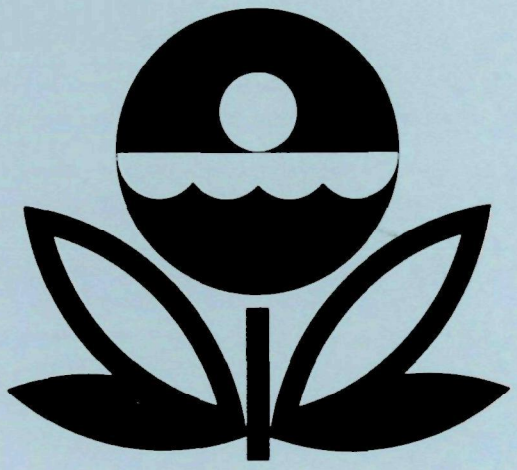
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT
ON
LAKE LOWELL
CANYON COUNTY
IDAHO
EPA REGION X
WORKING PAPER No. 783

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

REPORT
ON
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IDAHO
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WORKING PAPER No. 783

WITH THE COOPERATION OF THE
IDAHO DEPARTMENT OF HEALTH AND WELFARE
AND THE
IDAHO NATIONAL GUARD

JULY, 1977

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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.

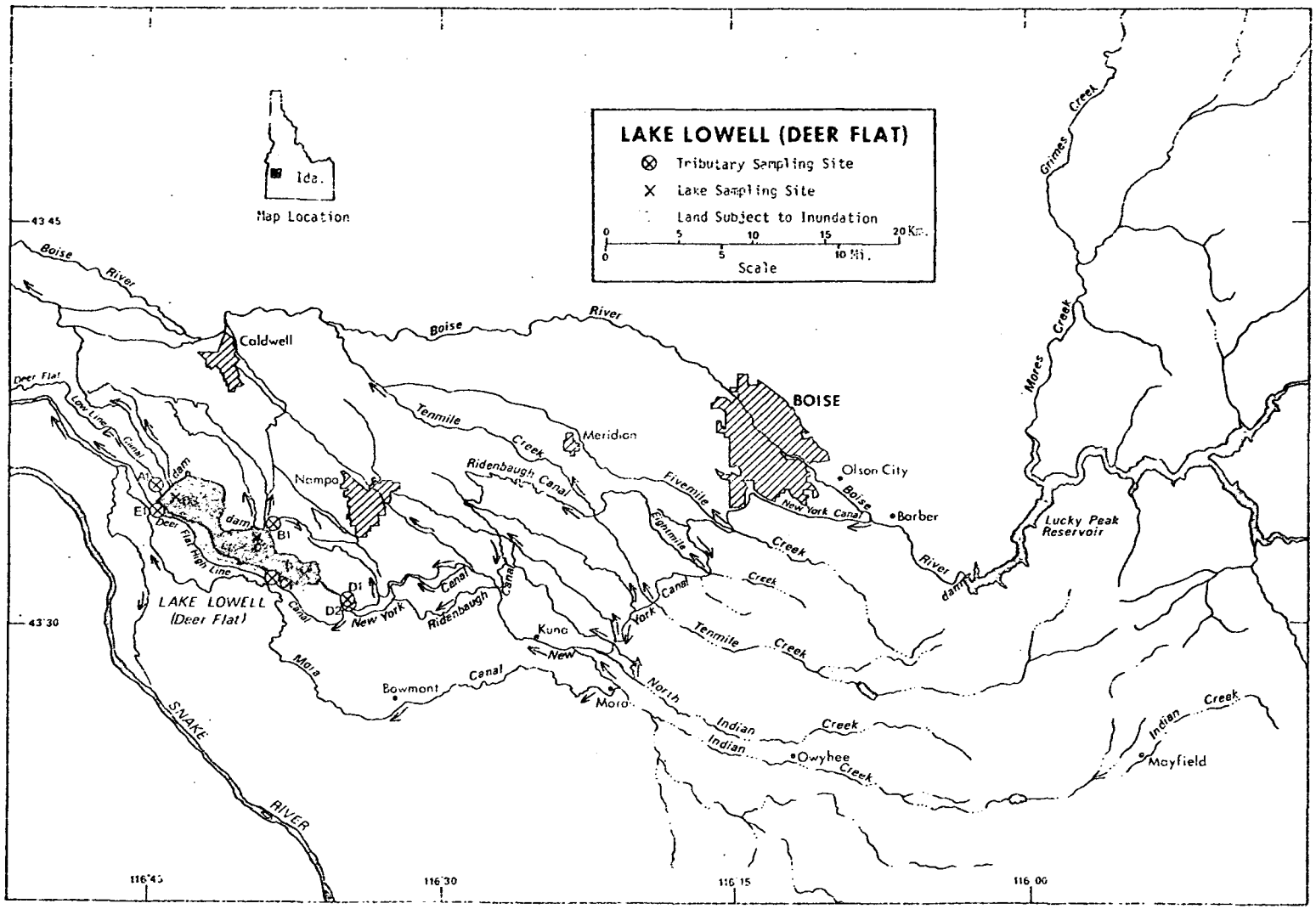
Major General James S. Brooks, Adjutant General of Idaho, and Project Officer Major Vestal L. Baker, who directed the volunteer efforts of the Idaho National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

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


LAKE LOWELL (DEER FLAT)
Tributary Sampling Site
Lake Sampling Site
Land Subject to Inundation
Scale
Ida.
Map Location
Boise River
Caldwell
Nampa
Meridion
Tenmile Creek
Ridenbaugh Canal
Fivemile Creek
BOISE
Olson City
Barber
Boise River
Lucky Peak Reservoir
dam
Mores Creek
Grimes Creek
Deer Flat
Low Line Canal
Deer Flat High Line Canal
LAKE LOWELL (Deer Flat)
New York Canal
Ridenbaugh Canal
Kuna
New York Canal
Tenmile Creek
Indian Creek
Owyhee
Mayfield
Bowmont
Moro
North Indian Creek
Indian Creek
SNAKE RIVER
43°45
43°30
116°45
116°30
116°15
116°00

REPORT ON LAKE LOWELL, IDAHO

STORET NO. 1608

I. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Lake Lowell is eutrophic, i.e., nutrient rich and highly productive. 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 values in the lake ranged from 16.0 µg/l to 39.2 µg/l with a mean of 25.4 µg/l. Potential for primary productivity as measured by algal assay control yield was moderate; however, it should be noted that significant nutrient losses occurred in assay samples prior to analysis and the results may not be representative of growth responses in the lake. Of the 13 Idaho lakes sampled in 1975, only 1 had higher median total phosphorus levels (0.070), 5 had higher median inorganic nitrogen values (0.070), and 2 had higher median orthophosphorus levels (0.015) than Lake Lowell.

Survey limnologists reported severe algal blooms and macrophyte growths during August and September visits to the lake.

*See Appendix E.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Lake Lowell was limited by available phosphorus. Lake data suggest nitrogen limitation during the spring (04/08/75) and summer (08/01/75) samplings and phosphorus limitation during the fall (09/17/75).

C. Nutrient Controllability:

1. Point sources -

There were no known point sources impacting Lowell Lake during the sampling year.

The present calculated phosphorus loading of 0.81 g $P/m^2/yr$ is greater than that proposed by Vollenweider (1975) as a "eutrophic" loading. Unless the nonpoint phosphorus load can be reduced, Lake Lowell can be expected to exhibit progressive symptoms of eutrophication.

2. Nonpoint sources -

All of the phosphorus entering Lake Lowell apparently came from nonpoint sources, primarily agricultural runoff into the drainage canals. New York Canal contributed 91.8% of the total phosphorus input into the lake and Unnamed Canal (C-1) contributed 6.0%. A study of land use practices in the drainage area is needed to determine whether any significant reduction of nonpoint phosphorus inputs can be accomplished.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS:

Lake and drainage basin characteristics are itemized below. Lake surface area, mean depth and volume were provided by Martin and Hanson (1966). Maximum depth was estimated on the basis of National Eutrophication Survey (NES) data. Tributary flow data were provided by the Idaho District Office of the U.S. Geological Survey (USGS). 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 NES Working Paper No. 175. A table of metric/English conversions is included in Appendix A.

A. Lake Morphometry:

1. Surface area: 39.80 km^2.
2. Mean depth: 5.9 meters.
3. Maximum depth: 12.2 meters.
4. Volume: 234.486 x 10^6 m^3.
5. Mean hydraulic retention time: 262 days.

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

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)
C-1 Unnamed Canal	----	0.42
D-1 New York Canal	----	9.74
Minor tributaries and immediate drainage -	----	----
Totals	----	10.16

2. Outlets -

A-1 Deer Flat Low Line Canal	----	9.74
B-1 Deer Flat at Nampa Canal	----	0.60
Totals	----	10.34

C. Precipitation:

1. Year of sampling: 29.4 cm.
2. Mean annual: 27.4 cm.

*Tributaries are canals with no associated drainage areas.

III. LAKE WATER QUALITY SUMMARY

Lake Lowell 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 4.3 meters at Station 01, 11.0 meters at Station 02, and 7.3 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.

LAKE LOWELL
STORET CODE 1408

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	(4/ 8/75) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(8/ 1/75) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	(9/16/75) S*** = 3 N*	RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	6	4.6- 4.8	4.6	0.0- 1.5	6	17.7- 20.7	18.5	0.0- 1.5	6	17.1- 20.7	18.8	0.0- 1.5
MAX DEPTH**	3	4.5- 4.6	4.6	4.3- 11.0	3	16.3- 17.7	17.5	4.0- 10.1	3	15.3- 17.4	16.8	3.0- 7.9
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	6	11.0- 13.0	13.0	0.0- 1.5	6	7.4- 15.0	9.9	0.0- 1.5	6	6.2- 10.4	8.9	0.0- 1.5
MAX DEPTH**	3	12.4- 13.0	12.8	4.3- 11.0	3	7.0- 7.8	7.8	4.0- 10.1	3	7.2- 9.5	7.4	3.0- 7.9
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	150.- 157.	152.	0.0- 1.5	6	197.- 203.	200.	0.0- 1.5	6	247.- 301.	284.	0.0- 1.5
MAX DEPTH**	3	151.- 155.	152.	4.3- 11.0	3	195.- 208.	204.	4.0- 10.1	3	241.- 345.	302.	3.0- 7.9
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	6	8.8- 8.9	8.9	0.0- 1.5	6	9.0- 9.6	9.4	0.0- 1.5	6	8.7- 9.3	9.1	0.0- 1.5
MAX DEPTH**	3	8.8- 8.9	8.8	4.3- 11.0	3	8.7- 9.3	9.2	4.0- 10.1	3	8.8- 9.3	9.2	3.0- 7.9
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	6	86.- 90.	88.	0.0- 1.5	6	82.- 92.	87.	0.0- 1.5	6	96.- 111.	105.	0.0- 1.5
MAX DEPTH**	3	85.- 90.	88.	4.3- 11.0	3	86.- 91.	90.	4.0- 10.1	3	97.- 130.	121.	3.0- 7.9
TOTAL P (MG/L)												
0.-1.5 M DEPTH	6	0.041-0.059	0.049	0.0- 1.5	6	0.068-0.174	0.080	0.0- 1.5	6	0.065-0.096	0.080	0.0- 1.5
MAX DEPTH**	3	0.049-0.279	0.049	4.3- 11.0	3	0.053-0.083	0.058	4.0- 10.1	3	0.073-0.096	0.086	3.0- 7.9
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	6	0.006-0.027	0.019	0.0- 1.5	6	0.010-0.033	0.023	0.0- 1.5	6	0.008-0.013	0.010	0.0- 1.5
MAX DEPTH**	3	0.019-0.033	0.030	4.3- 11.0	3	0.012-0.021	0.019	4.0- 10.1	3	0.009-0.013	0.010	3.0- 7.9
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.030	0.020	0.0- 1.5	6	0.020-0.020	0.020	0.0- 1.5	6	0.020-0.200	0.100	0.0- 1.5
MAX DEPTH**	3	0.020-0.040	0.020	4.3- 11.0	3	0.020-0.040	0.030	4.0- 10.1	3	0.020-0.400	0.100	3.0- 7.9
AMMONIA (MG/L)												
0.-1.5 M DEPTH	6	0.030-0.050	0.030	0.0- 1.5	6	0.030-0.070	0.040	0.0- 1.5	6	0.030-0.080	0.050	0.0- 1.5
MAX DEPTH**	3	0.030-0.050	0.040	4.3- 11.0	3	0.070-0.130	0.120	4.0- 10.1	3	0.040-0.060	0.040	3.0- 7.9
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	6	0.400-0.600	0.550	0.0- 1.5	6	0.700-1.500	0.800	0.0- 1.5	6	0.500-0.800	0.650	0.0- 1.5
MAX DEPTH**	3	0.500-0.600	0.500	4.3- 11.0	3	0.600-0.700	0.600	4.0- 10.1	3	0.500-0.800	0.800	3.0- 7.9
SECCHI DISC (METERS)												
	3	0.5- 1.1	0.9		3	0.1- 0.6	0.6		3	0.3- 0.6	0.6	

* 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
04/08/75	1. Fragilaria	9,120
	2. Asterionella	5,267
	3. Melosira	636
	4. Stephanodiscus	600
	5. Synedra	141
	Other genera	390
	Total	16,154
08/01/75	1. Aphanizomenon	5,622
	2. Melosira	861
	3. Fragilaria	208
	4. Stephanodiscus	124
	5. Chroomonas	84
	Other genera	306
	Total	7,205
09/16/75	1. Melosira	5,126
	2. Aphanizomenon	267
	3. Ankistrodesmus	160
	4. Cosmarium	107
	5. Oocystis	107
	Other genera	107
	Total	5,874

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
04/08/75	01	28.1
	02	26.8
	03	25.9
08/01/75	01	28.3
	02	25.4
	03	20.9
09/16/75	01	39.2
	02	17.9
	03	16.0

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 04/08/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.010	0.072	0.4
0.05 P	0.060	0.072	2.3
0.05 P + 1.0 N	0.060	1.072	7.8
1.00 N	0.010	1.072	0.4

b. 09/16/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.020	0.425	1.0
0.05 P	0.070	0.425	14.6
0.05 P + 1.0 N	0.070	1.425	18.6
1.00 N	0.020	1.425	1.0

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary production in Lake Lowell was moderate at the times of assay sample collection (04/08/75; 09/16/75). In both assays, addition of phosphorus alone and in combination with nitrogen caused a significant increase in yield over that of the control, indicating phosphorus limitation. The addition of nitrogen alone did not result in an increase over that of the control. However, it should be noted that there were substantial changes in nutrient levels between the collection and assay of the water samples. Therefore, the assay may not accurately reflect the nutrient limitation situation in the lake at the time of collection.

The mean inorganic nitrogen to orthophosphorus (N/P) ratios in the lake data were 3/1, 4/1, and 20/1 in the spring, summer, and fall respectively, suggesting nitrogen limitation in the spring and summer and phosphorus limitation in the fall (a mean N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

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 June and July when two samples were collected. 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.

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) -		
C-1 Unnamed Canal	1,925	6.0
D-1 New York Canal	29,470	91.8
b. Minor tributaries and immediate drainage (nonpoint load) -	-----	----
c. Known municipal STP's - None		
d. Septic tanks* -	10	<0.1
e. Known industrial - None		
f. Direct precipitation** -	695	2.2
Totals	32,100	100.0%

2. Outputs -

A-1 Deer Flat Low Line Canal	15,780
B-1 Deer Flat Nampa Canal	2,415
Totals	18,195

3. Net annual P accumulation - 13,905

*Estimate based on 32 lakeshore residences.
**Estimated (See NES Working Paper No. 175).

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (nonpoint load) -		
C-1 Unnamed Canal	42,530	15.1
D-1 New York Canal	196,660	69.6
b. Minor tributaries and immediate drainage (nonpoint load) -	------	----
c. Known municipal STP's - None		
d. Septic tanks* -	340	0.1
e. Known industrial - None		
f. Direct precipitation** -	42,970	15.2
Totals	282,500	100.0%

2. Outputs -

A-1 Deer Flat Low Line Canal	275,170
B-1 Deer Flat Nampa Canal	29,330
Totals	304,500

3. Net annual N export*** - 22,000

*Estimate based on 32 lakeshore residences.
**Estimated (See NES Working Paper No. 175).
***Export probably due to unknown sources and/or sampling error.

D. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P (mg/l)	Mean Total N (mg/l)
E-1 Unnamed Canal	<0.083	1.806

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."

Note 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 Lake Lowell	0.81
Vollenweider's "eutrophic" loading	0.56
Vollenwieder's "oligotrophic" loading	0.28

V. LITERATURE

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. 1965. 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 1608 LAKE LOWELL

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 0.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1608A1	0.0	0.113	0.057	0.566	10.506	18.916	21.747	25.117	22.087	12.205	4.361	0.255	0.142	9.735
1608B1	0.0	0.0	0.0	0.0	0.311	1.218	1.303	1.812	1.586	0.765	0.085	0.0	0.0	0.595
1608C1	0.0	0.0	0.0	0.0	0.283	0.765	0.963	1.189	1.189	0.566	0.085	0.0	0.0	0.423
1608D1	0.0	4.67	10.36	7.05	17.81	16.79	17.33	9.29	8.21	14.72	6.88	0.74	3.45	9.74
160877	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 0.0
SUM OF SUB-DRAINAGE AREAS = 0.0
TOTAL FLOW IN = 0.0
TOTAL FLOW OUT = 245.51

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1608A1	10	74	0.0	20	0.0				
	11	74	0.0	17	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	19	0.0				
	2	75	0.0	16	0.0				
	3	75	0.0	16	0.0				
	4	75	3.964	19	6.796				
	5	75	19.086	16	22.880				
	6	75	21.804	6	22.512	27	16.367		
	7	75	26.590	11	28.175	27	24.636		
	8	75	22.399	17	25.344				
	9	75	15.801	14	16.367				
1608B1	10	74	0.0	20	0.0				
	11	74	0.0	17	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	19	0.0				
	2	75	0.0	16	0.0				
	3	75	0.0	16	0.0				
	4	75	0.051	19	0.0				
	5	75	0.521	16	0.821				
	6	75	1.056	6	1.076	27	0.793		
	7	75	1.382	11	1.472	25	1.246		
	8	75	1.017	17	1.331				
	9	75	0.674	14	0.765				

TRIBUTARY FLOW INFORMATION FOR IDAHO 08/23/76

LAKE CODE 1608 LAKE LOWELL

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1608C1	10	74	0.088	20	0.0				
	11	74	0.0	17	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	19	0.0				
	2	75	0.0	16	0.0				
	3	75	0.0	16	0.0				
	4	75	0.028	19	0.0				
	5	75	0.660	16	1.133				
	6	75	1.110	6	0.991	27	1.104		
	7	75	1.266	11	1.642	12	1.784	25	1.048
	8	75	1.119	17	1.076				
	9	75	0.660	14	0.311				
1608D1	10	74	17.273	20	0.0				
	11	74	10.336	17	29.308				
	12	74	0.0	14	0.0				
	1	75	0.0	19	0.0				
	2	75	3.341	16	0.0				
	3	75	13.960	16	27.467				
	4	75	15.263	19	28.600				
	5	75	16.254	16	18.944				
	6	75	18.349	6	20.388	27	20.303		
	7	75	11.497	11	7.249	25	11.412		
	8	75	8.523	17	8.184				
	9	75	12.799	14	7.759				

APPENDIX C

PHYSICAL AND CHEMICAL DATA

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

160801
43 32 01.0 116 37 23.0 3
LAKE LOWELL
16027 IDAHO

130791

11EPALES 2111202
0018 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
75/04/08	10 35	0000	4.6	11.0	42	151	8.80	88	0.030	0.600	0.030	0.025
	10 35	0005	4.6	13.0		150	8.80	87	0.030	0.600	0.020K	0.027
	10 35	0010	4.5	13.0		150	8.80	89	0.030	0.600	0.020K	0.015
	10 35	0014	4.6	12.8		151	8.80	88	0.030	0.500	0.040	0.030
75/08/01	18 15	0000	20.7	15.0	4	203	9.60	82	0.040	1.500	0.020K	0.020
	18 15	0005	18.5	8.2		203	9.40	85	0.040	0.800	0.020K	0.026
	18 15	0013	17.7	7.8		195	9.35	86	0.070	0.600	0.020	0.019
75/09/16	14 15	0000	17.8	9.0	24	301	8.70	108	0.030	0.500	0.180	0.011
	14 15	0005	17.1	6.2		301	8.70	111	0.080	0.600	0.200	0.008
	14 15	0010	16.8	7.2		345	8.80	121	0.040	0.500	0.400	0.009

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/04/08	10 35	0000	0.041	28.1	
	10 35	0005	0.044		
	10 35	0010	0.047		
	10 35	0014	0.049		
75/08/01	18 15	0000	0.174	28.3	
	18 15	0005	0.072		
	18 15	0013	0.058		
75/09/16	14 15	0000	0.080	39.2	
	14 15	0005	0.081		
	14 15	0010	0.073		

K VALUE KNOWN TO BE LESS
THAN INDICATED

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

160802
43 33 22.0 116 39 22.0 3
LAKE LOWELL
16027 IDAHO

130791

11EPALES 2111202
0040 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
75/04/08	11 00	0000	4.8	13.0	36	152	8.90	87	0.030	0.600	0.020	0.022
	11 00	0005	4.7	12.6		152	8.90	86	0.040	0.500	0.020K	0.006
	11 00	0015	4.7	12.6		152	8.80	85	0.040	0.500	0.020K	0.022
	11 00	0036	4.6	12.4		152	8.80	85	0.050	0.600	0.020K	0.019
75/08/01	18 45	0000	18.5	12.2	22	200	9.45	87	0.030	1.300	0.020	0.010
	18 45	0005	17.7	8.0		200	9.40	89	0.050	0.800	0.020	0.012
	18 45	0015	17.5	7.8		197	9.30	90	0.060	0.500	0.030	0.016
	18 45	0033	16.3	7.0		208	9.20	91	0.130	0.700	0.040	0.021
75/09/16	14 40	0000	19.9	10.4	24	286	9.25	103	0.040	0.800	0.100	0.009
	14 40	0005	18.3	8.8		281	9.15	106	0.060	0.600	0.100	0.010
	14 40	0015	15.9	0.4		307	8.10	125	0.520	0.900	0.260	0.031
	14 40	0026	15.3	7.4		302	9.20	130	0.060	0.800	0.100	0.010

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/04/08	11 00	0000	0.048	26.8	
	11 00	0005	0.050		
	11 00	0015	0.063		
	11 00	0036	0.279		
75/08/01	18 45	0000	0.127	25.4	
	18 45	0005	0.068		
	18 45	0015	0.049		
	18 45	0033	0.083		
75/09/16	14 40	0000	0.084	17.9	
	14 40	0005	0.065		
	14 40	0015	0.095		
	14 40	0026	0.096		

K VALUE KNOWN TO BE LESS THAN INDICATED

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

160803
43 35 03.0 116 43 40.0 3
LAKE LOWELL
16027 IDAHO

130791

11EPALES 2111202
0027 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
75/04/08	11 25	0000	4.6	13.0	18	157	8.90	90	0.050	0.400	0.020	0.010
	11 25	0005	4.6	13.0		157	8.90	90	0.030	0.400	0.020K	0.016
	11 25	0015	4.5	12.8		156	8.85	91	0.040	0.600	0.020K	0.011
	11 25	0024	4.5	13.0		155	8.90	90	0.040	0.500	0.020K	0.033
75/08/01	19 20	0000	18.7	11.6	24	197	9.65	87	0.040	0.700	0.020K	0.033
	19 20	0005	17.9	7.4		199	9.00	92	0.070	0.700	0.020	0.033
	19 20	0016	17.5	7.8		204	8.70	90	0.120	0.600	0.030	0.012
75/09/16	15 05	0000	20.7	9.8	12	258	9.10	103	0.070	0.700	0.100	0.013
	15 05	0005	19.3	8.1		247	9.15	96	0.030	0.800	0.020K	0.011
	15 05	0011	17.4	9.5		241	9.30	97	0.040	0.800	0.020K	0.013

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT RFMNING PERCENT
75/04/08	11 25	0000	0.059	25.9	
	11 25	0005	0.055		
	11 25	0015	0.053		
	11 25	0024	0.049		
75/08/01	19 20	0000	0.088	20.9	
	19 20	0005	0.073		
	19 20	0016	0.053		
75/09/16	15 05	0000	0.074	16.0	
	15 05	0005	0.096		
	15 05	0011	0.084		

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

1608A1
43 35 22.0 116 44 42.0 4
DEER FLT LOW LINE CANAL
16 7.5 LAKE LOWELL
0/LAKE LOWELL 130791
HOODLEY RD BRDG 1.6 MI SW OF HWY 55
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
75/05/16	16 00		0.005	0.700	0.020	0.015	0.050
75/06/06	16 30		3.600	0.550	0.050	0.050	0.060
75/06/27	16 05		0.105	0.650	0.025	0.025	0.030
75/07/11	15 05		0.195	0.400	0.017	0.075	0.100
75/07/27	15 30		0.105	0.150	0.035	0.035	0.050
75/08/17	15 37		0.155	0.200	0.010	0.035	0.060
75/09/14	15 42		0.230	0.400	0.010	0.060	0.070

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

160881
43 33 40.0 116 38 52.0 4
DEER FLT AT NAMPA CANAL
16 7.5 LAKE LOWELL
0/LAKE LOWELL 130791
LK LOWELL AVE 5.2 MI SE OF DEATH CORNER
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
75/05/16	16	35	0.005	0.450	0.015	0.010	0.030
75/06/06	16	00	3.700	0.400	0.060	0.045	0.060
75/06/27	16	35	0.110	0.350	0.010	0.030	0.030
75/07/11	16	10	0.380	0.600	0.030	0.110	0.170
75/07/25	16	10	0.105	0.200	0.025	0.035	0.050
75/08/17	15	05	0.155	0.200	0.010	0.035	0.060
75/09/14	13	05	0.440	0.400	0.010	0.120	0.150

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

1608C1
43 31 27.0 116 38 04.0 4
UNNAMED CANAL
16 7.5 LAKE LOWELL
T/LAKE LOWELL 130791
LK SHORE DRV BRDG 4 MI SE OF LKVIEW SCH
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
74/10/20	14	10	0.008	0.200	0.015	0.005	0.010
75/04/19	09	45	0.360	1.250	0.035	0.015	0.030
75/05/16	14	30	0.140	0.600	0.015	0.035	0.100
75/06/06	14	30	0.390	0.500	0.025	0.060	0.100
75/06/27	15	10	0.250	0.400	0.005K	0.045	0.080
75/07/11	13	55	3.450	0.500	0.095	0.070	0.075
75/07/12	14	00	4.000	1.300	0.135	0.010	0.030
75/07/25	14	32	0.145	0.250	0.015	0.025	0.040
75/08/17	14	05	3.300	0.550	0.075	0.060	0.080
75/09/14	14	52	0.230	0.300	0.015	0.065	0.070

K VALUE KNOWN TO BE LESS
THAN INDICATED

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

160801
43 30 36.0 116 34 44.0 4
NEW YORK CANAL
16 7.5 NAMPA
T/LAKE LOWELL 130791
LK SHORE DRV BRDG .3 MI W OF HWY 45
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
74/10/20	13	10	1.160	0.500	0.020	0.025	0.025
74/11/17	14	00	0.192	0.200	0.025	0.015	0.030
75/03/16	09	30	0.105	0.250	0.015	0.005K	0.020
75/04/19	08	45	0.170	0.600	0.020	0.010	0.040
75/05/16	13	35	0.170	1.750	0.025	0.055	0.140
75/06/06	14	05	0.130	0.300	0.030	0.036	0.070
75/06/27	13	35	0.110	0.350	0.010	0.035	0.070
75/07/11	13	05	0.360	0.700	0.035	0.110	0.190
75/07/25	13	20	0.105	0.250	0.020	0.045	0.080
75/08/17	13	15	0.170	0.250	0.020	0.050	0.060
75/09/14	12	35	0.250	0.300	0.010	0.065	0.070

K VALUE KNOWN TO BE LESS THAN INDICATED

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

160802
43 30 33.0 116 34 35.0 4
NEW YORK CANAL
16 7.5 NAMPA
T/LAKE LOWELL 130791
BNK FRM DRT RD 3.2 MI S OF NAMPA
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
74/10/20	13	40	1.320	0.300	0.030	0.020	0.025
74/11/17	13	15	0.200	0.100	0.020	0.015	0.020
75/03/16	09	10	0.100	0.200	0.025	0.005	0.020
75/04/19	09	05	0.165	0.350	0.005	0.010	0.060
75/05/16	13	15	0.180	0.550	0.025	0.045	0.080
75/06/06	13	45	0.160	0.300	0.015	0.035	0.080
75/06/27	13	20	0.125	0.200	0.005	0.030	0.030
75/07/11	13	30	0.370	0.600	0.030	0.105	0.150
75/07/25	13	10	0.105	0.200	0.020	0.035	0.040
75/08/17	12	55	0.165	0.200	0.015	0.035	0.070
75/09/14	12	20	0.250	0.400	0.010	0.065	0.070

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

1606E1
43 34 02.0 116 44 30.0 4
UNNAMED CANAL
16 7.5 LAKE LOWELL
T/LAKE LOWELL 130791
BNK FRM LKSHORE DR 3.5 MI NW LKVIEW SCHL
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
74/10/20	14	45	0.024	0.400	0.025	0.005	0.010
75/04/19	10	15	0.175	0.650	0.010	0.035	0.170
75/05/16	15	15	0.155	1.050	0.017	0.008	0.010K
75/06/06	15	10	0.115	0.200	0.015	0.031	0.060
75/06/27	14	20	3.300	0.900	0.075	0.065	0.080
75/07/11	14	23	0.525	0.500	0.020	0.115	0.170
75/07/25	14	57	3.300	0.500	0.090	0.070	0.070
75/08/17	14	45	0.060	0.250	0.025	0.055	0.090
75/09/14	14	30	3.300	0.850	0.075	0.090	0.090

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)