10/19	16	05	0.048	0.300	0.015	0.005	0.005
74/11/16	12	05	0.032	0.200	0.024	0.008K	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STOPET RETRIEVAL DATE 76/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

530601
 47 22 00.0 121 23 35.0 4
 COLD CREEK
 53 KITTITAS CO HWY
 T/KEECHELUS LAKE 130492
 RR BRDG 1.8 MI S OF HYAK OF ELLENSBURG
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KjEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/22	12	30	0.048	0.100K	0.010	0.005K	0.005K
74/10/19	14	55	0.032	0.200	0.025	0.005K	0.005K
74/11/16	10	45	0.016	0.400	0.016	0.008K	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

5306E1
 47 23 40.0 121 22 50.0 4
 GOLD CREEK
 53 KITTITAS CO HWY
 T/KEECHELUS LAKE 130492
 BANK SMPL .5 MI NE OF HYAK OF ELLENSBURG
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/22	11	50	0.052	0.100K	0.015	0.005K	0.005K
74/10/19	14	25	0.048	0.100K	0.020	0.005K	0.005K
74/11/16	10	20	0.088	0.200	0.008	0.008K	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORED RETRIEVAL DATE 76/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

53061F
 47 22 10.0 121.37 25.0 4
 CEDAR RIVER
 S3 15 BANDERA
 T/KEECHICUS LAKE 131191
 COYOTE PS ACC RD XING 1.4 M CHES MOR LK
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO ₂ +NO ₃ N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH ₃ -N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM TO	OF DAY	FEET					
74/09/28	12 40		0.052	0.100	0.010	0.005K	0.005K
74/10/20	10 45		0.092	0.200	0.020	0.005K	0.005
74/11/16	11 25		0.128	0.300	0.088	0.008K	0.010K
74/12/14	11 25		0.088	0.100	0.005	0.005K	0.010K
75/06/17	12 00		0.020	0.050	0.015	0.005K	0.010K
75/08/16	11 30		0.040	0.200	0.015	0.005K	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 76/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

530616
 47 18 20.0 121 30 50.0 4
 S FORK CEDAR RIVER
 53 15 SANDERS
 T/KEECHELUS LAKE 131191
 LOGGING RD BRDG .6 MI UPSTDM OF N FORK
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO ₃ -N N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH ₃ -N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/09/28	19 05		0.008	0.100K	0.005	0.005K	0.005
74/10/20	11 15		0.016	0.100	0.015	0.005K	0.005
74/11/16	11 50		0.024	0.100K	0.048	0.008K	0.010K
75/06/17	12 45		0.005		0.015	0.005K	0.010K
75/08/16	14 50		0.010	0.550	0.015	0.005	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

53061H
 47 21 04.0 121 39 45.0 4
 RIX RIVER
 53 15 BANDERA
 T/KEECHULUS LAKE 131191
 BANK SMPL 1 MI UPSTRM COYOTE PASS RD BRG
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/28	12	00	0.028	0.300	0.025	0.005K	0.005
74/10/20	10	15	0.032	0.100	0.015	0.005K	0.005
74/11/16	10	55	0.072	0.200	0.016	0.008K	0.010K
74/12/14	10	50	0.064	0.200	0.005	0.005K	0.010K
75/06/17	11	00	0.030		0.020	0.020	0.020
75/08/16	12	45	0.020	0.600	0.015	0.005	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 76/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

53061J
 47 22 00.0 121 50 30.0 4
 BOULDER CREEK
 53 15 BANDERA
 T/KEECHELUS LAKE 131191
 PRIVATE RD XING .8 M SE CHESTER MORSE LK
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2AN03 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
74/09/28	11 15		0.036	0.200	0.010	0.005K	0.010
74/10/20	09 55		0.052	0.300	0.030	0.005K	0.015
74/11/16	10 25		0.096	0.300	0.056	0.008K	0.010K
74/12/14	10 20		0.088	0.200	0.010	0.005	0.010K
75/08/16	11 50		0.025	0.300	0.020	0.005	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

53061K
 47 13 30.0 121 36 10.0 4
 SMAY CREEK
 53 7.5 GREENWATER
 T/KEECHELUS LAKE 131191
 SEC RD BRDG 2.4 MI E OF MAYWOOD
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/28	18	00	0.028	0.300	0.015	0.005K	0.010

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STORET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

53061L
 47 13 15.0 121 27 20.0 4
 FRIDAY CREEK
 53 15 LESTER
 T/KEECHELUS LAKE 131192
 BANK SMPL ABOUT 1.9 MI NE OF LESTER
 11EPALES 2111204
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2+NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
FROM	OF	FEET					
TO	DAY						
74/09/20	11 25		0.034	0.100K	0.025	0.015	0.020
74/11/05			0.016	0.300	0.008	0.024	0.024

K VALUE KNOWN TO BE LESS
 THAN INDICATED

STOPET RETRIEVAL DATE 74/11/16
 NATL EUTROPHICATION SURVEY
 EPA- LAS VEGAS

53061M
 47 12 50.0 121 25 20.0 4
 GREEN RIVER
 53 15 LESTER
 T/KEECHELIS LAKE 131192
 BANK SMPL ABOUT 3.3 MI E OF LESTER
 11EPALES 2111264
 0000 FEET DEPTH CLASS 00

DATE	TIME	DEPTH	00630 NO2+N03 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTH0 MG/L P	00665 PHOS-TOT MG/L P
FROM	OF						
TO	DAY	FEET					
74/09/20	12 48		0.024	0.100K	0.010	0.010	0.010
74/11/05			0.008	0.100K	0.008	0.008	0.010K

K VALUE KNOWN TO BE LESS
 THAN INDICATED

APPENDIX E

PARAMETRIC RANKINGS OF LAKES
SAMPLED BY NES IN 1975

STATE OF WASHINGTON

Mean or median values for six of the key parameters evaluated in establishing the trophic conditions of Washington lakes sampled are presented to allow direct comparison of the ranking, by parameter, of each lake relative to the others. Median total phosphorus, median inorganic nitrogen and median dissolved orthophosphorus levels are expressed in mg/l. Chlorophyll a values are expressed in μ g/l. To maintain consistent rank order with the preceding parameters, the mean Secchi disc depth, in inches, is subtracted from 500. Similarly, minimum dissolved oxygen values are subtracted from 15 to create table entries.

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS ORTHO P
5301	AMERICAN LAKE	0.027	0.105	343.000	4.822	15.000	0.007
5302	BANKS LAKE	0.021	0.040	364.533	7.373	10.800	0.007
5303	CHELAN LAKE	0.005	0.070	111.900	0.905	6.400	0.003
5304	DIAMOND LAKE	0.014	0.060	303.667	14.537	14.200	0.010
5305	GREEN LAKE	0.027	0.050	415.000	2.983	10.600	0.009
5306	KEECHELUS LAKE	0.007	0.040	280.250	1.400	9.200	0.002
5307	MAYFIELD LAKE	0.014	0.100	402.000	4.250	10.600	0.007
5308	MEDICAL LAKE	0.275	0.225	401.714	16.425	15.000	0.166
5309	MOSES LAKE	0.115	0.150	463.600	29.060	14.600	0.038
5310	OZETTE LAKE	0.010	0.110	403.333	1.225	7.200	0.009
5311	SAMMAMISH LAKE	0.015	0.210	374.000	7.290	14.600	0.006
5312	WHATCOM LAKE	0.009	0.320	288.000	3.422	10.800	0.009
5313	LOWER GRANITE RESERVOIR	0.033	0.150	435.500	4.875	7.200	0.022

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500- MEAN SEC	MEAN CHLORA	15- MIN DO	MEDIAN DISS ORTHO P
5301	AMERICAN LAKE	29 (3)	50 (6)	67 (8)	50 (6)	4 (0)	58 (7)
5302	BANKS LAKE	42 (5)	100 (12)	58 (7)	25 (3)	46 (5)	71 (8)
5303	CHELAN LAKE	100 (12)	67 (8)	100 (12)	100 (12)	100 (12)	92 (11)
5304	DIAMOND LAKE	62 (7)	75 (9)	75 (9)	17 (2)	33 (4)	25 (3)
5305	GREEN LAKE	29 (3)	83 (10)	17 (2)	75 (9)	62 (7)	46 (5)
5306	KEECHELUS LAKE	92 (11)	92 (11)	92 (11)	83 (10)	75 (9)	100 (12)
5307	MAYFIELD LAKE	62 (7)	58 (7)	33 (4)	58 (7)	62 (7)	71 (8)
5308	MEDICAL LAKE	0 (0)	8 (1)	42 (5)	8 (1)	4 (0)	0 (0)
5309	MOSES LAKE	8 (1)	29 (3)	0 (0)	0 (0)	21 (2)	8 (1)
5310	OZETTE LAKE	75 (9)	42 (5)	25 (3)	92 (11)	87 (10)	33 (4)
5311	SAMMAMISH LAKE	50 (6)	17 (2)	50 (6)	33 (4)	21 (2)	83 (10)
5312	WHATCOM LAKE	83 (10)	0 (0)	83 (10)	67 (8)	46 (5)	46 (5)
5313	LOWER GRANITE RESERVOIR	17 (2)	29 (3)	8 (1)	42 (5)	87 (10)	17 (2)