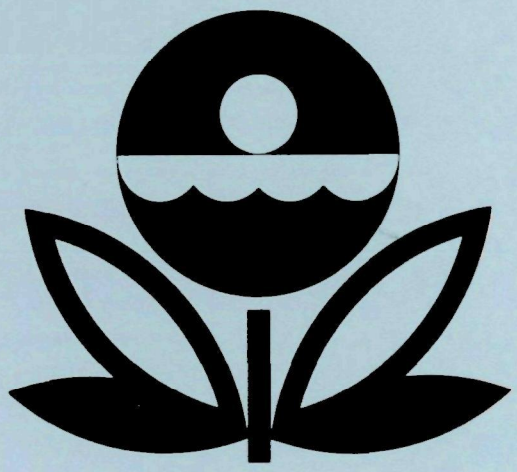
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT

ON

HAYDEN LAKE

KOOTENAI COUNTY

IDAHO

EPA REGION X

WORKING PAPER No. 781

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

REPORT
ON
HAYDEN LAKE
KOOTENAI COUNTY
IDAHO
EPA REGION X
WORKING PAPER No. 781

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

JULY, 1977

REPORT ON HAYDEN LAKE

KOOTENAI 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. 781

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.

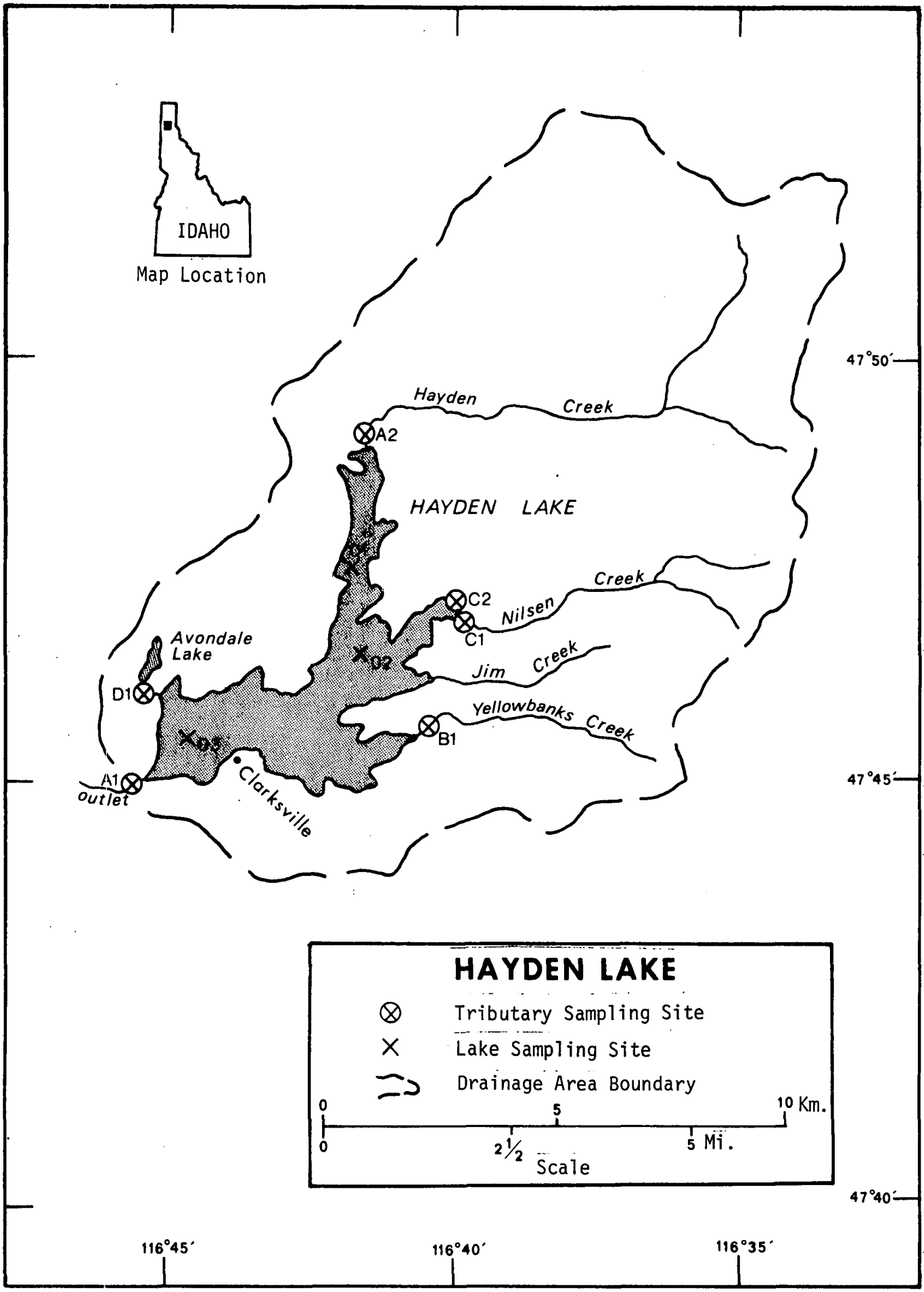
Major General James S. Brooks, Adjutant General of Idaho, and Project Officer Major Vestal L. Baker, who directed the volunteer efforts of the Idaho National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

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


IDAHO
Map Location
Hayden Creek
A2
HAYDEN LAKE
C3
C2
Nilsen Creek
C1
Avondale Lake
D1
D2
Jim Creek
Yellowbanks Creek
B1
D3
A1
outlet
Clarksville
47°50′
47°45′
47°40′
116°45′
116°40′
116°35′
HAYDEN LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0
5
10 Km.
0
2½
5 Mi.
Scale

REPORT ON HAYDEN LAKE, IDAHO

STORET NO. 1606

I. CONCLUSIONS

A. Trophic Condition:*

Survey data indicate that Hayden Lake is early mesotrophic. Chlorophyll a values in the lake ranged from 1.8 µg/l in the fall to 4.6 µg/l in the spring with a mean of 2.8 µg/l. Potential for primary production as measured by algal assay control yield was moderately low in the spring sample (04/04/75) and high in the fall (09/10/75) sample. Lake water transparency was excellent. Of the 13 Idaho lakes sampled in 1975, 11 had higher median total phosphorus values (0.010 mg/l), 11 had higher median inorganic nitrogen levels (0.040 mg/l), and all had higher median ortho-phosphorus (0.003 mg/l) values than Hayden Lake.

Survey limnologists did not report any problem conditions during their visits to the lake. The Idaho Department of Water Resources, et al. (1975), however, report existing pollution due to residential development, irrigation return and inadequate sewage systems.

*See Appendix E.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Hayden Lake was phosphorus limited at the time of sampling (04/04/75, 09/10/75). Lake data indicate phosphorus limitation in the spring and fall, and nitrogen limitation in the summer.

C. Nutrient Controllability:

1. Point sources -

There were no known municipal or industrial point sources impacting Hayden Lake during the sampling year. Septic tanks were estimated to account for 12.0% of the total phosphorus load to the lake.

2. Nonpoint sources -

Hayden Creek contributed 28.8%, Mokins Creek contributed 15.0%, and the ungaged tributaries and immediate drainage contributed an estimated 24.1% of the total phosphorus loading to Hayden Lake.

The Idaho District Office of the U.S. Geological Survey (Bill Harenburg, personal communication) reports that all water in Hayden Lake either seeps out through the lake bottom or is pumped out for irrigation. Therefore, no information is available on the outflow of nutrients, and the net nutrient accumulation in Hayden Lake cannot be determined. Additional sampling

is needed to determine the true nutrient budget for the lake before recommendations on nutrient controllability can be made.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

Lake and drainage basin characteristics are itemized below. Lake surface area, mean depth and volume were provided by Herman Ray (personal communication). 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). Outlet drainage area includes the lake surface area. Precipitation values are estimated by methods as outlined in NES Working Paper No. 175. A table of metric/English conversions is included as Appendix A.

A. Lake Morphometry:

1. Surface area: 17.00 km^2.
2. Mean depth: 7.3 meters.
3. Maximum depth: 54.2 meters.
4. Volume: 123.349 x 10^6 m^3.
5. Mean hydraulic retention time: ?

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

1. Tributaries -

Name	Drainage area (km^2)	Mean flow (m^3/sec)
A-2 Hayden Creek	73.8	0.91
C-1 Mokins Creek	20.2	0.25
D-1 Avondale Lake Outlet	5.5	0.07
Minor tributaries and immediate drainage -	44.9	0.77
Totals	144.4	2.00
2. Outlet - A-1 Irrigation ditch	161.4	----

C. Precipitation:

1. Year of sampling: 86.1 cm.
2. Mean annual: 84.2 cm.

III. LAKE WATER QUALITY SUMMARY

Hayden 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 indentification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 20.1 meters at Station 01, 52.7 meters at Station 02, and 51.8 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.

HAYDEN LAKE
STORET CODE 1606

PHYSICAL AND CHEMICAL CHARACTERISTICS

PARAMETER	N*	(4/ 4/75) S*** = 3 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(7/23/75) S*** = 3 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)	N*	(9/10/75) S*** = 3 RANGE	MEDIAN	MAX DEPTH RANGE (METERS)
TEMPERATURE (DEG CENT)												
0.-1.5 M DEPTH	4	4.1- 4.3	4.1	0.0- 1.5	5	24.5- 25.9	25.4	0.0- 1.5	6	15.2- 15.4	15.2	0.0- 1.5
MAX DEPTH**	2	4.2- 4.3	4.2	51.8- 51.8	3	7.2- 9.3	7.9	20.1- 52.7	3	1.0- 3.5	1.1	19.5- 51.8
DISSOLVED OXYGEN (MG/L)												
0.-1.5 M DEPTH	5	11.6- 12.8	11.6	0.0- 1.5	5	8.8- 10.2	9.6	0.0- 1.5	5	8.6- 9.0	8.8	0.0- 1.5
MAX DEPTH**	3	11.4- 11.6	11.5	19.8- 51.8	3	8.4- 8.8	8.6	20.1- 52.7	3	3.2- 10.0	8.8	19.5- 51.8
CONDUCTIVITY (UMHOS)												
0.-1.5 M DEPTH	6	27.- 37.	30.	0.0- 1.5	5	47.- 60.	52.	0.0- 1.5	6	38.- 45.	44.	0.0- 1.5
MAX DEPTH**	3	25.- 36.	29.	19.8- 51.8	3	32.- 35.	33.	20.1- 52.7	3	23.- 51.	27.	19.5- 51.8
PH (STANDARD UNITS)												
0.-1.5 M DEPTH	5	7.1- 7.5	7.5	0.0- 1.5	5	7.4- 8.6	8.1	0.0- 1.5	6	7.4- 8.0	7.6	0.0- 1.5
MAX DEPTH**	3	7.4- 7.5	7.5	19.8- 51.8	3	7.1- 7.9	7.6	20.1- 52.7	3	7.1- 7.8	7.3	19.5- 51.8
TOTAL ALKALINITY (MG/L)												
0.-1.5 M DEPTH	6	22.- 30.	26.	0.0- 1.5	5	27.- 38.	34.	0.0- 1.5	6	26.- 32.	30.	0.0- 1.5
MAX DEPTH**	3	25.- 32.	29.	19.8- 51.8	3	33.- 36.	35.	20.1- 52.7	3	29.- 30.	30.	19.5- 51.8
TOTAL P (MG/L)												
0.-1.5 M DEPTH	6	0.007-0.018	0.010	0.0- 1.5	5	0.005-0.012	0.010	0.0- 1.5	6	0.008-0.013	0.009	0.0- 1.5
MAX DEPTH**	3	0.008-0.061	0.013	19.8- 51.8	3	0.010-0.151	0.015	20.1- 52.7	3	0.010-0.042	0.011	19.5- 51.8
DISSOLVED ORTHO P (MG/L)												
0.-1.5 M DEPTH	6	0.002-0.003	0.002	0.0- 1.5	5	0.009-0.012	0.010	0.0- 1.5	6	0.002-0.008	0.004	0.0- 1.5
MAX DEPTH**	3	0.002-0.002	0.002	19.8- 51.8	3	0.009-0.012	0.009	20.1- 52.7	3	0.002-0.008	0.002	19.5- 51.8
NO2+NO3 (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.020	0.020	0.0- 1.5	5	0.020-0.020	0.020	0.0- 1.5	6	0.020-0.020	0.020	0.0- 1.5
MAX DEPTH**	3	0.020-0.020	0.020	19.8- 51.8	3	0.020-0.020	0.020	20.1- 52.7	3	0.020-0.040	0.020	19.5- 51.8
AMMONIA (MG/L)												
0.-1.5 M DEPTH	6	0.020-0.020	0.020	0.0- 1.5	5	0.020-0.040	0.030	0.0- 1.5	6	0.020-0.020	0.020	0.0- 1.5
MAX DEPTH**	3	0.020-0.020	0.020	19.8- 51.8	3	0.020-0.040	0.030	20.1- 52.7	3	0.020-0.020	0.020	19.5- 51.8
KJELDAHL N (MG/L)												
0.-1.5 M DEPTH	6	0.200-0.800	0.250	0.0- 1.5	5	0.200-0.400	0.300	0.0- 1.5	6	0.200-0.200	0.200	0.0- 1.5
MAX DEPTH**	3	0.200-0.300	0.200	19.8- 51.8	3	0.200-0.400	0.300	20.1- 52.7	3	0.200-0.300	0.200	19.5- 51.8
SECCHI DISC (METERS)												
	3	5.4- 8.8	7.6		1	4.2- 4.2	4.2		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
04/04/75	1. Dinobryon	510
	2. Melosira	198
	3. Asterionella	170
	4. Ankistrodesmus	113
	5. Cyclotella	113
	Other genera	58
	Total	1,162
07/23/75	1. Dinobryon	333
	2. Cyclotella	212
	3. Anabaena	30
	4. Ankistrodesmus	30
	Other genera	---
	Total	605
09/10/75	1. Stephanodiscus	80
	2. Chroomonas	32
	3. Aphanothece	16
	Other genera	---
	Total	128

2. Chlorophyll *a* -

Sampling Date	Station Number	Chlorophyll *a* (µg/l)
04/04/75	01	4.6
	02	3.3
	03	3.2
07/23/75	01	---
	02	3.3
	03	2.0
09/10/75	01	1.8
	02	2.0
	03	2.1

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

a. 04/04/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.005	0.020	0.2
0.05 P	0.055	0.020	1.3
0.05 P + 1.0 N	0.055	1.020	21.1
1.00 N	0.005	1.020	0.2

b. 09/10/75

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.015	0.055	1.5
0.05 P	0.065	0.055	5.9
0.05 P + 1.0 N	0.065	1.055	35.4
1.00 N	0.015	1.055	1.6

2. Discussion -

The control yields of the assay alga, Selenastrum capricornutum, indicate that the potential for primary production was moderately low in Hayden Lake during the spring sampling (04/04/75) and high during fall sampling (09/10/75). The increase in growth yield beyond that of the control caused by the addition of phosphorus, as well as the lack of response to the addition of nitrogen indicates phosphorus limitation in both assays. Maximum yield over that of the control was achieved with the simultaneous addition of both phosphorus and nitrogen.

The mean inorganic nitrogen to orthophosphorus (N/P) ratios for the spring, summer, and fall sampling were approximately 20/1, 5/1, and 14/1, respectively, suggesting phosphorus limitation in the spring and fall and nitrogen limitation in the summer (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 month of June when two samples were generally collected. Sampling was begun in October 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 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 $kg/km^2/year$, for Hayden Creek and Indian Creek at Stations A-2 and C-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 Hayden Creek	430	28.8
C-1 Mokins Creek	225	15.0
D-1 Avondale Lake Outlet	---	----
b. Minor tributaries and immediate drainage (nonpoint load) -	360	24.1
c. Known municipal STP's - None		
d. Septic tanks* -	180	12.0
e. Known industrial - None		
f. Direct precipitation** -	300	20.1
Totals	1,495	100.0

2. Outputs - A-1 Irrigation ditch ----

3. Net annual P accumulation - 1,495

*Estimate based on 627 lakeshore residences, 1 park and 1 camp.
**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) -		
A-2 Hayden Creek	13,990	22.6
C-1 Mokins Creek	8,815	14.2
D-1 Avondale Lake Outlet	------	----
b. Minor tributaries and immediate drainage (nonpoint load) -	14,055	22.7
c. Known municipal STP's - None		
d. Septic tanks* -	6,785	10.9
e. Known industrial - None		
f. Direct precipitation** -	18,355	29.6
Totals	62,000	100.0

2. Outputs - A-1 Irrigation ditch ------

3. Net annual N accumulation - 62,000

*Estimate based on 627 lakeshore residences, 1 park and 1 camp.
**Estimated (See NES Working Paper No. 175).

D. Mean Annual Nonpoint Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
A-2 Hayden Creek	6	190
C-1 Mokins Creek	11	436

E. Mean Nutrient Concentrations in Ungaged Streams:

Tributary	Mean Total P (mg/l)	Mean Total N (mg/l)
B-1 Yellowbanks Creek	0.018	2.100

F. Yearly Loading:

	Total Yearly Phosphorus Loading (g/m^2/yr)
Estimated loading for Hayden Lake	0.09

V. LITERATURE REVIEWED

Harenburg, William. 1976. Personal Communication. (Water Outflow from Hayden Lake) U.S. Geological Survey, Boise, Idaho.

Idaho Department of Water Resources, Department of Health and Welfare, Department of Fish and Game, and Department of Budget, Policy Planning and Coordination. 1975. Idaho Environmental Overview. Boise, Idaho.

Ray, Herman. 1976. Personal communication (morphometric data of selected Idaho water bodies). Boise, Idaho.

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.

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 1606 HAYDEN

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 161.4

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
1606A1	161.4	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
1606A2	73.8	0.85	1.33	2.15	2.44	1.84	0.71	0.31	0.17	0.20	0.20	0.34	0.45	0.91
1606C1	20.2	0.227	0.368	0.595	0.680	0.510	0.198	0.085	0.057	0.057	0.057	0.085	0.113	0.252
1606D1	5.5	0.057	0.113	0.170	0.170	0.142	0.057	0.023	0.014	0.014	0.017	0.025	0.028	0.069
1606ZZ	61.9	0.68	1.16	1.84	2.01	1.56	0.62	0.25	0.17	0.17	0.17	0.28	0.34	0.77

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 161.4
SUM OF SUB-DRAINAGE AREAS = 161.4
TOTAL FLOW IN = 24.11
TOTAL FLOW OUT = 0.0

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1606A1	10	74	0.0	19	0.0				
	11	74	0.0	16	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	18	0.0				
	2	75	0.0	16	0.0				
	3	75	0.0	16	0.0				
	4	75	0.0	19	0.0				
	5	75	0.170	18	0.283				
	6	75	0.028	15	0.057	30	0.0		
	7	75	0.0	16	0.0				
	8	75	0.0	10	0.0				
	9	75	0.0						
1606A2	10	74	0.136	19	0.127				
	11	74	0.210	16	0.147				
	12	74	0.221	14	0.187				
	1	75	0.283	18	0.651				
	2	75	0.396	16	0.510				
	3	75	1.161	16	0.906				
	4	75	2.350	19	3.002				
	5	75	3.455	18	3.455				
	6	75	1.019	15	0.906	30	0.538		
	7	75	0.396	16	0.396				
	8	75	0.232	10	0.201				
	9	75	0.184						

TRIBUTARY FLOW INFORMATION FOR IDAHO 08/23/76

LAKE CODE 1606 HAYDEN

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
1606C1	10	74	0.037	19	0.034				
	11	74	0.057	16	0.040				
	12	74	0.059	14	0.051				
	1	75	0.076	18	0.181				
	2	75	0.108	16	0.142				
	3	75	0.311	16	0.249				
	4	75	0.651	19	0.821				
	5	75	0.934	18	0.934				
	6	75	0.280	15	0.249	30	0.150		
	7	75	0.105	16	0.110				
	8	75	0.062	10	0.054				
	9	75	0.051						
1606D1	10	74	0.0	19	0.0				
	11	74	0.0	16	0.0				
	12	74	0.0	14	0.0				
	1	75	0.0	18	0.0				
	2	75	0.0	16	0.0				
	3	75	0.0	16	0.0				
	4	75	0.0	19	0.0				
	5	75	0.0						
	6	75	0.0	8	0.0	15	0.0	30	0.0
	7	75	0.0	16	0.0				
	8	75	0.0	10	0.0				
	9	75	0.0						

APPENDIX C

PHYSICAL AND CHEMICAL DATA

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

160601
47 47 29.0 116 41 47.0 3
HAYDEN LAKE
16055 IDAHO

130391

11EPALES 2111202
0069 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
75/04/04	11 50	0000		11.8	214	35	7.50	28	0.020K	0.300	0.020K	0.003
	11 50	0005		12.8		37	7.50	30	0.020K	0.300	0.020K	0.002
	11 50	0015		11.2		37	7.50	29	0.020K	1.100	0.020K	0.002
	11 50	0040		11.6		36	7.50	30	0.020K	0.300	0.020K	0.002K
	11 50	0065		11.5		36	7.45	29	0.020K	0.300	0.020K	0.002
75/07/23	14 15	0000	25.4	10.0	164	60	7.45	27	0.040	0.400	0.020K	0.010
	14 15	0005	25.9	9.6		51	8.60	29	0.030	0.200	0.020K	0.010
	14 15	0020	23.2	9.8		45	8.30	29	0.020	0.200K	0.020K	0.008
	14 15	0030	17.2	11.2		42	7.60	30	0.030	0.200K	0.020K	0.008
	14 15	0066	9.3	8.4		35	7.60	36	0.020	0.300	0.020K	0.009
75/09/10	11 10	0000	15.4	9.0		45	8.00	29	0.020K	0.200K	0.020K	0.002K
	11 10	0005	15.2			45	7.95	32	0.020K	0.200	0.020K	0.008
	11 10	0020	14.7	9.2		41	7.95	32	0.020K	0.200K	0.020K	0.003
	11 10	0035	13.2	10.0		37	7.90	31	0.020K	0.200K	0.020K	0.002K
	11 10	0055	4.8	8.8		27	7.60	29	0.020K	0.200K	0.020K	0.002K
	11 10	0064	3.5	10.0		27	7.80	29	0.020K	0.200K	0.020K	0.002

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/04/04	11 50	0000	0.015	4.6	
	11 50	0005	0.018		
	11 50	0015	0.315		
	11 50	0040	0.056		
	11 50	0065	0.061		
75/07/23	14 15	0000	0.011		
	14 15	0005	0.012		
	14 15	0020	0.010		
	14 15	0030	0.010		
	14 15	0066	0.010		
75/09/10	11 10	0000	0.010	1.8	
	11 10	0005	0.011		
	11 10	0020	0.008		
	11 10	0035	0.008		
	11 10	0055	0.008		
	11 10	0064	0.011		

K VALUE KNOWN TO BE LESS THAN INDICATED

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

160602
47 46 33.0 116 42 43.0 3
HAYDEN LAKE
16055 IDAHO

130391

11EPALES 2111202
0999 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
75/04/04	14 20	0000	4.2	11.6	348	33	7.10	22	0.020	0.800	0.020	0.003
	14 20	0005	4.3	11.6		27		24	0.020K	0.200	0.020K	0.002
	14 20	0030	4.2	11.6		28	7.50	24	0.020K	0.200	0.020K	0.002K
	14 20	0065	4.2	11.8		27	7.50	24	0.020K	0.200K	0.020K	0.002K
	14 20	0100	4.2	11.6		27	7.50	27	0.020K	0.200K	0.020K	0.002
	14 20	0135	4.2	11.6		27	7.50	28	0.020K	0.200K	0.020K	0.002
	14 20	0170	4.3	11.4		29	7.50	25	0.020	0.200K	0.020	0.002K
75/07/23	14 40	0000	25.0	9.0		58	8.10	36	0.020	0.300	0.020K	0.009
	14 40	0015	24.8	8.4		49	8.00	31	0.020	0.200K	0.020K	0.004
	14 40	0040	14.4	9.6		32	8.00	34	0.040	0.200K	0.020K	0.008
	14 40	0070	8.8	10.6		25	7.40	32	0.030	0.200K	0.020K	0.009
	14 40	0110	7.5	10.6		29	7.50	34	0.020K	0.200K	0.020K	0.008
	14 40	0140	7.3	10.0		30	7.40	34	0.020	0.200K	0.020K	0.008
	14 40	0173	7.2	8.8		32	7.90	35	0.030	0.400	0.020K	0.009
75/09/10	10 40	0000	15.3	8.6		44	7.60	26	0.020K	0.200K	0.020K	0.005
	10 40	0005	15.3	8.8		39	7.60	27	0.020K	0.200K	0.020K	0.004
	10 40	0030	14.4	8.8		36	7.75	28	0.020K	0.200K	0.020K	0.002
	10 40	0065	3.2	11.0		22	7.50	28	0.020K	0.200K	0.020K	0.002K
	10 40	0100	1.5	9.6		21	7.30	28	0.020K	0.200K	0.020K	0.002K
	10 40	0130	1.3	9.4		21	7.25	28	0.020K	0.200K	0.020K	0.002
	10 40	0161	1.1	8.8		23	7.10	30	0.020K	0.200K	0.020K	0.002

K VALUE KNOWN TO BE LESS
THAN INDICATED

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

160602
47 46 33.0 116 42 43.0 3
HAYDEN LAKE
16055 IDAHO
13ŏ391

11EPALES 2111202
0999 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/04/04	14 20	0000	0.013	3.3	
	14 20	0005	0.008		
	14 20	0030	0.009		
	14 20	0065	0.014		
	14 20	0100	0.013		
	14 20	0135	0.018		
	14 20	0170	0.013		
75/07/23	14 40	0000	0.010	3.3	
	14 40	0015	0.009		
	14 40	0040	0.010		
	14 40	0070	0.011		
	14 40	0110	0.009		
	14 40	0140	0.010		
	14 40	0173	0.151		
75/09/10	10 40	0000	0.013	2.0	
	10 40	0005	0.009		
	10 40	0030	0.011		
	10 40	0065	0.009		
	10 40	0100	0.008		
	10 40	0130	0.008		
	10 40	0161	0.010		

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

160603
47 45 45.0 116 43 12.0 3
HAYDEN LAKE
16055 IDAHO

130391

11EPALES 2111202
0999 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
75/04/04	14 50	0000	4.1	11.6	300	27	7.50	26	0.020K	0.200K	0.020K	0.002K
	14 50	0005	4.1			27	7.50	26	0.020K	0.200K	0.020K	0.002K
	14 50	0030	4.1	11.6		27	7.50	26	0.020K	0.200K	0.020K	0.002K
	14 50	0065	4.1	11.6		27	7.50	42	0.020K	0.200K	0.020K	0.002K
	14 50	0100	4.1	11.6		27	7.50	30	0.020K	0.200K	0.020K	0.002K
	14 50	0135	4.1	11.4		25	7.50	30	0.020K	0.200K	0.020K	0.002K
	14 50	0170	4.2	11.6		25	7.50	32	0.020K	0.200K	0.020K	0.002K
75/07/23	15 10	0000	25.8	10.2		52	7.90	38	0.030	0.300	0.020K	0.012K
	15 10	0005	24.5	8.8		47	8.10	34	0.020	0.200K	0.020K	0.011K
	15 10	0020	24.2	9.0		44	8.05	33	0.020	0.200K	0.020K	0.010K
	15 10	0050	10.7	11.0		26	8.20	35	0.020	0.200K	0.020K	0.010K
	15 10	0090	8.1	11.2		23	7.70	32	0.030	0.200K	0.020	0.009J
	15 10	0125	7.8	12.4		30	7.30	32	0.030	0.200K	0.020K	0.008J
	15 10	0168	7.9	8.6		33	7.10	33	0.040	0.200K	0.020	0.012K
75/09/10	10 05	0000	15.2	8.6		43	7.40	31	0.020K	0.200	0.020K	0.004
	10 05	0005	15.2	8.8		38	7.40	31	0.020K	0.200	0.020K	0.003
	10 05	0035	14.2	8.8		36	7.50	33	0.020K	0.200K	0.020K	0.003
	10 05	0066	3.3	11.2		21	7.30	33	0.020K	0.200	0.020K	0.002
	10 05	0105	1.6	9.8		21	7.10	32	0.020K	0.200K	0.020K	0.002
	10 05	0140	1.3	9.4		20	7.10	28	0.060	0.400	0.020K	0.008
	10 05	0170	1.0	3.2		51	7.25	30	0.020	0.300	0.040	0.008

K VALUE KNOWN TO BE LESS THAN INDICATED

J VALUE KNOWN TO BE ESTIMATED

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

160603
47 45 45.0 116 43 12.0 3
HAYDEN LAKE
16055 IDAHO

130391

11EPALES 2111202
0999 FEET DEPTH CLASS 00

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/04/04	14 50	0000	0.007	3.2	
	14 50	0005	0.007		
	14 50	0030	0.008		
	14 50	0065	0.009		
	14 50	0100	0.009		
	14 50	0135	0.010		
	14 50	0170	0.008		
75/07/23	15 10	0000	0.009	2.0	
	15 10	0005	0.005		
	15 10	0020	0.005		
	15 10	0050	0.006		
	15 10	0090	0.009		
	15 10	0125	0.026		
	15 10	0168	0.015		
75/09/10	10 05	0000	0.009	2.1	
	10 05	0005	0.008		
	10 05	0035	0.008		
	10 05	0066	0.008		
	10 05	0105	0.007		
	10 05	0140	0.020		
	10 05	0170	0.042		

APPENDIX D

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

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

1606A1
47 45 00.0 116 45 30.0 4
IRRIGATION DITCH
16055 7.5 HAYDEN
0/HAYDEN LAKE 130391
BELOW CONCRETE DAM NEAR VLGOF HAYDEN LK
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
75/06/15	14	47		0.350			0.040

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

1606A2
47 48 58.0 116 41 37.0 4
HAYDEN CREEK
16 7.5 HAYDEN LAKE
T/HAYDEN LAKE 130391
SEC RD BRDG 3.2 MI NNE OF HARRIS LANDING
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	11	20	0.016	0.200	0.010	0.010	0.020
74/11/16	11	45	0.032	0.100	0.020	0.010	0.010
74/12/14	12	45	0.040	0.300	0.020	0.010	0.030
75/01/18	10	45	0.124	0.100K	0.010	0.010	0.010
75/02/16	11	40	0.088	0.900	0.016	0.008	0.010K
75/03/16	09	40	0.070	0.150	0.015	0.005K	0.010K
75/04/19	15	30	0.075	0.350	0.010	0.005	0.040
75/05/18			0.020	1.000	0.045	0.005	0.020
75/06/15	14	07	0.005	0.200	0.020	0.010	0.010
75/06/30	17	55	0.005	0.650	0.010	0.010	0.010
75/07/16	15	58	0.020	0.050K	0.020	0.010	0.010
75/08/10	15	50	0.005	1.250	0.015	0.005	0.010

K VALUE KNOWN TO BE LESS
THAN INDICATED

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

160681
47 45 55.0 116 40 22.0 4
YELLOWBANKS CREEK
16 7.5 HAYDEN LAKE
T/HAYDEN LAKE 130391
SEC RD BRDG 1 MI S OF LEES POINT
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
75/04/19	14	35	0.010	0.050K	0.010	0.010	0.025
75/05/18	12	19	0.005	2.900	0.065	0.010	0.020
75/06/15	13	05	0.010	0.050K	0.040	0.020	0.020
75/06/30	17	05	0.005	1.300	0.020	0.010	0.010

K VALUE KNOWN TO BE LESS
THAN INDICATED

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

1606C1
47 47 00.0 116 40 00.0 4
MOKINS CREEK
16 7.5 HAYDEN LAKE
T/HAYDEN LAKE 130391
SEC RD BRDG 1 MI NE OF LEES POINT
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	10 45		0.024	0.800	0.015	0.015	0.020
74/11/16	11 25		0.024	0.100K	0.010	0.020	0.020
74/12/14	11 35		0.048	0.200	0.015	0.015	0.030
75/04/19	14 50		0.025	0.650	0.005K	0.015	0.030
75/05/18	12 04		0.005	2.600	0.040	0.010	0.020
75/06/15	13 25		0.005	0.850	0.020	0.005	0.030
75/06/30	15 17		0.005	0.500	0.010	0.010	0.030
75/07/16	15 35		0.005	0.200	0.015	0.005	0.020
75/08/10	15 20		0.005	1.250	0.010	0.015	0.070

K VALUE KNOWN TO BE LESS
THAN INDICATED

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

1606C2
43 03 43.0 112 43 15.0 4
MOKINS CREEK
16 7.5 SPRINGFIELD
T/HAYDEN LAKE 130691
CLVRT ON FS RD 3090 2.5 MI SW OF SPRGFLD
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
75/04/19	14	55	0.005	0.600	0.010	0.020	0.050
75/06/15	13	20	0.005	0.175	0.015	0.005	0.025
75/06/30	17	20	0.005	2.100	0.025	0.005	0.020
75/07/16	15	42	0.005	0.200	0.015	0.005	0.010
75/08/19	15	33	0.005	0.850	0.015	0.015	0.080

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)