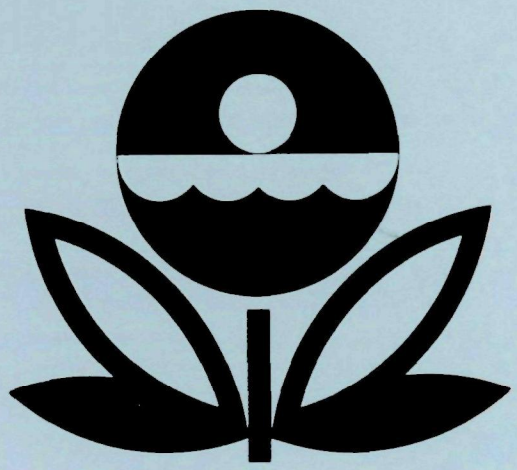
U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES



REPORT
ON
MOON LAKE
DUCHESNE COUNTY
UTAH
EPA REGION VIII
WORKING PAPER No. 847

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

REPORT
ON
MOON LAKE
DUCHESNE COUNTY
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EPA REGION VIII
WORKING PAPER No. 847

WITH THE COOPERATION OF THE
UTAH STATE DIVISION OF HEALTH
AND THE
UTAH NATIONAL GUARD
OCTOBER, 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 non-point 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 fresh water 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 EPA and to augment plans implementation by the states.

ACKNOWLEDGEMENT

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

The staffs of the Bureau of Water Quality of the Division of Health and the Division of Wildlife Resources 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.

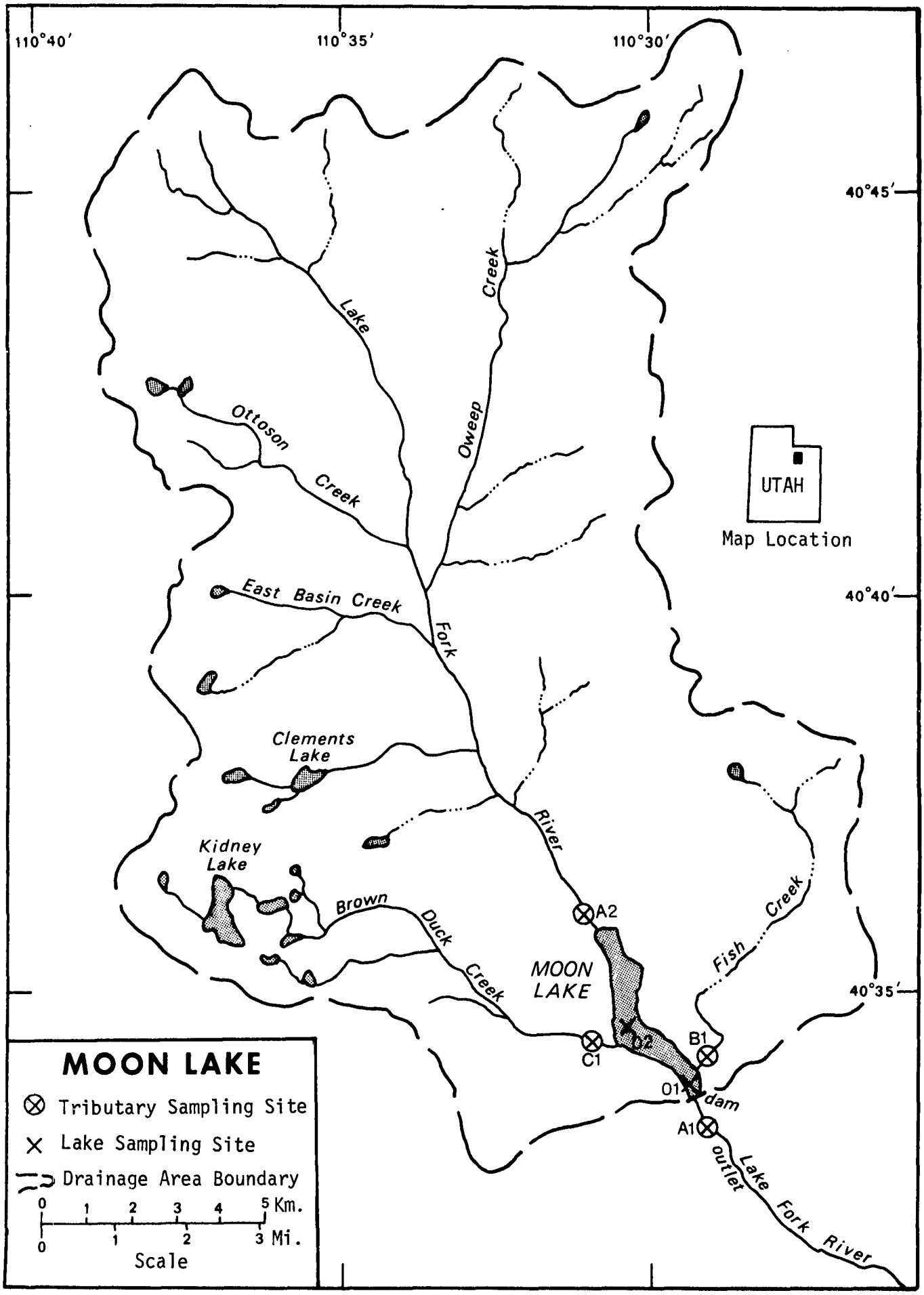
Major General Maurice L. Watts, the Adjutant General of Utah, and Project Officer Lt. Colonel T. Ray Kingston, who directed the volunteer efforts of the Utah National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES AND RESERVOIRS

STATE OF UTAH

NAME	COUNTY
Bear	Rich, UT; Bear Lake, ID
Deer Creek	Wasatch
Echo	Summit
Fish	Sevier
Flaming Gorge	Daggett, UT; Sweetwater, WY
Huntington	Emery
Joes Valley	Emery
Lower Bowns	Garfield
Lynn	Box Elder
Minersville	Beaver
Moon	Duchesne
Navajo	Kane
Newcastle	Iron
Otter Creek	Piute
Panguich	Garfield
Pelican	Uintah
Pineview	Weber
Piute	Piute
Porcupine	Cache
Powell	Garfield, Kane, San Juan, UT; Coconino, AZ
Pruess	Millard
Sevier Bridge	Juab, Sanpete
Starvation	Duchesne
Steinaker	Uintah
Tropic	Garfield
Utah	Utah
Willard Bay	Box Elder


110°40′
110°35′
110°30′
40°45′
40°40′
40°35′
Lake Creek
Oweep Creek
Ottoson Creek
East Basin Creek
Fork
Clements Lake
Kidney Lake
Brown Duck Creek
River
MOON LAKE
Fish Creek
A2
C1
O2
B1
O1
dam
A1
outlet
Lake Fork River
UTAH
Map Location
MOON LAKE
Tributary Sampling Site
Lake Sampling Site
Drainage Area Boundary
0 1 2 3 4 5 Km.
0 1 2 3 Mi.
Scale

MOON LAKE

STORET NO. 4910

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Moon Lake is oligotrophic. It ranked third in overall trophic quality when the 27 Utah lakes and reservoirs sampled in 1975 were compared using a combination of six parameters*. None of the other water bodies had less median total phosphorus or dissolved orthophosphorus, none had less but ten had the same median inorganic nitrogen, six had less mean chlorophyll a, and seven had greater mean Secchi disc transparency. No significant depression of dissolved oxygen occurred at depths as great as 40.2 meters.

B. Rate-Limiting Nutrient:

The algal assay results indicate the lake was phosphorus limited in September. The lake data indicate phosphorus limitation at all sampling stations and times.

C. Nutrient Controllability:

1. Point sources--No known point sources impacted Moon Lake during the sampling year.

2. Non-point sources--Non-point sources contributed the entire phosphorus loading to the lake during the sampling year. The Lake Fork River contributed about 76% of the total load, and Brown Duck Creek contributed about 13%.

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* See Appendix A.

The estimated phosphorus loading of 0.52 $g/m^2/yr$ is less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic loading (see page 11). Management of the lake should be directed toward prevention of any increase in the existing loading.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

A. Morphometry††:

1. Surface area: 3.12 kilometers^2.
2. Mean depth: 14.1 meters.
3. Maximum depth: 22.2 meters.
4. Volume: 44.110 x 10^6 m^3.
5. Mean hydraulic retention time: 140 days (based on outflow).

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

1. Tributaries -

Name	Drainage area (km^2)*	Mean flow (m^3/sec)*
Lake Fork River	202.0	3.280
Fish Creek	25.9	0.177
Brown Duck Creek	36.3	0.264
Minor tributaries & immediate drainage -	22.8	0.105
Totals	287.0	3.826

2. Outlet -

Lake Fork River	290.1**	3.650

C. Precipitation***:

1. Year of sampling: 18.1 centimeters.
2. Mean annual: 18.9 centimeters.

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† Table of metric conversions--Appendix B.
†† Sudweeks, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. WATER QUALITY SUMMARY

Moon Lake was sampled twice 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 a number of depths at two stations on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the last visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll *a* analysis. The maximum depths sampled were 11.6 meters at station 1 and 40.2 meters at station 2.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR MOON LAKE
STORET CODE 4910

	1ST SAMPLING (8/11/75)			2ND SAMPLING (9/23/75)			3RD SAMPLING		
	2 SITES			2 SITES			0 SITES		
PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	6.0 - 17.5	12.9	13.9	10.8 - 14.2	13.2	13.7	******	**********	
DISS OXY (MG/L)	5.4 - 8.0	7.3	7.5	7.1 - 7.6	7.3	7.2	******	**********	
CNDCTVY (MCROMO)	15. - 23.	20.	19.	4. - 6.	5.	5.	******	**********	
PH (STAND UNITS)	7.7 - 9.3	8.5	8.4	7.0 - 8.9	7.8	7.8	******	**********	
TOT ALK (MG/L)	10. - 14.	11.	10.	10. - 84.	19.	10.	******	**********	
TOT P (MG/L)	0.008 - 0.017	0.010	0.008	0.004 - 0.014	0.007	0.006	******	**********	
ORTHO P (MG/L)	0.002 - 0.003	0.002	0.002	0.002 - 0.005	0.002	0.002	******	**********	
NO2+NO3 (MG/L)	0.020 - 0.060	0.029	0.020	0.020 - 0.060	0.026	0.020	******	**********	
AMMONIA (MG/L)	0.020 - 0.020	0.020	0.020	0.020 - 0.020	0.020	0.020	******	**********	
KJEL N (MG/L)	0.300 - 0.400	0.367	0.400	0.200 - 0.200	0.200	0.200	******	**********	
INORG N (MG/L)	0.040 - 0.080	0.049	0.040	0.040 - 0.080	0.046	0.040	******	**********	
TOTAL N (MG/L)	0.320 - 0.460	0.396	0.420	0.220 - 0.260	0.226	0.220	******	**********	
CHLRPYL A (UG/L)	2.5 - 3.1	2.8	2.8	2.6 - 2.6	2.6	2.6	******	**********	
SECCHI (METERS)	3.5 - 3.8	3.7	3.7	2.4 - 2.4	2.4	2.4	******	**********	

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
08/11/75	1. Chroomonas (?) sp.	69
	2. Asterionella sp.	34
	3. Pennate diatoms	34
	Total	137
09/23/75	1. Cyclotella sp.	251
	2. Pennate diatoms	126
	3. Asterionella sp.	42
	4. Dinobryon sp.	42
	Total	461

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
08/11/75	1	2.5
	2	3.1
09/23/75	1	2.6
	2	2.6

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.005	0.110	0.2
0.050 P	0.055	0.110	7.6
0.050 P + 1.0 N	0.055	1.110	18.5
1.0 N	0.005	1.110	0.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity

of Moon Lake was low at the time the sample was collected (09/23/75). Also, the significant increase in yield with the addition of phosphorus alone indicates that the lake was limited by phosphorus at that time.

The lake data also indicate phosphorus limitation; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 23/1 or greater, and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Utah National Guard collected monthly near-surface grab samples when possible from each of the tributary sites indicated on the map (page v). Sampling was begun in November, 1974, and was completed in October, 1975.

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

In this report, nutrient loads for sampled tributaries were calculated using mean annual concentrations and mean annual flows. Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the mean concentrations in Fish Creek at station B-1 and the mean annual ZZ flow.

No known wastewater treatment plants impacted Moon Lake during the sampling year.

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 (non-point load) -		
Lake Fork River	1,240	76.1
Fish Creek	80	4.9
Brown Duck Creek	210	12.9
b. Minor tributaries & immediate drainage (non-point load) -	45	2.7
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	55	3.4
Total	1,630	100.0

2. Outputs -

Lake outlet - Lake Fork Creek 1,610

3. Net annual P accumulation - 20 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/yr	% of total
a. Tributaries (non-point load) -		
Lake Fork Creek	128,985	88.7
Fish Creek	4,240	2.9
Brown Duck Creek	6,335	4.4
b. Minor tributaries & immediate drainage (non-point load) -	2,515	1.7
c. Known municipal STP's - None	-	-
d. Septic tanks - Unknown	?	-
e. Known industrial - None	-	-
f. Direct precipitation* -	3,370	2.3
Total	145,445	100.0

2. Outputs -

Lake outlet - Lake Fork Creek 65,495

3. Net annual N accumulation - 79,950 kg.

D. Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km^2/yr	kg N/km^2/yr
Lake Fork Creek	6	639
Fish Creek	3	164
Brown Duck Creek	6	175

* See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" 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 "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m^2/yr	0.52	<0.01	46.6	25.6

Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Moon Lake:	
"Dangerous" (eutrophic loading)	1.16
"Permissible" (oligotrophic loading)	0.58

V. LITERATURE REVIEWED

Sudweeks, Calvin K., 1975. Personal communication (lake morphometry). UT Bur. of Env. Health, Salt Lake City.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

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
0406	LAKE POWELL	0.010	0.410	339.830	3.081	13.800	0.007
4901	BEAR LAKE	0.011	0.040	253.167	0.945	9.200	0.003
4902	LOWER BOWN'S RESERVOIR	0.031	0.040	336.000	5.567	9.400	0.006
4903	DEER CREEK RESERVOIR	0.038	0.215	430.333	9.078	14.800	0.006
4904	ECHO RESERVOIR	0.047	0.170	450.333	6.967	14.000	0.012
4905	LYNN RESERVOIR	0.121	0.200	417.667	39.600	10.400	0.052
4906	FISH LAKE	0.023	0.040	152.000	12.483	10.400	0.004
4907	HUNTINGTON NORTH RESERVO	0.013	0.040	392.000	1.900	7.800	0.005
4908	JOE'S VALLEY RESERVOIR	0.012	0.045	400.000	2.483	11.200	0.003
4909	MINERSVILLE RESERVOIR	0.192	0.060	445.000	33.583	8.600	0.107
4910	MOON LAKE	0.008	0.040	381.000	2.700	9.600	0.002
4911	NAVAJO LAKE	0.016	0.040	368.000	2.000	6.000	0.003
4912	NEWCASTLE RESERVOIR	0.051	0.040	428.667	12.467	13.600	0.009
4913	OTTER CREEK RESERVOIR	0.067	0.040	453.667	11.767	10.600	0.033
4914	PANGUITCH LAKE	0.071	0.040	426.500	45.950	14.200	0.010
4915	PELICAN LAKE	0.044	0.050	438.500	6.350	8.400	0.004
4916	PINEVIEW RESERVOIR	0.028	0.300	435.083	5.692	14.600	0.006
4917	PIUTE RESERVOIR	0.047	0.150	482.625	25.329	11.600	0.007
4918	PORCUPINE RESERVOIR	0.025	0.110	440.000	7.860	12.400	0.011
4919	PRUESS RESERVOIR (GARRIS	0.057	0.140	491.000	4.533	8.800	0.008
4920	SEVIER BRIDGE RESERVOIR	0.026	0.355	449.778	18.222	12.400	0.008
4921	STARVATION RESERVOIR	0.016	0.040	394.583	5.675	13.200	0.004
4922	STEINAKER RESERVOIR	0.011	0.040	316.750	1.844	12.600	0.005
4923	TROPIC RESERVOIR	0.021	0.050	425.000	7.200	8.400	0.006
4924	UTAH LAKE	0.132	0.320	490.583	72.012	11.400	0.012
4925	WILLARD BAY RESERVOIR	0.044	0.060	457.182	7.567	11.000	0.009
5605	FLAMING GORGE RESERVOIR	0.011	0.690	285.636	2.500	10.400	0.003

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	INDEX NO
0408	LAKE POWELL	96 (25)	4 (1)	81 (21)	73 (19)	15 (4)	42 (11)	311
4901	BEAR LAKE	90 (23)	87 (19)	96 (25)	100 (26)	77 (20)	90 (23)	540
4902	LOWER BOWN'S RESERVOIR	46 (12)	87 (19)	85 (22)	65 (17)	73 (19)	50 (13)	406
4903	DEER CREEK RESERVOIR	42 (11)	19 (5)	42 (11)	35 (9)	0 (0)	58 (14)	196
4904	ECHO RESERVOIR	31 (8)	27 (7)	19 (5)	50 (13)	12 (3)	13 (3)	152
4905	LYNN RESERVOIR	8 (2)	23 (6)	58 (15)	8 (2)	62 (15)	4 (1)	163
4906	FISH LAKE	62 (16)	65 (16)	100 (26)	23 (6)	62 (15)	79 (20)	391
4907	HUNTINGTON NORTH RESERVO	77 (20)	65 (16)	69 (18)	92 (24)	96 (25)	69 (18)	468
4908	JOE'S VALLEY RESERVOIR	81 (21)	58 (15)	62 (16)	85 (22)	46 (12)	96 (25)	428
4909	MINERSVILLE RESERVOIR	0 (0)	44 (11)	27 (7)	12 (3)	85 (22)	0 (0)	168
4910	MOON LAKE	100 (26)	87 (19)	73 (19)	77 (20)	69 (18)	100 (26)	506
4911	NAVAJO LAKE	69 (18)	87 (19)	77 (20)	88 (23)	100 (26)	85 (22)	506
4912	NEWCASTLE RESERVOIR	23 (6)	87 (19)	46 (12)	27 (7)	19 (5)	27 (7)	229
4913	OTTER CREEK RESERVOIR	15 (4)	87 (19)	15 (4)	31 (8)	54 (14)	8 (2)	210
4914	PANGUITCH LAKE	12 (3)	65 (16)	50 (13)	4 (1)	8 (2)	23 (6)	162
4915	PELICAN LAKE	37 (9)	54 (14)	35 (9)	54 (14)	90 (23)	73 (19)	343
4916	PINEVIEW RESERVOIR	50 (13)	15 (4)	38 (10)	58 (15)	4 (1)	58 (14)	223
4917	PIUTE RESERVOIR	27 (7)	31 (8)	8 (2)	15 (4)	38 (10)	46 (12)	165
4918	PORCUPINE RESERVOIR	58 (15)	38 (10)	31 (8)	38 (10)	33 (8)	19 (5)	217
4919	PRUESS RESERVOIR (GARRIS	19 (5)	35 (9)	0 (0)	69 (18)	81 (21)	37 (9)	241
4920	SEVIER BRIDGE RESERVOIR	54 (14)	8 (2)	23 (6)	19 (5)	33 (8)	37 (9)	174
4921	STARVATION RESERVOIR	73 (19)	87 (19)	65 (17)	62 (16)	23 (6)	79 (20)	389
4922	STEINAKER RESERVOIR	85 (22)	87 (19)	88 (23)	96 (25)	27 (7)	65 (17)	448
4923	TROPIC RESERVOIR	65 (17)	50 (13)	54 (14)	46 (12)	90 (23)	58 (14)	363
4924	UTAH LAKE	4 (1)	12 (3)	4 (1)	0 (0)	42 (11)	13 (3)	75
4925	WILLARD BAY RESERVOIR	37 (9)	44 (11)	12 (3)	42 (11)	50 (13)	31 (8)	216
5605	FLAMING GORGE RESERVOIR	90 (23)	0 (0)	92 (24)	81 (21)	62 (15)	90 (23)	415

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4901	BEAR LAKE	540
2	4911	NAVAJO LAKE	506
3	4910	MOON LAKE	506
4	4907	HUNTINGTON NORTH RESERVO	468
5	4922	STEINAKER RESERVOIR	448
6	4908	JOE'S VALLEY RESERVOIR	428
7	5605	FLAMING GORGE RESERVOIR	415
8	4902	LOWER BOWN'S RESERVOIR	406
9	4906	FISH LAKE	391
10	4921	STARVATION RESERVOIR	389
11	4923	TROPIC RESERVOIR	363
12	4915	PELICAN LAKE	343
13	0408	LAKE POWELL	311
14	4919	PRUESS RESERVOIR (GARRIS	241
15	4912	NEWCASTLE RESERVOIR	229
16	4916	PINEVIEW RESERVOIR	223
17	4918	PORCUPINE RESERVOIR	217
18	4925	WILLARD BAY RESERVOIR	216
19	4913	OTTER CREEK RESERVOIR	210
20	4903	DEER CREEK RESERVOIR	196
21	4920	SEVIER BRIDGE RESERVOIR	174
22	4909	MINERSVILLE RESERVOIR	168
23	4917	PIUTE RESERVOIR	165
24	4905	LYNN RESERVOIR	163
25	4914	PANQUITCH LAKE	162
26	4904	ECHO RESERVOIR	152
27	4924	UTAH LAKE	75

APPENDIX B

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 C

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR UTAH 10/18/76

LAKE CODE 4910 MOON LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 290.1

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4910A1	290.1	0.0	0.028	0.085	1.642	8.212	9.911	10.194	7.362	4.248	1.557	0.255	0.0	3.650
4910A2	202.0	0.76	0.68	0.68	1.30	7.65	14.44	5.95	2.78	1.84	1.30	1.05	0.88	3.28
4910B1	25.9	0.042	0.042	0.042	0.071	0.396	0.793	0.311	0.156	0.099	0.071	0.057	0.042	0.177
4910C1	36.3	0.057	0.057	0.057	0.142	0.595	0.680	0.566	0.595	0.170	0.113	0.057	0.057	0.264
4910ZZ	25.9	0.023	0.023	0.023	0.042	0.227	0.481	0.198	0.085	0.057	0.042	0.034	0.028	0.105

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 290.1
SUM OF SUB-DRAINAGE AREAS = 290.1
TOTAL FLOW IN = 45.83
TOTAL FLOW OUT = 43.49

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4910A1	11	74	0.0	15	0.0				
	12	74	0.0	16	0.0				
	1	75	0.0	13	0.0	16	0.0		
	2	75	0.0	11	0.0				
	3	75	0.0	19	0.0				
	4	75	0.025						
	5	75	8.155	15	8.580				
	6	75	6.145	10	5.918				
	7	75	15.716	31	7.730				
	8	75	8.438	13	9.883				
	9	75	7.192	30	5.239				
	10	75	2.209	2	4.870				
4910A2	11	74	0.892	14	0.821				
	12	74	0.767	16	0.765				
	1	75	0.708						
	2	75	0.665	11	0.680				
	3	75	0.637	19	0.623				
	4	75	0.623	24	0.708				
	5	75	2.223	28	3.030				
	6	75	16.792	11	12.912				
	7	75	16.395	31	7.674				
	8	75	3.625	13	4.191				
	9	75	1.495	2	1.699				
	10	75	1.181	2	1.189				

TRIBUTARY FLOW INFORMATION FOR UTAH 10/18/76

LAKE CODE 4910 MOON LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
491081	11	74	0.042	13	0.042				
	12	74	0.042	16	0.042				
	1	75	0.042						
	2	75	0.042						
	3	75	0.042						
	4	75	0.028	24	0.028				
	5	75	0.311	28	0.425				
	6	75	1.982	11	1.699				
	7	75	1.416	31	0.340				
	8	75	0.198						
	9	75	0.085	2	0.113				
	10	75	0.071	2	0.085				
4910C1	11	74	0.142	14	0.142				
	12	74	0.085	16	0.085				
	1	75	0.085						
	2	75	0.085						
	3	75	0.085						
	4	75	0.085						
	5	75	0.311	28	0.425				
	6	75	1.926	11	1.529				
	7	75	1.699	31	0.538				
	8	75	0.396	13	0.481				
	9	75	0.142	30	0.113				
	10	75	0.113						
4910ZZ	11	74	0.020						
	12	74	0.017						
	1	75	0.017						
	2	75	0.014						
	3	75	0.014						
	4	75	0.014						
	5	75	0.051						
	6	75	0.396						
	7	75	0.368						
	8	75	0.085						
	9	75	0.034						
	10	75	0.028						

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/08/12

491001
40 33 14.0 110 29 24.0 3
MOON LAKE
49013 UTAH

11EPALES 2111202
0042 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
75/08/11	14 20	0000	17.0	7.6	138	22	9.35	14	0.020K	0.300	0.020	0.003
	14 20	0005	16.3	8.0		21	9.00	11	0.020K	0.300	0.020K	0.002
	14 20	0016	16.1	5.4		19	9.20	10	0.020K	0.400	0.020K	0.002
	14 20	0030	12.2	7.6		19	8.70	10K	0.020K	0.300	0.020K	0.003
	14 20	0038	8.9	6.4		15	8.40	10	0.020K	0.400	0.040	0.003
75/09/23	14 20	0000	14.1	7.2	94	4	8.90	10K	0.020K	0.200K	0.020K	0.002K
	14 20	0005	13.8	7.2		5	8.60	14	0.020K	0.200	0.020K	0.002K
	14 20	0015	13.6	7.4		4	8.25	16	0.020K	0.200K	0.020K	0.002
	14 20	0038	13.2	7.2		5	8.00	17	0.020K	0.200K	0.020K	0.002K

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/08/11	14 20	0000	0.008	2.5	
	14 20	0005	0.008		
	14 20	0016	0.008		
	14 20	0030	0.009		
	14 20	0038	0.010		
75/09/23	14 20	0000	0.005	2.6	
	14 20	0005	0.008		
	14 20	0015	0.007		
	14 20	0038	0.007		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

491002
40 34 28.0 110 30 17.0 3
MOON LAKE
49013 UTAH

11EPALES 2111202
0135 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
75/08/11	14 50	0000	17.5	7.4	150	21	8.50	10	0.020K	0.300	0.020K	0.002
	14 50	0005	17.0	7.3		23	8.40	11	0.020K	0.400	0.020K	0.003
	14 50	0016	15.7	7.2		23	8.40	10K	0.020K	0.400	0.020K	0.003
	14 50	0030	12.2	7.6		19	8.20	10K	0.020K	0.400	0.020	0.002
	14 50	0050	8.2	7.6		19	7.90	10K	0.020K	0.400	0.040	0.003
	14 50	0085	7.4	7.8		19	7.80	10K	0.020K	0.400	0.050	0.002K
	14 50	0132	6.0	7.4		19	7.70	10K	0.020K	0.400	0.060	0.002K
75/09/23	13 50	0000	14.0	7.6	94	6	7.90	84	0.020K	0.200	0.020	0.005
	13 50	0005	14.2	7.4		5	7.70	10K	0.020K	0.200K	0.020K	0.002K
	13 50	0015	14.1	7.6		4	7.60	10K	0.020K	0.200K	0.020K	0.002K
	13 50	0030	13.4	7.2		4	7.40	10K	0.020K	0.200K	0.020K	0.002K
	13 50	0050	11.2	7.2		4	7.10	10K	0.020K	0.200K	0.040	0.002K
	13 50	0089	10.8	7.1		5	7.00	10K	0.020K	0.200K	0.060	0.002K

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
75/08/11	14 50	0000	0.008	3.1	
	14 50	0005	0.008		
	14 50	0016	0.008		
	14 50	0030	0.009		
	14 50	0050	0.014		
	14 50	0085	0.015		
	14 50	0132	0.017		
75/09/23	13 50	0000	0.014	2.6	
	13 50	0005	0.006		
	13 50	0015	0.004		
	13 50	0030	0.005		
	13 50	0050	0.006		
	13 50	0089	0.008		

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY AND WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 76/08/12

4910A1
40 33 23.0 110 29 02.0 4
LAKE FORK RIVER
49 7.5 LK FORK MTN
O/MOON LAKE
GAGE STATN .2 MI SE MOON LK LOWER SPLWAY
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
75/05/15	15	45	0.110	0.100	0.015	0.005K	0.010
75/06/10	16	00	0.085	1.400	0.025	0.005	0.020
75/07/31	12	30	0.045	0.250	0.025	0.010	0.010
75/08/13	17	00	0.040	0.500	0.025	0.005	0.010K
75/09/30	11	00	0.017	0.300	0.017	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

4910A2
40 36 24.0 110 31 35.0 4
LAKE FORK RIVER
49 7.5 KIDNEY LAKE
T/MOON LAKE 110691
GAGE STATN 2.7 MI NW OF MOON LK CMPGRND
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
74/11/14	12	15	0.150	3.600	0.115	0.005K	0.010K
75/05/28	13	30	0.045	0.600	0.035	0.005K	0.010K
75/06/11	16	00	0.045	2.000	0.540	0.005K	0.010
75/07/31	12	00	0.020	0.100	0.010	0.005K	0.010K
75/09/02	14	15	0.050	0.200	0.085	0.005	0.010
75/10/02	11	30	0.070	0.600	0.015	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

491081
40 34 15.0 110 29 13.0 4
FISH CREEK
49 7.5 LAKE FORK
T/MOON LAKE
BNK .7 MI N OF LOWER SPILLWAY
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
74/11/13	10	10	0.168	0.300	0.040	0.005K	0.010K
74/12/16	15	10	0.176	0.150	0.015	0.005K	0.010K
75/05/28	16	20	0.075	0.450	0.020	0.005K	0.010K
75/06/11	16	00	0.030	1.600	0.030	0.005K	0.030
75/07/31	10	10	0.030	0.150	0.005	0.005K	0.010K
75/09/02	16	30	0.090	1.900	0.070	0.005K	0.010K
75/10/02	15	00	0.100	0.100K	0.005	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/08/12

4910C1
40 34 00.0 110 31 00.0 4
BROWN DUCK CREEK
49 7.5 KIDNEY LAKE
T/MOON LAKE 110691
GAGE STATN 2.8 MI NW OF MOON LK CMPGRND
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
74/11/14	15	30	0.120	1.800	0.035	0.005	0.010K
74/12/16	14	15	0.160	0.200	0.020	0.005K	0.010K
75/05/28	14	45	0.070	0.800	0.030	0.005K	0.010K
75/06/11	17	20	0.055	1.200	0.035	0.005K	0.080
75/07/31	13	20	0.015	0.150	0.010	0.005K	0.010
75/08/13	17	30	0.030	0.400	0.010	0.005	0.010
75/09/30	09	30	0.075	0.250	0.015	0.005K	0.042

K VALUE KNOWN TO BE
LESS THAN INDICATED