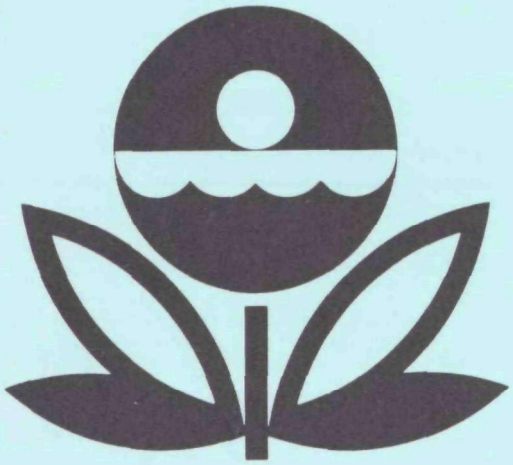
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT

ON

ISLAND PARK RESERVOIR

FREMONT COUNTY

IDAHO

EPA REGION X

WORKING PAPER No. 782

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

☆G.P.O. 699-440

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WITH THE COOPERATION OF THE

IDAHO DEPARTMENT OF HEALTH AND WELFARE

AND THE

IDAHO NATIONAL GUARD

JULY, 1977

REPORT ON ISLAND PARK RESERVOIR

FREMONT COUNTY, IDAHO

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. 783

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

July 1977

CONTENTS

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 Idaho Department of Health and Welfare for professional involvement, to the Idaho National Guard for conducting the tributary sampling phase of the Survey, and to those Idaho wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the State of Idaho Department of Health and Welfare, Division of Environment, 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.

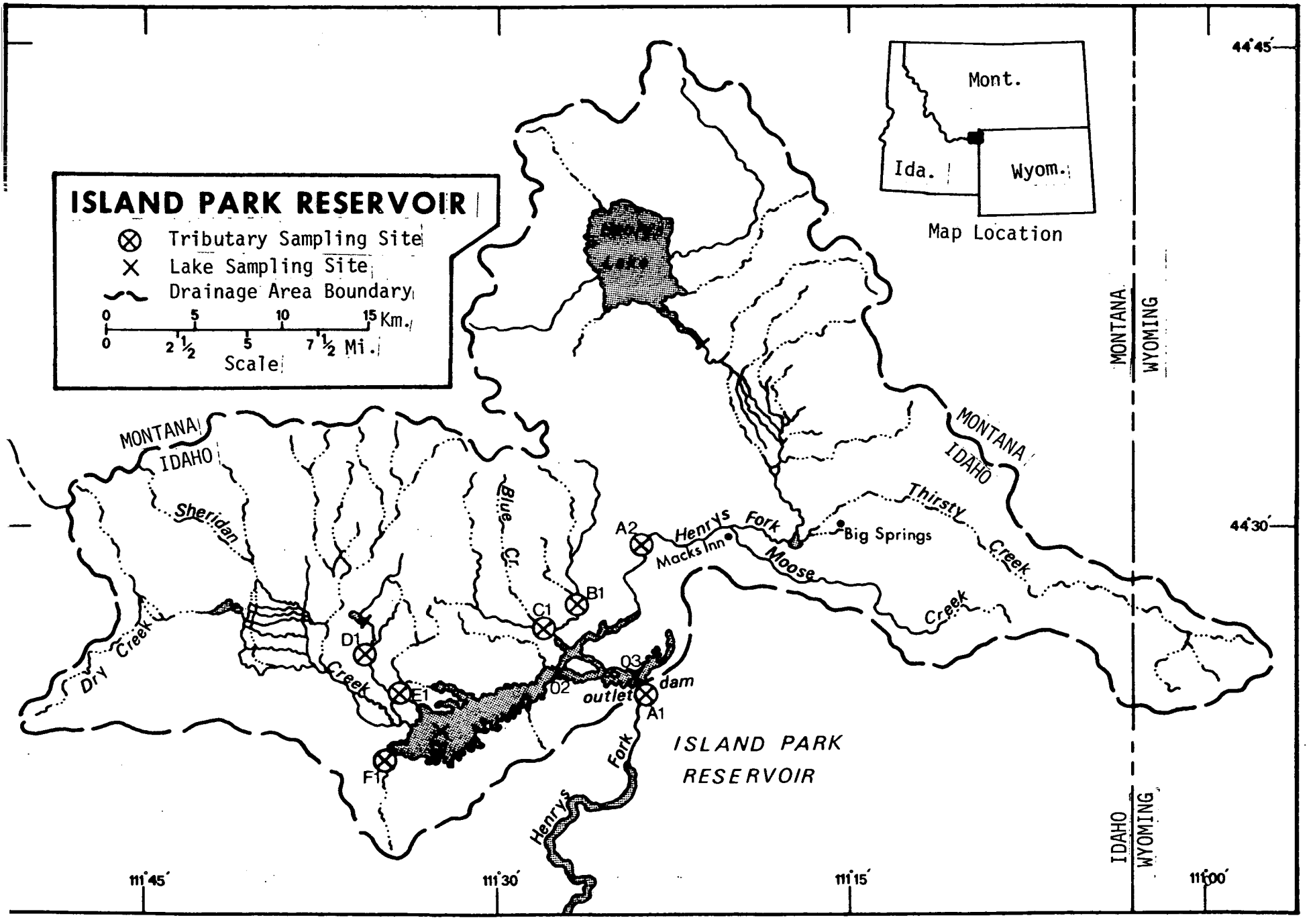
Major General James S. Brooks, Adjutant General of Idaho, and Project Officer Major Vestal L. Baker, who directed the volunteer efforts of the Idaho National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF IDAHO

LAKE NAME	COUNTY
American Falls Reservoir	Bannock, Bingham, Power
Cascade Reservoir	Valley
Coeur d'Alene Lake	Benewah, Kootenai
Dworshak Reservoir	Clearwater
Hauser Lake	Kootenai
Hayden Lake	Kootenai
Island Park Reservoir	Fremont
Lake Lowell (Deer Flat Reservoir)	Canyon
Magic Reservoir	Blaine, Camas
Palisades Reservoir	Bonneville (Lincoln in WY)
Payette Lake	Valley
Lower Twin Lake	Kootenai
Upper Twin Lake	Kootenai


ISLAND PARK RESERVOIR
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0 5 10 15 Km.
0 2½ 5 7½ Mi.
Scale
Mont.
Ida.
Wyom.
Map Location
Rocky Lake
MONTANA
WYOMING
IDAHO
MONTANA
IDAHO
Sheridan
Blue Cr.
Dry Creek
Creek
A2
Henrys Fork
Mack's Inn
Big Springs
Thirsty Creek
Moose Creek
B1
C1
D1
E1
F1
O2
O3
outlet
dam
A1
ISLAND PARK RESERVOIR
Henrys Fork
44°45'
44°30'
111°45'
111°30'
111°15'
111°00'

REPORT ON ISLAND PARK RESERVOIR, IDAHO

STORET NO. 1607

I. CONCLUSIONS

A. Trophic Condition:*

On the basis of Survey data and field observations, Island Park Reservoir is considered eutrophic, i.e., nutrient rich and highly eutrophic. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual or potential impact upon designated beneficial water uses of each lake.

Chlorophyll a levels in the lake ranged from 0.9 µg/l to 26.3 µg/l with a mean of 9.3 µg/l. Potential for primary productivity as measured by algal assay control yield was high. The relatively high Secchi disc visibility of July sampling was severely depressed during September. Of the 13 Idaho lakes sampled in 1975, 3 had higher median total phosphorus levels, 8 had greater median inorganic nitrogen values and 4 had greater median orthophosphorus levels than Island Park Reservoir.

Survey limnologists reported heavy algal blooms throughout the lake during both September and October visits to the lake.

*See Appendix E.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Island Park Reservoir was limited by available phosphorus during September sampling, and by available nitrogen during July and October. The reservoir data suggest primary limitation by nitrogen on all three sampling occasions.

C. Nutrient Controllability:

1. Point sources -

During the sampling year, point sources were not found to have contributed any of the nutrient loading to Island Park Reservoir. Septic tanks were estimated to have contributed 0.3% of the total phosphorus load to the lake.

The calculated annual phosphorus loading to Island Park Reservoir of 0.32 g $P/m^2/yr$ was less than Vollenweider's (1975) proposed oligotrophic loading for lakes with such volume and hydraulic retention time. However, this loading rate is probably far too low since loading calculations based upon nutrient concentrations indicate a net export of phosphorus and nitrogen from the lake, suggesting that sampling was not adequate to depict actual loading and export rates. This apparent export could be due to an underestimation of nutrient loadings from the ungaged tributaries to the reservoir, to unknown industrial or municipal point sources, or to sampling

error. Additional sampling to determine the true nutrient budget for the lake is needed before any recommendation on nutrient controllability in Island Park Reservoir can be made.

2. Nonpoint sources -

All of the total phosphorus input to Island Park Reservoir was found to be contributed by nonpoint sources during the sampling year. Ungaged tributaries were estimated to have contributed 13.2%, Henrys Fork contributed 61.3% and Sheridan Creek contributed 7.2%. The remaining three gaged tributaries collectively contributed a total of 12.5%.

II. LAKE AND DRAINAGE CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake morphometry data were provided by Martin and Hanson (1966). Tributary flow data were provided by the Idaho 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: 31.54 km^2.
2. Mean depth: 5.0 meters.
3. Maximum depth: 21.9 meters.
4. Volume: 156.980 x 10^6 m^3.
5. Mean hydraulic retention time: 109 days.

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

1. Tributaries -

Name	Drainage area (km^2)	Mean flow (m^3/sec)
A-2 Henrys Fork	676.0	9.14
B-1 Hotel Creek	38.3	0.52
C-1 Sheep Creek	32.4	0.08
D-1 Icehouse Creek	19.7	0.56
E-1 Sheridan Creek	282.3	0.85
Minor tributaries and immediate drainage -	165.6	2.41
Totals	1,214.3	13.56
2. Outlet - A-1 Henrys Fork	1,245.8	16.61

C. Precipitation:

1. Year of sampling: 34.2 cm.
2. Mean annual: 30.3 cm.

III. LAKE WATER QUALITY SUMMARY

Island Park Reservoir 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. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 3.0 meters at Station 01, 14.9 meters at Station 02, and 21.0 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.

ISLAND PARK RESERVOIR
STORET CODE 1607

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(7/30/75) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(9/ 3/75) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(10/20/75) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	16.8- 17.8	17.6	0.0- 1.5	5	15.0- 16.6	16.2	0.0- 1.5	6	8.4- 10.2	9.8	0.0- 1.5
MAX DEPTH**	3	6.3- 16.9	8.5	3.0- 21.0	2	13.6- 15.0	14.3	1.5- 19.5	3	8.4- 8.8	8.8	1.5- 15.5
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	6	6.8- 9.2	8.7	0.0- 1.5	5	5.0- 9.2	8.8	0.0- 1.5	6	7.1- 9.1	8.5	0.0- 1.5
MAX DEPTH**	3	2.2- 7.8	3.2	3.0- 21.0	2	5.0- 5.4	5.2	1.5- 19.5	3	6.4- 7.4	7.1	1.5- 15.5
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	132.- 145.	135.	0.0- 1.5	5	120.- 130.	123.	0.0- 1.5	6	89.- 126.	115.	0.0- 1.5
MAX DEPTH**	3	93.- 137.	105.	3.0- 21.0	2	117.- 130.	124.	1.5- 19.5	3	97.- 126.	106.	1.5- 15.5
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	6	9.2- 9.4	9.3	0.0- 1.5	5	7.8- 9.1	9.0	0.0- 1.5	6	8.3- 9.1	9.0	0.0- 1.5
MAX DEPTH**	3	8.1- 9.2	8.4	3.0- 21.0	2	7.8- 8.3	8.0	1.5- 19.5	3	8.3- 8.5	8.4	1.5- 15.5
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	6	70.- 82.	74.	0.0- 1.5	7	68.- 77.	72.	0.0- 1.5	6	66.- 84.	68.	0.0- 1.5
MAX DEPTH**	3	60.- 80.	62.	3.0- 21.0	3	72.- 77.	74.	1.5- 19.5	3	63.- 84.	73.	1.5- 15.5
TOTAL P (MG/L)												
0.-1.5 M DEPTH	6	0.018-0.028	0.020	0.0- 1.5	7	0.017-0.124	0.062	0.0- 1.5	6	0.029-0.077	0.046	0.0- 1.5
MAX DEPTH**	3	0.034-0.258	0.105	3.0- 21.0	3	0.029-0.123	0.052	1.5- 19.5	3	0.044-0.089	0.077	1.5- 15.5
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	6	0.011-0.014	0.012	0.0- 1.5	7	0.004-0.027	0.008	0.0- 1.5	6	0.009-0.036	0.013	0.0- 1.5
MAX DEPTH**	3	0.014-0.134	0.066	3.0- 21.0	3	0.004-0.032	0.027	1.5- 19.5	3	0.018-0.036	0.029	1.5- 15.5
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.020	0.020	0.0- 1.5	7	0.020-0.100	0.020	0.0- 1.5	6	0.020-0.090	0.020	0.0- 1.5
MAX DEPTH**	3	0.020-0.040	0.020	3.0- 21.0	3	0.020-0.100	0.020	1.5- 19.5	3	0.020-0.090	0.040	1.5- 15.5
AMMONIA (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.030	0.025	0.0- 1.5	7	0.020-0.060	0.030	0.0- 1.5	6	0.020-0.070	0.030	0.0- 1.5
MAX DEPTH**	3	0.030-0.400	0.160	3.0- 21.0	3	0.020-0.210	0.060	1.5- 19.5	3	0.070-0.070	0.070	1.5- 15.5
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	6	0.200-0.400	0.200	0.0- 1.5	7	0.200-0.500	0.400	0.0- 1.5	6	0.200-0.400	0.300	0.0- 1.5
MAX DEPTH**	3	0.200-0.500	0.300	3.0- 21.0	3	0.200-0.500	0.400	1.5- 19.5	3	0.200-0.400	0.300	1.5- 15.5
SECCHI DISC (METERS)	3	3.4- 4.3	3.7		3	1.1- 2.4	1.3		3	2.4- 3.0	3.0	

* N = NO. OF SAMPLES
** MAXIMUM DEPTH SAMPLED AT EACH SITE
*** S = NO. OF SITES SAMPLED ON THIS DATE

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
07/30/75	1. Aphanizomenon	454
	2. Chroomonas	165
	3. Cryptomonas	83
	4. Cyanophytan	83
	5. Microcystis	83
	Other genera	82
	Total	950
09/03/75	1. Aphanizomenon	3,254
	2. Chroomonas	38
	3. Melosira	38
	Other genera	---
	Total	3,330
10/20/75	1. Fragilaria	596
	2. Aphanizomenon	553
	3. Melosira	213
	4. Chrysophytan	170
	5. Cryptomonas	85
	Other genera	---
	Total	1,617

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
07/30/75	01	2.8
	02	2.3
	03	5.1
09/03/75	01	5.3
	02	18.7
	03	26.3
10/20/75	01	0.9
	02	19.6
	03	2.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 07/30/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.025	0.025	3.6
0.05 P	0.075	0.025	3.6
0.05 P + 1.0 N	0.075	1.025	13.5
1.00 N	0.025	1.025	9.9

b. 09/03/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.025	0.310	6.6
0.05 P	0.075	0.310	17.9
0.05 P + 1.0 N	0.075	1.310	32.0
1.00 N	0.025	1.310	5.4

c. 10/20/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.015	0.115	6.0
0.05 P	0.065	0.115	7.4
0.05 P + 1.0 N	0.065	1.115	28.4
1.00 N	0.015	1.115	9.3

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential primary productivity in Island Park Reservoir was high during all three sampling periods. In the July and October assays, a significant increase in yield occurred when nitrogen was added alone and in combination with phosphorus indicating nitrogen limitation at those times. In the September assay, the addition of orthophosphorus alone produced a significant increase in yield over that of the control, indicating phosphorus limitation at that time. Note that in the September assay the addition of nitrogen alone did not result in any increase in yield over that of the control.

The mean inorganic nitrogen to orthophosphorus ratios (N/P) in the lake data were less than 6/1 on all sampling occasions, suggesting primary limitation by nitrogen on all three sampling occasions.

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Idaho National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of May and June when two samples were collected at some stations. Sampling was begun in October 1974, and was completed in September 1975.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Idaho 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 $kg/km^2/year$, in Hotel Creek, Sheep Creek and Sheridan Creek, at Stations B-1, C-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 -

Source	kg P/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Henrys Fork	6,135	61.3
B-1 Hotel Creek	690	6.9
C-1 Sheep Creek	130	1.3
D-1 Icehouse Creek	430	4.3
E-1 Sheridan Creek	715	7.2
b. Minor tributaries and immediate drainage (nonpoint load) -	1,325	13.2
c. Known municipal STP's - None		
d. Septic tanks* -	30	0.3
e. Known industrial - None		
f. Direct precipitation** -	550	5.5
Totals	10,005	100.0%

2. Outputs - A-1 Henrys Fork 22,550

3. Net annual P export*** - 12,545

*Estimate based on 100 lakeshore residences.
**Estimated (See NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
A-2 Henrys Fork	52,870	36.8
B-1 Hotel Creek	8,920	6.2
C-1 Sheep Creek	1,970	1.4
D-1 Icehouse Creek	8,325	5.8
E-1 Sheridan Creek	17,055	11.9
b. Minor tributaries and immediate drainage (nonpoint load) -	19,540	13.6
c. Known municipal STP's - None		
d. Septic tanks* -	1,065	0.7
e. Known industrial - None		
f. Direct precipitation** -	34,050	23.6
Totals	143,795	100.0%

2. Outputs - A-1 Henrys Fork 459,510

3. Net annual N export*** - 315,715

*Estimate based on 100 lakeshore residences.
**Estimated (See NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Henrys Fork	9	78
Hotel Creek	18	233
Sheep Creek	4	61
Icehouse Creek	22	423
Sheridan Creek	2	60

E. Yearly Loadings:

In the following table, the existing phosphorus 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."

It should be noted that Vollenweider's model may not be applicable to water bodies with very short retention times or in which light penetration is severely restricted from high concentrations of suspended solids in the surface waters.

	Total Yearly Phosphorus Loading ($g/m^2/yr$)
Estimated loading for Island Park Reservoir	0.32
Vollenweider's "eutrophic" loading	0.78
Vollenweider's "oligotrophic" loading	0.39

V. LITERATURE REVIEWED

Martin, R.O.R. and Ronald L. Hanson. 1966. Reservoirs in the U.S. Geological Survey Water Supply Paper No. 1838. U.S. Government Printing Office, Washington, D.C.

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.

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 IDAHO 08/23/76

LAKE CODE 1607 ISLAND PARK RES.

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 1245.8

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1607A1	1245.8	4.96	6.91	8.38	12.86	27.33	25.94	30.58	31.15	22.00	13.65	8.52	6.14	16.61
1607A2	676.0	7.02	7.02	7.14	10.73	14.10	9.51	11.64	11.84	8.35	7.67	7.31	7.08	9.14
1607B1	38.3	0.20	0.20	0.20	0.40	1.59	1.84	0.54	0.31	0.28	0.25	0.25	0.23	0.52
1607C1	32.4	0.028	0.028	0.028	0.057	0.085	0.255	0.227	0.085	0.085	0.057	0.057	0.028	0.085
1607D1	19.7	0.48	0.48	0.54	0.76	0.79	0.71	0.59	0.45	0.45	0.48	0.48	0.48	0.56
1607E1	282.3	0.40	0.40	0.40	1.76	3.28	1.67	0.68	0.37	0.23	0.28	0.34	0.40	0.85
1607Z7	197.1	1.67	1.67	1.78	2.89	4.56	4.42	2.80	2.07	1.81	1.78	1.76	1.70	2.41

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1245.8
SUM OF SUB-DRAINAGE AREAS = 1245.8
TOTAL FLOW IN = 162.54
TOTAL FLOW OUT = 198.42

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1607A1	10	74	21.181	19	18.604				
	11	74	16.395	3	23.928				
	12	74	17.641	23	18.293				
	1	75	17.443	11	18.604				
	2	75	10.647	9	9.175				
	3	75	15.150	8	15.433				
	4	75	23.446	12	27.722				
	5	75	31.998	3	21.577	31	43.891		
	6	75	35.396	3	47.006				
	7	75	28.911	12	26.051				
	8	75	34.037	10	34.830				
	9	75	21.408	14	20.303				
1607A2	10	74	12.601	19	12.743				
	11	74	13.224	3	12.459				
	12	74	14.073	23	14.102				
	1	75	14.017	11	14.073				
	2	75	14.187	9	14.045				
	3	75	15.291	8	15.291				
	4	75	15.206	12	15.234				
	5	75	16.311	3	15.631	31	14.640		
	6	75	14.442	13	20.671	15	20.671		
	7	75	15.857	12	16.424				
	8	75	15.801	10	16.424				
	9	75	15.121	14	15.065				

TRIBUTARY FLOW INFORMATION FOR IDAHO 08/23/76

LAKE CODE 1607 ISLAND PARK RES.

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1607B1	10	74	0.340	19	0.227				
	11	74	0.311	3	0.227				
	12	74	0.311	23	0.283				
	1	75	0.283	11	0.255				
	2	75	0.229	9	0.227				
	3	75	0.201	8	0.227				
	4	75	0.190	12	0.170				
	5	75	0.850	31	2.549				
	6	75	3.540	13	9.628				
	7	75	2.209	12	1.756				
	8	75	0.481	10	0.453				
	9	75	0.340	14	0.227				
1607C1	10	74	0.071	19	0.057				
	11	74	0.068	3	0.057				
	12	74	0.065	23	0.057				
	1	75	0.054	11	0.057				
	2	75	0.040	9	0.028				
	3	75	0.031	8	0.028				
	4	75	0.028	12	0.028				
	5	75	0.340	31	2.860				
	6	75	3.398	13	3.653	15	3.964		
	7	75	1.586	12	2.464				
	8	75	0.127	10	0.113				
	9	75	0.074	14	0.057				
1607D1	10	74	0.623	19	0.623				
	11	74	0.623	3	0.623				
	12	74	0.623	23	0.566				
	1	75	0.566	11	0.538				
	2	75	0.510	9	0.510				
	3	75	0.453	8	0.481				
	4	75	0.453	12	0.425				
	5	75	1.161	31	2.718				
	6	75	2.917	13	3.002				
	7	75	2.180	12	2.577				
	8	75	0.793	10	0.765				
	9	75	0.651	14	0.623				
1607E1	10	74	2.435	19	3.115				
	11	74	2.407	3	2.662				
	12	74	2.379	23	2.294				
	1	75	2.237	11	2.209				
	2	75	2.067	9	2.124				
	3	75	1.954	8	2.010				
	4	75	1.897	12	1.841				
	5	75	3.710	31	5.097				
	6	75	6.881	13	20.105				
	7	75	5.635	12	2.662				
	8	75	2.860	10	2.237				
	9	75	2.464	14	2.237				

APPENDIX C

PHYSICAL AND CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

160701
44 23 41.0 111 33 13.0 3
ISLAND PARK RESERVOIR
16043 IDAHO

11EPALES 751117 2111202
0014 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 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 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
75/07/30	09 30	0000	16.8	9.0	146	133	9.20	82	0.030	0.200	0.020K	0.012
	09 30	0005	17.0	8.2		134	9.30	80	0.030	0.200	0.020K	0.011
	09 30	0010	16.9	7.8		137	9.20	80	0.030	0.300	0.020K	0.014
75/09/03	09 30	0000	15.0	5.2	44	130	8.75	74	0.050	0.500	0.100	0.027
	09 30	0005	15.0	5.0		130	7.75	77	0.060	0.500	0.100	0.027
75/10/20	11 15	0000	8.5	9.1	96	126	9.00	74	0.040	0.300	0.020K	0.017
	11 15	0005	8.4	7.1		126	8.30	84	0.070	0.400	0.090	0.036

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/07/30	09 30	0000	0.023	2.8	
	09 30	0005	0.028		
	09 30	0010	0.034		
75/09/03	09 30	0000	0.124	5.3	
	09 30	0005	0.123		
75/10/20	11 15	0000	0.056	0.9	
	11 15	0005	0.077		

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

160702
44 25 37.0 111 27 20.0 3
ISLAND PARK RESERVOIR
16043 IDAHO

11EPALES 751117 2111202
0053 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 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 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
75/07/30	10 00	0000	17.6	9.2	168	145	9.30	74	0.020	0.400	0.020K	0.012
	10 00	0005	17.7	8.8		139	9.40	73	0.020	0.200K	0.020K	0.012
	10 00	0030	11.1	4.0		116	8.60	68	0.060	0.200K	0.020	0.034
	10 00	0049	8.5	3.2		105	8.40	62	0.160	0.200	0.040	0.066
75/09/03	09 55	0000	16.3	9.2	52	121	9.00	68	0.040	0.400	0.020K	0.008
	09 55	0005	16.2	9.0		123	9.10	68	0.030	0.400	0.020K	0.011
	09 55	0015	16.1	9.2		121	9.15	70	0.020	0.300	0.020K	0.012
	09 55	0030	15.8	9.0		120	9.15	73	0.040	0.500	0.020K	0.012
	09 55	0045	14.1	8.0		108	8.85	66	0.050	0.300	0.020K	0.013
	10 20	0005						72	0.020K	0.200	0.020K	0.004
75/10/20	11 00	0000	9.9	8.4	120	106	9.00	68	0.020	0.200	0.020K	0.009
	11 00	0005	9.8	8.8		111	9.00	68	0.040	0.300	0.020K	0.018
	11 00	0016	9.7	8.4		107	8.70	68	0.060	0.300	0.020K	0.021
	11 00	0040	8.8	6.4		106	8.45	73	0.070	0.300	0.040	0.029

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/07/30	10 00	0000	0.019	2.3	
	10 00	0005	0.018		
	10 00	0030	0.041		
	10 00	0049	0.105		
75/09/03	09 55	0000	0.062	18.7	
	09 55	0005	0.063		
	09 55	0015	0.024		
	09 55	0030	0.032		
	09 55	0045	0.035		
	10 20	0005	0.029		
75/10/20	11 00	0000	0.037	19.6	
	11 00	0005	0.055		
	11 00	0016	0.052		
	11 00	0040	0.089		

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA-LAS VEGAS

160703
44 25 12.0 111 23 42.0 3
ISLAND PARK RESERVOIR
16043 IDAHO

11EPALES 751117 2111202
0073 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 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 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
75/07/30	10 15	0000	17.8	6.8	132	135	9.30	71	0.030	0.200K	0.020K	0.014
	10 15	0005	17.8	8.6		132	9.20	70	0.020	0.300	0.020K	0.012
	10 15	0020	13.2	7.2		123	7.90	64	0.030	0.200K	0.020K	0.012
	10 15	0045	8.8	4.8		102	7.80	61	0.060	0.200K	0.020	0.024
	10 15	0069	6.3	2.2		93	8.10	60	0.400	0.500	0.020	0.134
75/09/03	10 20	0000	16.6	8.8	96	120	9.10	72	0.020	0.200	0.020K	0.005
	10 20	0005						72	0.020K	0.200	0.020K	0.004
	10 20	0015	16.5	8.2		120	9.10	71	0.020	0.200	0.020K	0.003
	10 20	0040	15.8	8.4		119	9.10	72	0.020	0.300	0.020K	0.004
	10 20	0064	13.6	5.4		117	8.30	74	0.210	0.400	0.020K	0.032
75/10/20	10 30	0000	10.2	8.5	120	118	9.00	66	0.020K	0.300	0.020K	0.009
	10 30	0005	10.2	8.6		89	9.10	68	0.020K	0.200	0.020K	0.010
	10 30	0021	10.1	7.9		105	8.70	67	0.050	0.200	0.020K	0.014
	10 30	0051	8.8	7.4		97	8.50	63	0.070	0.200	0.020K	0.018

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/07/30	10 15	0000	0.022	5.1	
	10 15	0005	0.019		
	10 15	0020	0.017		
	10 15	0045	0.030		
	10 15	0069	0.258		
75/09/03	10 20	0000	0.017	26.3	
	10 20	0005	0.029		
	10 20	0015	0.020		
	10 20	0040	0.016		
	10 20	0064	0.052		
75/10/20	10 30	0000	0.029	2.9	
	10 30	0005	0.034		
	10 30	0021	0.037		
	10 30	0051	0.044		

K VALUE KNOWN TO BE LESS THAN INDICATED

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

1607A1
44 25 05.0 111 23 43.0 4
HENRYS FORK
16 7.5 ISLAND PK DM
O/ISLAND PARK RESERVOIR 130691
BELO DAM 4.5 MI W OF RT 20/191 JCT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	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
74/10/19	12	47	0.040	0.300	0.050	0.015	0.025
74/11/03	11	15	0.024	0.650	0.050	0.035	0.035
75/01/11	15	32	0.072	0.300	0.060	0.030	0.050
75/02/09	12	38	0.112	0.700	0.112	0.032	0.060
75/03/08	11	15	0.155	0.350	0.025	0.030	0.040
75/04/12	11	00	0.100	2.700	0.055	0.030	0.030
75/05/03	09	00	0.120	1.950	0.060	0.020	0.060
75/05/31	11	40	0.005	1.050	0.025	0.005K	0.025
75/06/03	11	50	0.010	1.150	0.015	0.014	0.030
75/07/12	12	10	0.005	0.500	0.015	0.010	0.020
75/08/10	10	00	0.015	0.300	0.070	0.050	0.060
75/09/14	12	10	0.055	0.500	0.110	0.075	0.080

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

1607A2
44 29 25.0 111 23 52.0 4
HENRYS FORK
16 7.5 ISLAND PK DM
T/ISLAND PARK RESERVOIR 130691
BNK 300 FT W END RD BY LWR COFFE POT CMP
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	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
74/10/19	14 10		0.040	0.300	0.015	0.005K	0.010
74/11/03	10 40		0.024	0.300	0.020	0.005K	0.005K
75/01/11	15 10		0.072	0.200	0.020	0.005	0.020
75/03/08	11 48		0.060	0.150	0.015	0.005	0.010K
75/04/12	11 34		0.070	1.250	0.030	0.010	0.010
75/05/03	09 50		0.030	0.350	0.040	0.005	0.070
75/06/13	12 30		0.010	1.200	0.030	0.015	0.020
75/06/15	11 45			1.500	0.090		
75/07/12	12 45		0.005	0.450	0.015	0.025	0.025
75/08/10	11 40		0.005	0.500	0.045	0.005	0.010K
75/09/14	11 30		0.035	0.800	0.020	0.040	0.040

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

160781
44 27 38.0 111 26 45.0 4
HOTEL CREEK
16 7.5 ISLAND PK DM
T/ISLAND PARK RESERVOIR 130691
SEC RD BRDG 2 MI W MCCREA BRDG CMP
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	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
74/10/19	15 40		0.024	0.100	0.010	0.020	0.025
74/11/03	10 20		0.008	0.100K	0.020	0.030	0.030
75/05/31	12 10		0.065	1.700	0.045	0.025	0.070
75/06/13	13 00		0.035	0.500	0.015	0.025	0.050
75/07/12	13 12		0.030	0.500	0.025	0.025	0.040
75/08/10	11 05		0.015	0.250	0.005K	0.015	0.015
75/09/14	09 55		0.045	0.750	0.015	0.057	0.060

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

1607C1
44 27 03.0 111 28 12.0 4
SHEEP CREEK
16 7.5 ISLAND PK DM
T/ISLAND PARK RESERVOIR 130691
SEC RD BRDG 4 MI WSW OF MCCREA BRDG CMP
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	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
74/10/19	16	10	0.016	0.400	0.020	0.010	0.025
74/11/03	10	15	0.008	0.400	0.025	0.020	0.025
75/01/11	14	35	0.128	0.500	0.075	0.030	0.050
75/02/09	11	30	0.128	0.500	0.096	0.024	0.060
75/05/31	12	20	0.090	1.900	0.050	0.055	0.100
75/06/13	13	15	0.010	1.300	0.025	0.025	0.070
75/06/15	11	40		1.700	0.260		
75/07/12	13	40	0.010	0.300	0.020	0.020	0.070
75/08/10	11	15	0.005	0.300	0.025	0.030	0.050
75/09/14	10	10	0.030	1.000	0.015	0.050	0.050

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

1607D1
44 25 05.0 111 34 57.0 4
ICEHOUSE CREEK
16 7.5 ICEHOUSE CRK
T/ISLAND PARK RESERVOIR 130691
SEC RD BRDG 1.1 MI E OF COUNTY LINE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	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
74/10/19	16	40	0.024	0.700	0.015	0.005	0.015
74/11/03	10	00	0.048	0.200	0.020	0.020	0.035
75/05/31	12	45	0.230	0.600	0.025	0.025	0.050
75/06/13	13	40	0.165	0.850	0.020	0.020	0.070
75/07/12	14	00	0.095	0.550	0.025	0.020	0.035
75/08/10	11	35	0.045	0.600	0.025	0.015	0.015
75/09/14	10	30	0.050	0.400	0.010	0.035	0.040

STORET RETRIEVAL DATE 76/08/25
NATL EUTROPHICATION SURVEY
EPA- LAS VEGAS

1607E1
44 24 42.0 111 35 48.0 4
SHERIDAN CREEK
16 7.5 ICEHOUSE CRK
T/ISLAND PARK RESERVOIR 130691
GRN CYN RD BRDG 1 MI E OF COUNTY LINE
11EPALES 2111204
0000 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	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
74/10/19	16 55		0.016	0.600	0.020	0.005K	0.010
74/11/03	10 05		0.008	0.200	0.015	0.005	0.010
75/05/31	12 50		0.045	0.400	0.020	0.045	0.120
75/06/13	13 55		0.005	1.150	0.020	0.045	0.130
75/07/12	14 20		0.015	0.600	0.025	0.065	0.100
75/08/10	12 00		0.005	0.600	0.025	0.015	0.020
75/09/14	10 45		0.030	1.000	0.015	0.030	0.040

K VALUE KNOWN TO BE LESS
THAN INDICATED

APPENDIX E

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1975

STATE OF IDAHO

Mean or median values for six of the key parameters evaluated in establishing the trophic conditions of Idaho 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 µg/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
1601	AMERICAN FALLS RESERVOIR	0.105	0.080	463.800	15.379	14.700	0.035
1602	CASCADE LAKE	0.032	0.060	415.067	8.081	14.800	0.009
1603	LAKE COEUR D'ALENE	0.017	0.040	380.348	10.391	12.200	0.005
1604	DWORSHAK RESERVOIR	0.010	0.080	401.866	2.420	7.400	0.009
1605	HAUSER	0.028	0.075	366.286	11.112	14.800	0.013
1606	HAYDEN LAKE	0.010	0.040	243.500	2.787	11.800	0.003
1607	ISLAND PARK RESERVOIR	0.034	0.050	391.778	9.322	12.800	0.012
1608	LAKE LOWELL	0.070	0.070	477.111	25.389	14.600	0.015
1609	MAGIC RESERVOIR	0.062	0.130	400.750	7.322	14.700	0.020
1610	PALISADES RESERVOIR	0.024	0.080	345.428	2.067	12.800	0.007
1611	LOWER PAYETTE	0.013	0.060	234.000	4.600	9.600	0.007
1612	LOWER TWIN LAKES	0.016	0.050	370.000	2.318	13.600	0.009
1613	UPPER TWIN LAKES	0.017	0.045	369.143	4.986	8.200	0.004

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
1601	AMERICAN FALLS RESERVOIR	0 (0)	17 (1)	8 (1)	8 (1)	21 (2)	0 (0)
1602	CASCADE LAKE	33 (4)	54 (6)	17 (2)	42 (5)	4 (0)	50 (5)
1603	LAKE COEUR D'ALENE	67 (8)	96 (11)	50 (6)	25 (3)	67 (8)	83 (10)
1604	DWORSHAK RESERVOIR	96 (11)	17 (1)	25 (3)	83 (10)	100 (12)	50 (5)
1605	HAUSER	42 (5)	33 (4)	75 (9)	17 (2)	4 (0)	25 (3)
1606	HAYDEN LAKE	96 (11)	96 (11)	92 (11)	75 (9)	75 (9)	100 (12)
1607	ISLAND PARK RESERVOIR	25 (3)	71 (8)	42 (5)	33 (4)	54 (6)	33 (4)
1608	LAKE LOWELL	8 (1)	42 (5)	0 (0)	0 (0)	33 (4)	17 (2)
1609	MAGIC RESERVOIR	17 (2)	0 (0)	33 (4)	50 (6)	21 (2)	8 (1)
1610	PALISADES RESERVOIR	50 (6)	17 (1)	83 (10)	100 (12)	54 (6)	75 (9)
1611	LOWER PAYETTE	83 (10)	54 (6)	100 (12)	67 (8)	83 (10)	67 (8)
1612	LOWER TWIN LAKES	75 (9)	71 (8)	58 (7)	92 (11)	42 (5)	50 (5)
1613	UPPER TWIN LAKES	58 (7)	83 (10)	67 (8)	58 (7)	92 (11)	92 (11)