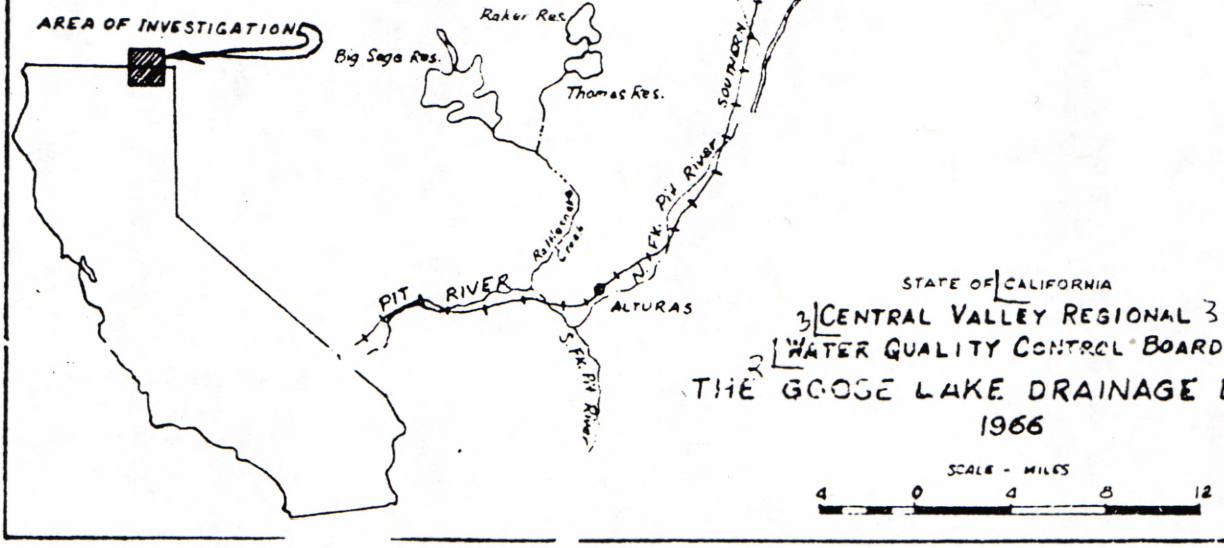
GOOSE LAKE WATER QUALITY CONTROL POLICY

[Report GL 1966p

BASIC DATA REPORT

-PRELIMINARY EDITION-

JULY 1966



STATE OF CALIFORNIA
CENTRAL VALLEY REGIONAL
WATER QUALITY CONTROL BOARD

THE GOOSE LAKE DRAINAGE BASIN
1966

SCALE - MILES
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STATE OF CALIFORNIA

THE RESOURCES AGENCY

REGIONAL WATER QUALITY CONTROL BOARD

CENTRAL VALLEY REGION

3

GOOSE LAKE

WATER QUALITY CONTROL POLICY

BASIC DATA REPORT

- PRELIMINARY EDITION -

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WATER RESOURCES

THE VOLUME OF WATER IN GOOSE LAKE AND ITS AREAL EXTENT IS AFFECTED BY THE DEVELOPMENT OF LAND RESOURCES IN THE BASIN WHICH, IN TURN, IS DEPENDENT UPON THE WATER RESOURCES OF THE BASIN. FOR THIS REASON IT IS NECESSARY TO DETERMINE THE NATURE, QUANTITY, QUALITY AND PATTERN OF DISTRIBUTION OF THE WATER RESOURCES OF GOOSE LAKE BASIN IN ADDITION TO PRESENTING HISTORIC AND EXISTING LAKE CONDITIONS.

CHARACTERISTICS OF GOOSE LAKE

THE WATER SURFACE OF GOOSE LAKE FLUCTUATES OVER A WIDE RANGE. DURING 1965 THE LAKE LEVEL ROSE ALMOST 4 FEET AND THE MAXIMUM ANNUAL LEVEL REACHED WAS 2 FEET ABOVE THAT FOR 1964(1). OCCASIONALLY THE LAKE OVERFLOWS INTO RUSSELL SLOUGH, A TRIBUTARY OF THE NORTH FORK OF THE PIT RIVER, AND AT TIMES, THE LAKE HAS BEEN DRY. TABLE 5, FOLLOWING, SHOWS DATA ON VARIATIONS IN BASIN CONDITIONS AND LAKE LEVEL FOR THE PERIOD 1800 TO THE PRESENT TIME. DATA FOR THE PERIOD 1800 TO 1937 IS BASED ON MATERIAL ABSTRACTED BY THE U. S. GEOLOGICAL SURVEY(2) FROM A REPORT BY ANTEVS(3). DATA FOR THE PERIOD 1937 TO 1958 AND FROM 1960 TO 1965 IS FROM INFORMATION SUPPLIED BY THE U. S. GEOLOGICAL SURVEY(2). DATA FOR THE PERIOD 1959-60

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(1) ANON., "PACIFIC NORTHWEST WATER RESOURCES SUMMARY." ANNUAL SUMMARY-WATER YEAR 1965, U.S. DEPT. OF INTERIOR, GEOLOGICAL SURVEY (OCTOBER 18, 1965).

(2) ANDERSON, R.B., "GOOSE LAKE, OREGON-CALIFORNIA, DESCRIPTION." COMMUNICATION FROM DIST. ENGR. U. S. DEPT. OF INTERIOR, GEOLOGICAL SURVEY, PORTLAND, OREGON TO CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD (FEBRUARY 28, 1966).

(3) ANTEVS, E., "RAINFALL AND TREE GROWTH IN THE GREAT BASIN." AMERICAN GEOG. SOC. SPEC. PUBLICATION NO. 21 (1938).

TABLE 5

GOOSE LAKE BASIN CONDITIONS AND GOOSE LAKE WATER SURFACE ELEVATIONS
(1801-1966)

BASIN CONDITIONS (1801-1937)

DATE	CONDITION
1801-28	WET PERIOD
1829	SEVERE DROUGHT
1830-35	LAKE LOW
1836-38	FAIR MAXIMUM
1839-44	GENERAL DECREASE SEVERE DROUGHT
1845	RAINY
1846	LAKE LARGE
1848	LAKE LOW
8-27-49	SURFACE 20 x ≈9 MI.
1849-50	DEEP SNOW
1850	EXCEP. LOW ≈50 MI.^{2}
1851	SUMMER DRY
1852	SUMMER DRY
1855-58	DECREASED PRECIP.
1859-62	INCREASED PRECIP.
1860's	LAKE EXPANDING
1869	LAKE OVERFLOWED
1871-76	HEAVY SNOW
1872-SPRING	EXTENDED TO LAKEVIEW
1877	LAKE HIGH
1877-79	DRY IN LAKE COUNTY
1879-81	FLOODS
1881	LAKE OVERFLOWED 2 HOURS
1887	WATER SURFACE FEW FEET BELOW OUTLET
1885-89	DRY YEARS
1890-97	PRECIP. ABOVE NORMAL
1890-98	LAKE PROBABLY OVER-FLOWED
1898-1903	DRY YEARS
1903-04	WET
8-20-04	WATER SURFACE 1 FOOT BELOW OUTLET
1910	HIGH RUN-OFF
1911	DREW RESERVOIR
1914 FALL	WATER SURFACE 3 FEET BELOW OUTLET
1920-23	WET YEARS
1921	COTTONWOOD RESERVOIR
1924	DRY YEAR PRECIP. 45% OF NORMAL
1924-25	HEAVY SNOW
1926	LAKE DRY IN JULY OR AUGUST
1927-28	PLENTY OF WATER
1929-34	LAKE DRY EACH SUMMER
1935-37	LAKE LEVEL RISING
1937	LAKE ≈2/3 FULL

IS FROM CALIFORNIA DEPARTMENT OF WATER RESOURCES RECORDS[1].

FIGURE 3 ILLUSTRATES THE HISTORIC WATER SURFACE ELEVATIONS OF GOOSE LAKE. ELEVATIONS FROM 1945 TO PRESENT ARE BASED ON TABLE 5. WATER SURFACE ELEVATIONS PRIOR TO 1945 ARE FROM PROFESSOR HARDINGS EVALUATION OF GOOSE LAKE[2].

AS SHOWN BY FIGURE 3, GOOSE LAKE WAS ESSENTIALLY DRY DURING THE SUMMERS OF 1926 AND 1929 THROUGH 1934. PROFESSOR HARDING REPORTED[2] THAT AMERICAN INDIAN LEGEND RELATES GOOSE LAKE HAD BEEN DRY FIVE TIMES PRIOR TO THE ARRIVAL OF WHITE MEN TO THE AREA (1832). IT SHOULD BE NOTED THAT INDIANS PROBABLY OCCUPIED THE AREA FOR AT LEAST 3,000 YEARS. SIMILAR INFORMATION ON LAKE OVERFLOW OCCURRENCES HAS NOT BEEN DERIVED FROM INDIAN TRADITION. LONG TIME RESIDENTS OF THE AREA REPORT THAT DURING THE DRY PERIOD, 1926-34, THE LAKE BOTTOM CONTAINED NUMEROUS MARSH AREAS THAT WERE SUPPLIED WITH WATER FROM THOUSANDS OF FRESH WATER SPRINGS. KEEN REPORTED[3] THAT THE RETARDED TREE GROWTH IN GOOSE LAKE BASIN SHOWS THAT THE PERIOD FROM 1918 TO 1930 WAS THE DRIEST IN 650 YEARS. THIS OBSERVATION AND INDIAN HISTORY INDICATE THAT LAKE DRYNESS HAS BEEN A RARE EVENT IN THE PAST.

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(1) ANON. "NORTHEASTERN COUNTIES GROUND WATER INVESTIGATION." BULLETIN 98, CALIFORNIA RESOURCES AGENCY, DEPT. OF WATER RESOURCES, UNPUBLISHED BASIC DATA, (FEBRUARY, 1963).

(2) HARDING, S. T., "RECENT VARIATIONS IN THE WATER SUPPLY OF THE WESTERN GREAT BASIN." ARCHIVES SERIES REPORT NO. 16, UNIV. OF CALIFORNIA AT BERKELEY, WATER RESOURCES CENTER ARCHIVES (JUNE, 1965).

(3) KEEN, F.P., "CLIMATIC CYCLES IN EASTERN OREGON INDICATED BY TREE RINGS." MONTHLY WEATHER REVIEW, VOL. 65, NO. 5, PAGES 183-188 (1937).

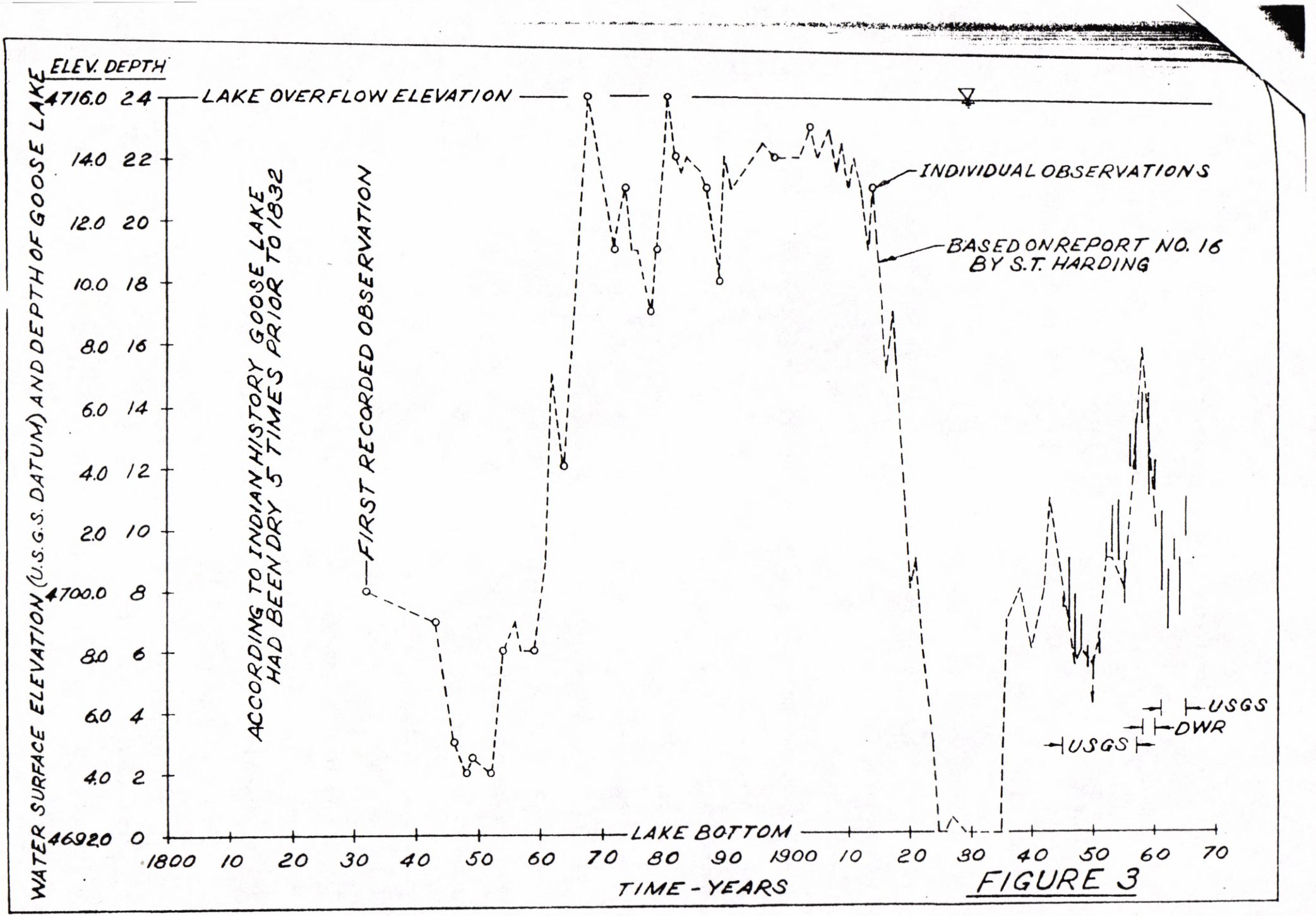
ELEV. DEPTH
4716.0 24
14.0 22
12.0 20
10.0 18
8.0 16
6.0 14
4.0 12
2.0 10
4700.0 8
8.0 6
6.0 4
4.0 2
4692.0 0
WATER SURFACE ELEVATION (U.S.G.S. DATUM) AND DEPTH OF GOOSE LAKE
LAKE OVERFLOW ELEVATION
ACCORDING TO INDIAN HISTORY GOOSE LAKE HAD BEEN DRY 5 TIMES PRIOR TO 1832
FIRST RECORDED OBSERVATION
INDIVIDUAL OBSERVATIONS
BASED ON REPORT NO. 16 BY S.T. HARDING
USGS
DWR
USGS
LAKE BOTTOM
1800 10 20 30 40 50 60 70 80 90 1900 10 20 30 40 50 60 70
TIME - YEARS

FIGURE 3

FIGURE 3 ALSO SHOWS THAT GOOSE LAKE OVERFLOWED IN 1868 AND 1881, A TIME DIFFERENCE OF 13 YEARS. THEREFORE IT APPEARS THAT LAKE OVERFLOW MAY HAVE BEEN QUITE COMMON UNDER NATURAL BASIN CONDITIONS, I.E., BEFORE DEVELOPMENT AND USE OF BASIN LAND AND WATER RESOURCES. WITH PRESENT CONDITIONS OF DEVELOPMENT IN THE BASIN OVERFLOW EVENTS PROBABLY WILL BECOME MORE RARE, PERHAPS ONCE EACH 200 OR 300 YEARS, IF AT ALL.

IN 1960, THE CALIFORNIA DEPARTMENT OF WATER RESOURCES MADE A BOTTOM SURVEY OF GOOSE LAKE. SUBSEQUENTLY A LAKE BOTTOM CONTOUR MAP WAS PREPARED. THE BOTTOM CONTOUR MAP, SHOWN HEREIN AS FIGURE 4, IS SUBSTANTIALLY THE SAME AS ONE PREPARED BY LIPPINCOTT[1] IN 1905, INDICATING THAT VERY LITTLE CHANGE IN THE LAKE BED HAS TAKEN PLACE OVER THE YEARS. THE AREA-CAPACITY DATA DERIVED FROM THE LAKE BOTTOM CONTOUR MAP IS SHOWN IN TABLE 6. FIGURE 5 ILLUSTRATES THE DATA IN GRAPHICAL FORM.

PRECIPITATION

PRECIPITATION ON THE GOOSE LAKE DRAINAGE AREA IS EXTREMELY VARIABLE BECAUSE OF DIFFERENCES IN TOPOGRAPHY AND ELEVATION. THE YEARLY AMOUNT OF PRECIPITATION RANGES FROM 12 INCHES ON THE LAKE AND ADJACENT VALLEY LANDS TO MORE THAN 32 INCHES IN THE WARNER MOUNTAINS EAST OF GOOSE LAKE. THE REGION NORMALLY RECEIVES THE MAJOR PORTION OF ITS PRECIPITATION AS SNOW DURING THE WINTER MONTHS OF NOVEMBER THROUGH MARCH.

THE MEAN SEASONAL PRECIPITATION ON VALLEY AND MESA LANDS OF GOOSE

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(1) LIPPINCOTT, J. B., "REPORT ON HYDROGRAPHIC INVESTIGATIONS IN THE SACRAMENTO BASIN, CALIFORNIA." (1905)

The precipitation record for Lakeview is shown in Table 8 and Figure 7. The estimated precipitation on the lake would be slightly less (15 per cent) than the amount shown for Lakeview as indicated by the isohyets in Figure 6.

Table 9, shows the average monthly distribution of precipitation at Lakeview based on the period of record 1883-84 to 1959-60 and the estimated average monthly quantity of precipitation on Goose Lake based on the Lakeview record. Figure 8 illustrates the yearly pattern of precipitation on Goose Lake as given by Table 9. The figure shows that the smallest amount of precipitation occurs during the three month summer period, June through August, a little more than a tenth of the yearly precipitation.

Surface Water Inflow

Two-thirds of Goose Lake Basin is in the State of Oregon, therefore the major portion of surface water inflow to Goose Lake naturally comes from the tributary streams in Oregon.

The principal streams in Oregon tributary to Goose Lake are, proceeding clockwise from state line west to state line east, Dry, Mill, Drews, Antelope, Cottonwood, Thomas, Crane, Cogswell, Tandy and Kelley Creeks, respectively. The perennial streams in California tributary to Goose Lake drain the Warner Mountain Range and are minor compared with Oregon tributaries. These streams, from north to south, are New Pine, Cottonwood, Willow, Lassen and Davis Creeks. California streams entering Goose Lake from the west side are ephemeral and so minor that only two are named; Corral and Long Branch Creeks.

THE AVERAGE ANNUAL NATURAL FLOW INTO GOOSE LAKE FROM ITS TRIBUTARY STREAMS HAS BEEN REPORTED TO BE 60,000 ACRE-FEET[1], 208,000 ACRE-FEET[2] AND 217,600 ACRE-FEET[3]. THE AVERAGE ANNUAL NATURAL FLOW INTO GOOSE LAKE FROM CALIFORNIA TRIBUTARIES ONLY HAS BEEN REPORTED TO BE 30,000 ACRE-FEET[1], 50,000 ACRE-FEET[2] AND 68,000 ACRE-FEET[4].

THE 208,000 ACRE-FEET ESTIMATE FOR AVERAGE SEASONAL NATURAL RUN-OFF OF TRIBUTARIES INTO GOOSE LAKE IS BASED ON THE 34-YEAR PERIOD 1920-21 THROUGH 1953-54. FOR THIS SAME 34-YEAR PERIOD, MAXIMUM AND MINIMUM SEASONAL UNIMPAIRED RUN-OFF QUANTITIES ARE REPORTED[2] TO BE 490,000 AND 60,000 ACRE-FEET, RESPECTIVELY, OR ALMOST AN ORDER OF MAGNITUDE DIFFERENCE. THE AVERAGE SEASONAL NATURAL GOOSE LAKE INFLOW DURING CALIFORNIA'S CRITICAL 6-YEAR DRY PERIOD, 1928 THROUGH 1934, IS ESTIMATED TO BE 110,000 ACRE-FEET, OR ABOUT HALF THE AMOUNT ESTIMATED FOR THE 34-YEAR PERIOD.

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(1) WARING, G.A., "GEOLOGY AND WATER RESOURCES OF A PORTION OF SOUTH-CENTRAL OREGON." WATER SUPPLY PAPER 220, U. S. DEPARTMENT OF INTERIOR, GEOLOGICAL SURVEY (1908).

(2) ANON, "NORTHEASTERN COUNTIES INVESTIGATION." BULLETIN NO. 58, CALIFORNIA DEPARTMENT OF WATER RESOURCES, DIVISION OF RESOURCES PLANNING (JUNE, 1960).

(3) JACOBS, J., CONSULTING ENGINEER, "CENTRAL OREGON INVESTIGATIONS-IRRIGATION POSSIBILITIES, LAKEVIEW DISTRICT." (MARCH, 1909).

(4) ANON, "THE CALIFORNIA WATER PLAN." BULLETIN NO. 3, CALIFORNIA DEPARTMENT OF WATER RESOURCES, DIV. OF RESOURCES PLANNING (MAY, 1957).

THE AVERAGE ANNUAL RUN-OFF QUANTITIES OF INDIVIDUAL STREAMS IN GOOSE LAKE BASIN ARE PRESENTED HEREIN.

TABLE 10 LISTS STREAM GAGING STATION LOCATIONS, PERIODS OF RECORD, DRAINAGE BASIN AREAS, AND ESTIMATED 35-YEAR AVERAGE (1919-20 TO 1953-54) NATURAL FLOWS FOR STREAMS IN THE CALIFORNIA PORTION OF GOOSE LAKE BASIN.

TABLE 10

STREAM GAGING STATIONS - CALIFORNIA

Gaging Station Location	Period of Record	Area sq. mi.	Natural Flow Ac/ft/yr
Davis Creek at Old Fish Wheel	Apr.-Sep., 1928-Present	17.8	6,700
New Pine Creek* below Schroeder	Apr.-Sep., 1932-Present	12.6	8,500
Cottonwood Creek below Larkin Garden Ditch	Apr.-Sep., 1941-Present	6.6	4,200
Willow Creek near Willow Ranch	June, 1961-Present	----	-----
Lassen Creek near Willow Ranch	June, 1961-Present	----	-----
North Fork Davis Creek near Davis Creek**	June, 1961-Present	----	-----

*Also called Pine Creek
**Tributary to Davis Creek

HIGH FLOWS FOR THE STREAMS LISTED GENERALLY OCCUR DURING THE MONTHS OF MARCH, APRIL, MAY AND JUNE. FLOWS DURING THE REMAINDER OF THE YEAR ARE USUALLY LOW ALTHOUGH THE EAST SIDE STREAMS ARE PERENNIAL.

West side streams in California tributary to Goose Lake are ephemeral and unmeasured. An area run-off factor was developed[1] from an operation study of Big Sage Reservoir, a correlation and extension with the Pit River at Big Bend and an estimated evaporation rate from the reservoir. The 35-year natural inflow to the lake from the west side, California streams is estimated to be 17,100 acre-feet per year based on the foregoing information.

The 35-year average natural run-off from other ungaged areas in California, including Willow and Lassen Creeks, is estimated to be 15,800 acre-feet per year.

Table 11 shows stream gaging locations, periods of record, drainage basin areas and estimated 35-year average (1919-20 to 1953-54) natural flows for stream in the Oregon Portion of Goose Lake Basin.

The 35-year average natural inflow to Goose Lake from the ungaged areas in Oregon is estimated to be 14,100 acre-feet per year. The 44-year average natural streamflow from the gaged streams in Oregon has been computed to be slightly higher, about 3 per cent or 4,200 acre-feet per year, than the 35-year average. Therefore the error introduced by using the 35-year average, which is in the range of stream flow measuring techniques, appears to be negligible.

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(1) Hoffmaster, B. H., "Water Supply-Goose Lake Basin." Unpublished Data of the Northeastern Counties Investigation, California Department of Water Resources, Division of Resources Planning (September 16, 1955).

TABLE 11

STREAM GAGING STATIONS - OREGON

Gaging Station Location	Period of Record Used	Area sq. mi.	Natural Flow ac/ft/year	*
Dry Creek at Lakeview	Nov 1945-Sep 1950	25	8,100	(8,400)
Drews Creek at Lakeview	Jan 1909-Sep 1921 Oct 1925-Sep 1954	211	68,800	(69,400)
Cottonwood Creek at Lakeview	Nov 1908-Sep 1919 Oct 1925-Sep 1954	30	17,500	(19,100)
Thomas Creek at Lakeview	Jan 1912-Dec 1917 Mar 1919-Aug 1919 Apr 1927-Dec 1929 Oct 1945-Sep 1953	28	9,300	(9,900)
Cox Creek at Lakeview	Oct 1945-Sep 1951	36	9,200	(9,500)
Bauers Creek at Lakeview	Oct 1945-Sep 1951	63	15,800	(16,400)
Crane Creek at Lakeview	Jul 1924-Sep 1931	12	4,800	(4,900)
Kelley Creek at Lakeview	Jul 1929-Sep 1931	8	3,700	(3,800)
Antelope Creek at Lakeview	Mar 1927-Sep 1927 Apr 1929-Jun 1929	6	--	
Muddy Creek at Lakeview	Mar 1927-Aug 1927 Apr 1929-Jun 1929	13	--	
Dog Creek at Lakeview	Mar 1912-Sep 1913	--	--	

*Estimated 44-year average natural flow.

The 35-year average natural inflow to Goose Lake from California and Oregon is estimated to be 52,300 and 151,300 acre-feet per year, respectively. Therefore the estimated total seasonal natural run-off into Goose Lake is 203,600 acre-feet.

Table 12 shows a summary of the estimated yearly natural inflow to Goose Lake for the period 1919-20 to 1953-54.

TABLE 12

ESTIMATED NATURAL INFLOW TO GOOSE LAKE

(ACRE-FEET PER YEAR)

Measured Inflow, California	19,400
Unmeasured Inflow, California	
West-side	17,100
Other	15,800
Measured Inflow, Oregon	137,200
Unmeasured Inflow, Oregon	14,100
Total Natural Inflow	203,600

In 1909, Jacobs[1] prepared the following table which is based on a comparison of mean annual precipitation at Paisley and at Lakeview and a run-off factor for Goose Lake Basin developed from the measured run-off from the Chewaucan basin.

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(1) Jacobs, Joseph; Consulting Engineer, "Central Oregon Investigations-Irrigation Possibilities, Lakeview District (March, 1909).

TABLE 13

PROBABLE MEAN RUN-OFF OF THE ENTIRE GOOSE LAKE DRAINAGE AREA

Drainage Basin	Drainage Area in sq. miles	Mean Annual Run-Off A.F./sq. mi.	Mean Annual Run-Off A.F. Total
Cottonwood Creek above dam site	56	350	19,600
Drews Creek above dam site	208	400	83,200
Dry Creek	30	300	9,000
Warner Canyon Stream, above flat	5	200	1,000
Kelly Creek, above flat	10	200	2,000
Bullard Creek, above flat	5	200	1,000
Aggregate of 16 small streams in California	250	300	75,000
Bottom Lands Drainage not included above	536	50	26,800
TOTAL	1,100	198	217,600

The mean annual fun-off computed by Jacobs is within 4 per cent of the 44-year average natural inflow to Goose Lake computed by more refined techniques and presented in Table 13. This would indicate that our knowledge of unimpaired surface water flow in Goose Lake Basin is reasonably accurate and that no further refinements are necessary.

The pattern of surface run-off into Goose Lake is another matter. Quantity and occurrence of annual basin surface run-off are reflected in Figure 7, Precipitation at Lakeview, Oregon, since basin run-off is a result of basin precipitation.

THE PATTERN OF RUN-OFF THROUGHOUT THE YEAR IS DEPICTED IN FIGURE 9, PATTERN OF SURFACE RUN-OFF IN GOOSE LAKE BASIN. THE FIGURE SHOWS THAT SNOWMELT IS THE PRINCIPAL SOURCE OF SURFACE RUN-OFF IN THE BASIN SINCE TWO-THIRDS OF THE RUN-OFF OCCURS DURING THE MONTHS OF MARCH, APRIL AND MAY. THIS NATURAL PATTERN OF RUN-OFF HAS BEEN MODIFIED BY LAND DEVELOPMENT IN THE BASIN, PRINCIPALLY IN OREGON WHICH IS THE SOURCE OF FOUR-FIFTHS OF THE AVERAGE ANNUAL SURFACE RUN-OFF OF THE BASIN.

DREWS RESERVOIR, ON DREWS CREEK IN OREGON, HAS A USEFUL CAPACITY OF 62,500 ACRE-FEET AND IS THE LARGEST RESERVOIR IN THE BASIN. COTTONWOOD RESERVOIR, ON COTTONWOOD CREEK IN OREGON, IS THE SECOND LARGEST RESERVOIR IN THE BASIN WITH A CAPACITY OF 7,540 ACRE-FEET. OTHER RESERVOIRS IN THE BASIN HAVE AN ESTIMATED COMBINED CAPACITY OF LESS THAN 7,000 ACRE-FEET. THE RESERVOIRS IN THE BASIN MODIFY STREAM FLOW PATTERNS THROUGH STORAGE OF FALL, WINTER AND EARLY SPRING RUN-OFF AND RELEASE OF IRRIGATION WATER IN THE SUMMERTIME. THE EFFECT OF STREAM REGULATION ON GOOSE LAKE IS TO REDUCE THE QUANTITY INFLOW TO THE LAKE THROUGHOUT THE YEAR. DURING THE FALL, WINTER, AND EARLY SPRING SEASONS, RESERVOIRS STORE TRIBUTARY STREAM RUN-OFF, WHILE SUMMER RESERVOIR RELEASES ARE ALMOST ENTIRELY DIVERTED FOR AGRICULTURAL USE. THE EFFECT OF STREAMFLOW REGULATION ON GOOSE LAKE INFLOW IS ILLUSTRATED IN FIGURE 9.

Sub-Surface Water Inflow

GOOSE LAKE VALLEY GROUND WATER BASIN IS APPROXIMATELY 260 SQUARE MILES IN SIZE, THAT PORTION OF THE GROUND WATER BASIN IN CALIFORNIA IS

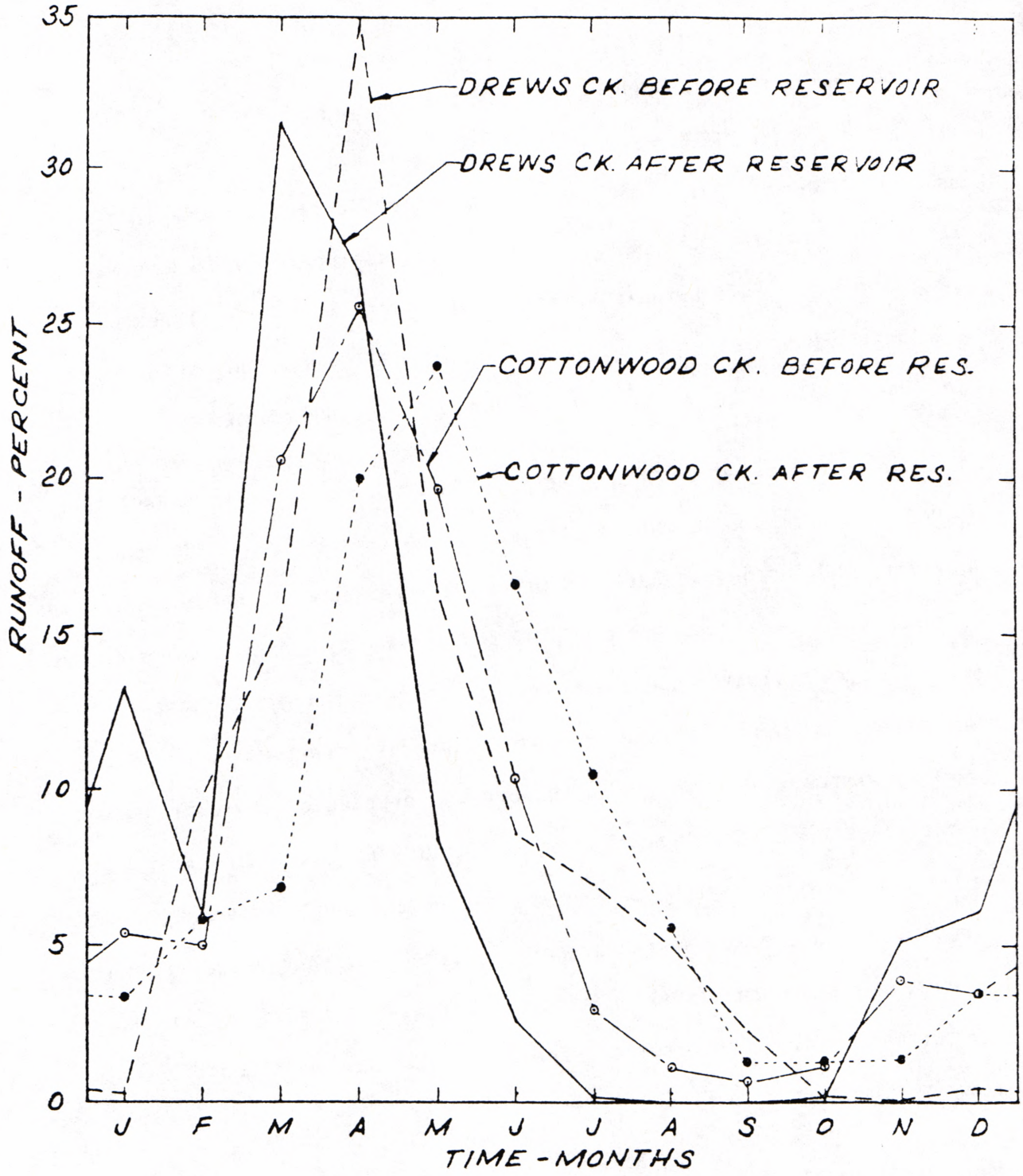

FIGURE 9

PATTERN OF SURFACE RUNOFF
IN GOOSE LAKE BASIN

WATER INFLOW OF 244,000 ACRE-FEET PER YEAR AND IS AN EFFLUENT LAKE. IF A CHANGE IN ΔQ_L OCCURS THEN, OF COURSE, Q_{GN} WOULD BE EQUAL TO 244,000 ACRE-FEET PLUS THE INCREMENTAL CHANGE IN ΔQ_L, IN TERMS OF ACRE-FEET. FIGURE 13 ILLUSTRATES THE HYDROLOGIC BALANCE.

ALTHOUGH THE ENTIRE LAKE IS AN EFFLUENT BODY OF WATER ON THE BASIS OF ANNUAL NET FLOW, IT MAY BE EITHER INFLUENT OR EFFLUENT WHEN CONSIDERED AS TO SPECIFIC AREAS AND SEASONS.

THE HYDROLOGIC BALANCE IS PRESENTED TO SHOW THAT GROUND WATER INFLOW-OUTFLOW MAY BE AN IMPORTANT FACTOR IN MAINTAINING GOOSE LAKE AND CANNOT BE OVERLOOKED IN PRESCRIBING A WATER QUALITY CONTROL POLICY FOR THE LAKE.

WATER RIGHTS

THE WATER RIGHTS TO THE PRINCIPAL STREAMS TRIBUTARY TO GOOSE LAKE HAVE BEEN ADJUDICATED BOTH IN CALIFORNIA AND IN OREGON, AND EACH STATE FURNISHES WATER MASTER SERVICE IN ITS RESPECTIVE PORTION OF THE BASIN.

A SUMMARY OF WATER RIGHTS APPLICATIONS, PERMITS AND LICENSES IN GOOSE LAKE BASIN, CALIFORNIA, RECORDED AS OF JANUARY 25, 1966, AND SUBSEQUENT TO DECEMBER 19, 1914, ARE SHOWN IN TABLE 22. RIPARIAN RIGHTS ARE NOT INCLUDED NOR ARE RIGHTS ESTABLISHED PRIOR TO DECEMBER 19, 1914. PENDING REQUESTS ARE ALSO EXCLUDED FROM THE SUMMARY. THE WATER RIGHTS ON NEW PINE, COTTONWOOD AND DAVIS CREEKS HAVE BEEN ADJUDICATED. THE AGREEMENTS, WHICH ALLOCATE A TOTAL WATER QUANTITY OF 89 CUBIC FEET PER SECOND TO 7,846 ACRES OF LAND, ARE SHOWN IN TABLE 23.

TABLE III

SUMMARY OF APPLICATIONS, PERMITS AND LICENSES IN GOOSE LAKE BASIN, CALIFORNIA AS OF JANUARY 25, 1966

App. No.	Date Filed	Applicant	Source	Point of Diversion Section	Point of Diversion TWP & Range	Point of Diversion B&M	Amount CFS OR GPD	Amount Acre-Feet	Use	Status
194	120215	Dorothy J & Estate of I C Everly	Unnamed Ravine	L1 07	46N13E	MD		120	I	L
312	042216	J G & Ethel D Cundiff	Bonner Ravine	NENE03	46N14E	MD		*115	I	L
312	042216	J G & Ethel D Cundiff	Bonner Ravine	SESE34	47N14E	MD		*115	I	L
312	042216	J G & Ethel D Cundiff	Bonner Ravine	SWSE34	47N14E	MD		*115	I	L
3217	010923	J G & Ethel D Cundiff	Bonner Ravine	SWSE34	47N14E	MD	*0.87CFS		A	L
3217	010923	J G & Ethel D Cundiff	Bonner Ravine	SWNE34	47N14E	MD	*0.87CFS		A	L
5385	031927	R E Swarthout	Unnamed Ravine	NWNE13	47N12E	MD		*185	I	L
5385	031927	R E Swarthout	Unnamed Ravine	NENW24	47N12E	MD		*185	I	L
9825	021540	Floyd E & Roselma M Balsley	Unnamed Stream	NESE04	45N14E	MD		50	KS	P
9825	021540	Floyd E & Roselma M Balsley	Unnamed Stream	NESE10	45N14E	MD		75	KS	P
9825	021540	Floyd E & Roselma M Balsley	N.F. Davis Creek	NWNE14	45N14E	MD		75	KS	P
10207	051341	Walter & Lawrence Butler	New Pine Creek	NWSE32	46N15E	MD	0.1CFS		I	L
10549	101942	Godfrey H & Edytha Reed	Davis Creek	NWNE14	45N14E	MD		45	I	L
10742	122743	U S Modoc National Forest	Enquist Spring	SWSE19	47N13E	MD	650GPD		S	L
11126	080245	R E Swarthout	Unnamed Stream	SWSE07	47N13E	MD	*2.5CFS		IS	L
11126	080245	R E Swarthout	Unnamed Stream	NESE02	47N12E	MD	*2.5CFS		IS	L
11569	093046	Eugene G Tomlinson	Pleasants Creek	SESW14	47N14E	MD	*0.56CFS	*1	IS	L
11569	093046	Eugene G Tomlinson	Pleasants Creek	SWSE14	47N14E	MD	*0.56CFS	*1	IS	L
13191	063049	U S Modoc National Forest	Box Spring	NWNE29	46N13E	MD	650GPD		DS	L
13192	063049	U S Modoc National Forest	Fossett Spring	SWSW01	45N15E	MD	450GPD		DS	L
13960	092250	Perry O Clark	Unnamed Spring	SENE28	46N14E	MD	1440GPD		DS	L
14422	081051	U S Modoc National Forest	Highgrade Spring	SWSE10	47N15E	MD	700GPD		S	L
14690	022852	Dorothy J & Estate of I C Everly	Everly Spring	L3 32	47N13E	MD	200GPD		D	L
14972	081552	U S Modoc National Forest	Unnamed Stream	SWNW01	47N15E	MD	275GPD		D	L
21011	110962	Irvin L & Buna B Faris	Unnamed Stream	NENW34	48N15E	MD		2	RE	P

NOTE: An asterisk indicates alternate points of diversion.

Use abbreviations are: I-Irrigation, A-Agricultural, K-Irrigation & Domestic, S-Stockwatering, D-Domestic, R-Recreation and E-Fire Protection

Status abbreviations are: L-License and P-Permit, No entry indicates application.

TABLE 23

WATER RIGHTS AGREEMENTS IN GOOSE LAKE BASIN, CALIFORNIA

Number	Decree	Date	Allotted cfs	Irrigated Acreage
2821	New Pine Creek	June 14, 1932	22	1,108
2782	Davis Creek	June 30, 1932	52	4,814
2344	Cottonwood Creek	May 3, 1940	15	1,924

Water rights in the California portion of the basin are primarily for irrigation purposes. Stockwatering is secondary and domestic use tertiary in amounts of water appropriated.

There are no water rights applications in California for appropriating water from Goose Lake. Of course, abutting property owners have riparian rights to water from the lake.

In Oregon, water was adjudicated prior to 1909 when established use determined the priority. After 1909 an application for a permit to divert and use surface water was required. After 1927 a permit was required to divert and use ground water east of the Cascades. A similar requirement was placed on the diversion and use of ground water west of the Cascades in 1955. Information regarding water rights on streams in Oregon tributary to Goose Lake is not readily available, neither is the amount of acreage in Oregon having water rights allocations.

Water Development

Past water development in the basin has taken place primarily in Oregon. The paucity of adequate reservoir sites and the small size of

DRAINAGE AREAS HAVE LIMITED THE DEVELOPMENT OF SURFACE STORAGE ON STREAMS IN CALIFORNIA TRIBUTARY TO GOOSE LAKE.

DREWS RESERVOIR, IN OREGON, A FACILITY OF THE GOOSE LAKE VALLEY IRRIGATION DISTRICT (LAKEVIEW WATER USERS, INC.), IS THE MAJOR WATER DEVELOPMENT PROJECT IN THE BASIN. COTTONWOOD RESERVOIR, ALSO IN OREGON, IS THE SECOND LARGEST PROJECT IN THE BASIN ALTHOUGH IT IS ONLY ABOUT A TENTH THE SIZE OF DREWS RESERVOIR. THERE ARE A NUMBER OF SMALLER RESERVOIRS IN BOTH THE OREGON AND CALIFORNIA PORTIONS OF THE BASIN AND A NUMBER MORE PROPOSED.

IN CALIFORNIA, THE GOOSE LAKE SOIL CONSERVATION DISTRICT HAS UNDER CONSIDERATION THREE RESERVOIRS PROPOSED IN A COMPREHENSIVE PLAN(1) FOR THE DISTRICT. THE RESERVOIR SITES ARE ON WILLOW AND LASSEN CREEKS AND THE NORTH FORK OF DAVIS CREEK. THE COMBINED STORAGE CAPACITY OF THE PROPOSED WATER RESERVOIRS AMOUNTS TO APPROXIMATELY 8,900 ACRE-FEET.

PAST WATER DEVELOPMENT PROPOSALS FOR GOOSE LAKE WERE OUTLINED BY JACOBS(2). THE TWO SCHEMES FOR UTILIZING GOOSE LAKE FOR IRRIGATION WERE:

(1) LOWERING OF THE LAKE SURFACE BY PUMPING OR DRAINING WATER FROM THE LAKE TO THE PIT RIVER BASIN AND UTILIZATION OF THE RECLAIMED LAND. THE LAKE WOULD BE RESTRICTED TO A VERY SMALL AREA BY CONSTRUCTION OF DIKES;

(2) UTILIZATION OF THE LAKE AS A RESERVOIR AND DRAINING IT INTO THE PIT

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(1) ANON, "COMPREHANSIVE PLAN FOR GOOSE LAKE SOIL CONSERVATION DISTRICT." BERNDTSON NORTHWEST INC., PLEASANT HILL, CALIFORNIA (UNDATED).

(2) JACOBS, J. "CENTRAL OREGON INVESTIGATIONS, IRRIGATION POSSIBILITIES-LAKEVIEW DISTRICT (MARCH, 1909).

DUCTANCE) IN GOOSE LAKE GENERALLY PLACES THE WATER IN THE CLASS II CATEGORY FOR IRRIGATION USE, I.E., GOOD TO INJURIOUS. THE BORON CONTENT OF GOOSE LAKE ALWAYS HAS BEEN OVER 2.0 MG/L AND THE SODIUM PERCENTAGE IS USUALLY ABOUT 90. THEREFORE GOOSE LAKE WATER ALWAYS HAS BEEN INJURIOUS TO UNSATISFACTORY (CLASS III) FOR IRRIGATION PURPOSES DUE TO THE SODIUM AND BORON CONCENTRATIONS.

REGARDLESS OF THE FACT THAT GOOSE LAKE WATER IS UNSATISFACTORY FOR IRRIGATION USE, THE LAKE HAS BEEN USED TO A LIMITED EXTENT FOR IRRIGATION OF PASTURELANDS ADJACENT TO IT. IN ADDITION, CERTAIN ADAPTED, SALT-TOLERANT GRASSES GROW IN AREAS AROUND THE LAKE THAT ARE INUNDATED AT TIMES. THE GRASSES ARE USED FOR FORAGE BY CATTLE TO SOME EXTENT.

GOOSE LAKE HAS BEEN, IS, AND PROBABLY WILL CONTINUE TO BE USED FOR LIVESTOCK WATERING, THEREFORE LIVESTOCK WATERING IS A BENEFICIAL USE OF GOOSE LAKE.

ALTHOUGH GOOSE LAKE HAS BEEN USED TO A LIMITED EXTENT FOR IRRIGATION PURPOSES, IT IS REALLY NOT SUITABLE. PROBABLY MORE HARM THAN BENEFIT RESULTS FROM ITS USE FOR IRRIGATION, THEREFORE IT IS CONCLUDED THAT SUCH USE OF GOOSE LAKE WATER IS NOT BENEFICIAL.

FISHLIFE AND WILDLIFE USE

FISHES KNOWN TO INHABITAT THE GOOSE LAKE BASIN INCLUDE RAINBOW TROUT, SALMO GAIRDNERI; YELLOW PERCH, PERCA FLAVESCENS; BLACK CRAPPIE, POMOXIS NIGROMACULATUS; BROWN BULLHEAD, ICTALURUS NEBULOSUS; BLUEGILL SUNFISH, LEPOMIS MACROCHIRUS; PUMPKINSEED SUNFISH, LEPOMIS GIBBOSUS; LARGEMOUTH BASS, MICOPTERUS SALMOIDES; TUI CHUB, SIPHATILES BICOLOR; SUCKERS, CATOSTOMUS SP.; DACE, RHINICHTHYS SP., AND LAMPREY, PETROMYZONTIDOE SP.

During a two-day survey[1] in May, 1966, fishes found to inhabit Goose Lake included Tui chubs, suckers, rainbow trout, brown bullhead and lamprey. Tui chubs were found to be the most abundant and widely distributed species in the lake. Specimens up to 13 inches in size were noted. Other species in descending order of abundance were found to be suckers, lamprey, rainbow trout, and brown bullhead. Most of the trout were taken at the mouths of creeks or near springs. Specimens up to 18 inches in size were observed. Many of the fishes including Tui chubs showed signs of numerous and recent lamprey attacks.

Prior to 1926, when the lake went dry, a minor fishery for trout existed in the lake, primarily at the north end in Oregon. Currently, angling for rainbow trout in the lake is almost non-existent.

The existing trout fishery in the Goose Lake Basin is centered in the tributary streams. Trout are taken by anglers during the spring as the fish move from the lake to their ancestral spawning grounds. Currently, Lassen and Willow Creeks are the main angling areas. Davis, Cottonwood, and New Pine Creeks formally supported rainbow trout runs, although their use today is almost non-existent. In 1964, the California Department of Fish and Game made an attempt to bolster the Goose Lake trout population by stocking 408,000 rainbow trout fingerlings. The impact of this plant has not been evaluated at this time.

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(1) O'Brien, R. J., Memorandum to C. T. Carnahan regarding results of fisheries survey of Goose Lake (July 6, 1966).

GOOSE LAKE

WATER QUALITY SURVEY

Location of Survey

Goose Lake (Figure 1) is located in the northeastern corner of California, just north of Alturas, Modoc County, and in the south-central portion of Oregon, a few miles south of Lakeview, Lake County.

Time of Survey

Comprehensive water quality sampling of Goose Lake was conducted during daylight hours on May 24-25, 1966. Limited water quality sampling was undertaken on the morning of May 26. The fishery survey was initiated on May 24 and completed May 26, 1966.

Purpose of Survey

The water quality survey was undertaken for the primary purpose of determining existing water quality indicator levels so that reasonable water quality control objectives for Goose Lake could be formulated. Other purposes of the study were to determine if the lake was homogeneous in quality and to locate suitable water quality control monitoring stations in order that an adequate enforcement program could be established.

The purpose of the fishery survey was to determine species composition, relative abundance and distribution of the existing fish fauna of Goose Lake.

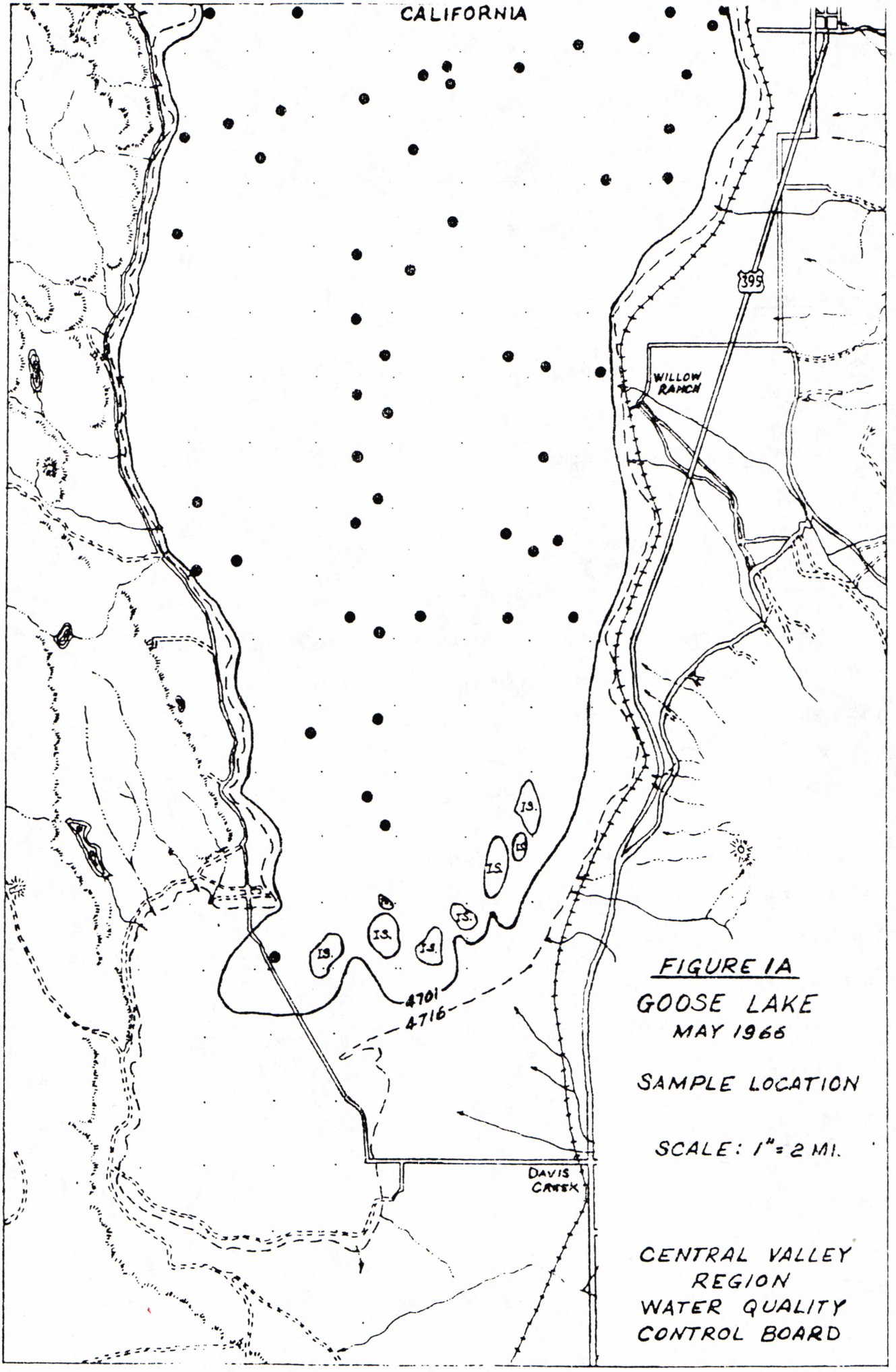

FIGURE 1A

GOOSE LAKE

MAY 1966

SAMPLE LOCATION

SCALE: 1" = 2 MI.

CENTRAL VALLEY REGION WATER QUALITY CONTROL BOARD

Participants

Personnel from both Oregon and California participated in the water quality and fishery surveys. In addition, Federal Water Pollution Control Administration personnel agreed to do the biological analyses and a portion of the pesticide determinations (fish).

Participants in the field study are listed in Table 1.

TABLE 1

PARTICIPANTS

Oregon

Sanitary Authority
- Bryan Johnston
- Glen Carter

Fish Commission
- Fred Locke

Game Commission
- Henry Mastin

California

Department of Fish & Game
- Dick Hansen
- Vern King

Department of Water Resources
- Don Skinkle
- Lindy Bates
- Chuck Hodge
- Bob Clawson
- Dick Rosenberger

Regional Water Quality Control Board #5
- Larry Trumbull
- Ted Fenner
- Dick Daum

Lake Conditions

At the time of the survey the deepest point in the lake was found to be 8.5 feet. The depth of the lake at any given location depends upon wind conditions. A strong wind for a short length of time will pile the water up on the leeward side of the lake, usually the south or western shore, by at least a foot in excess of normal depth.

During the two-day survey the wind was generally calm, a condition which allowed a thermocline to develop in the lake. Thermoclines in Goose Lake are probably transitory, their existence, extent, and persistence being dependent upon wind and solar intensities.

Goose Lake, although shallow, has a large surface area which at the time of the study was approximately 210 square miles, (about 23 miles in length and with a maximum east to west width of 9 miles).

The extreme turbidity of the lake, light tan to reddish-brown in color, is readily apparent. It appears that clay particles, not algae, constitute the turbidity source.

The temperature of the water during the survey was warm enough to make swimming a pleasure and the water, although somewhat alkaline, had no deleterious effect on the skin of the sampling personnel whose hands were in the water almost continuously.

Sampling Program

Field water quality observations included specific conductance, temperature, dissolved oxygen, pH and turbidity. In addition, water depths and sampling depths were recorded. Samples were collected at various points in the water column, but generally 1 foot below the water surface and 1 foot above the bottom of the lake. Mid-depth samples were also collected, but usually only in shallow water or where conductivity and temperature profiles were made.

Four mid-depth plankton samples were collected along the north-south centerline of the lake and delivered to Klamath Falls, Oregon, for counting and identification.

Observations of lake bottom sediments were made at 10 locations and 4 sediment samples were collected for laboratory analyses which includes total nitrogen, total phosphorous and per cent volatile matter.

Nine water samples were collected along the periphery of the lake for mineral analyses in order that lake homogeneity may be determined.

Three water samples were collected along the longitudinal axis of the lake for complete mineral and sanitary analyses. These analyses are shown in Table 2.

TABLE 2

COMPLETE WATER QUALITY ANALYSES

Mineral - Silica (SiO_2), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), bicarbonate (HCO_3), sulfate (SO_4), chloride (Cl), nitrate (NO_3), boron (B), dissolved solids, total hardness, specific conductance, and pH.

Sanitary - Nitrogen series (NH_3, Org. N, NO_3 and NO_2), phenols, ether solubles, phosphate series (Ortho-PO_4 and Total PO_4), chemical oxygen demand (COD), organic carbon (Org. C), turbidity, color, pesticides and heavy metals (spectographic determination).

Three water samples were collected across the breadth of the lake near the state line for a biochemical oxygen demand (BOD_5 and BOD_{20}) analysis.

Carl Overmeier, Modoc County Sanitarian, will collect bacteriological samples around the periphery of the lake at some future date.

Sampling locations are shown in Figure 1.

Temperature

Water temperatures during the survey ranged from 57 to 78°F. The average water temperature during this period was 63°F. The maximum, minimum and average values of surface and bottom temperatures were 78, 58 and 66°F and 65, 57 and 60°F, respectively.

In addition to surface and bottom water temperature measurements, six temperature measurements, six temperature-depth profiles were made. Figure 2 shows the thermoclines that formed in Goose Lake during the study as a result of the calm weather at that time.

The maximum temperature difference observed in a water column was 17°F; the minimum was none. There appeared to be no relationship between water depth and the difference in surface and bottom water temperatures. Data show that the largest temperature differences in the water columns occurred near noon during the study period.

Figure 3 shows the relationship between air temperature, surface water temperature and bottom water temperature on May 25, 1966. The lowest temperatures were reported at the beginning of the sampling cruise, 0745, and all temperatures peaked out at 1405. The best-fit curves in the figure show that water temperatures respond proportionally to air temperature, as is to be expected. At the maximum air temperature of 85°F, surface and bottom water temperature were 74 and 65°F, respectively. Based on a 72-year Lakeview temperature record, the average maximum summer air temperature at Goose Lake is 85°F (July) and the average minimum summer air temperature is 49°F (July), a range of 36°F. July and August, the two warmest months of the year, have average air temper-

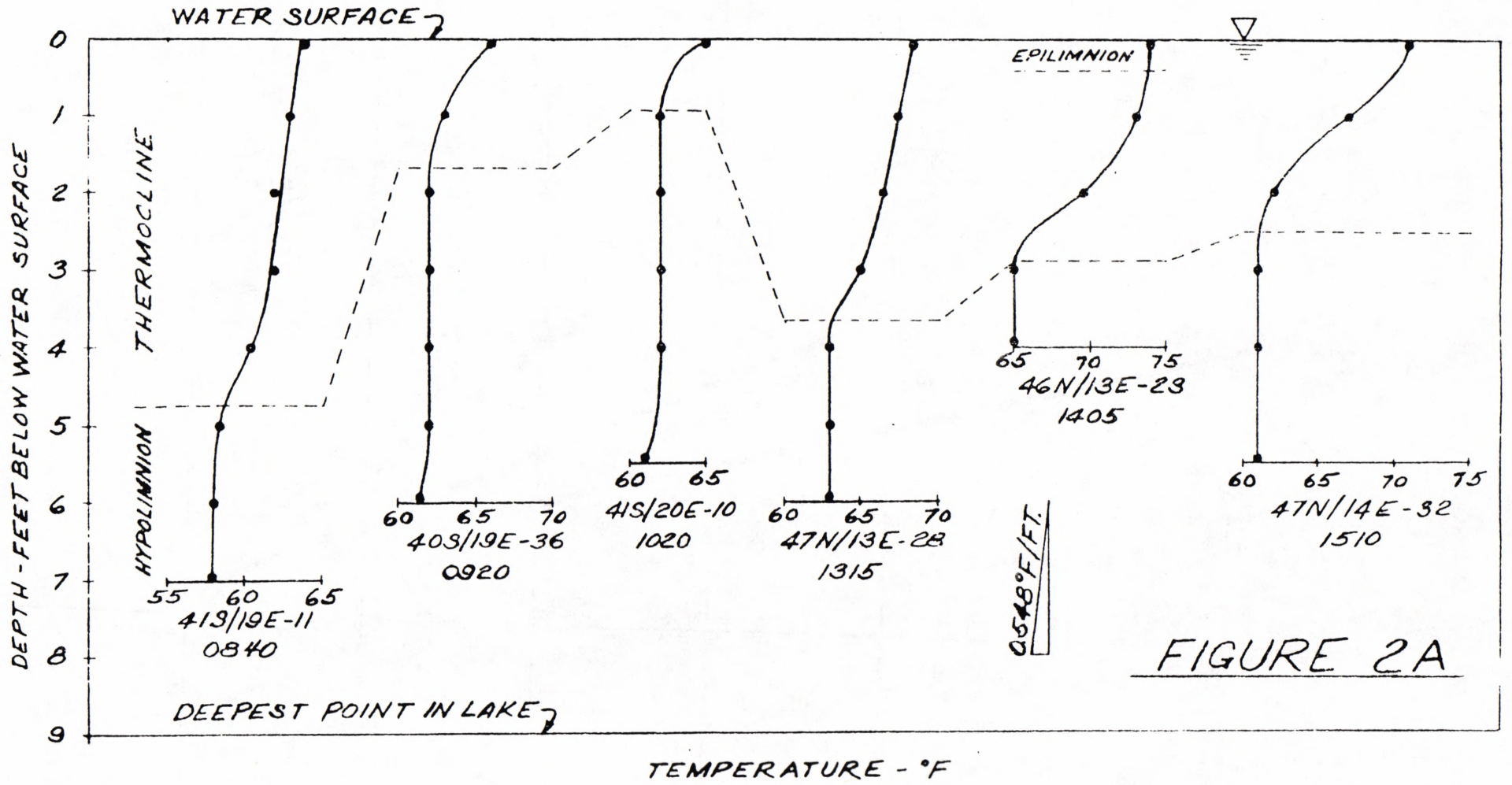
WATER SURFACE
DEPTH - FEET BELOW WATER SURFACE
0
1
2
3
4
5
6
7
8
9
THERMOCLINE
HYPOLIMNION
EPILIMNION
55 60 65
41S/19E-11
0840
60 65 70
40S/19E-36
0920
60 65
41S/20E-10
1020
60 65 70
47N/13E-28
1315
65 70 75
46N/13E-23
1405
60 65 70 75
47N/14E-32
1510
0.5-1.0°F/FT.
DEEPEST POINT IN LAKE
TEMPERATURE - °F

FIGURE 2A

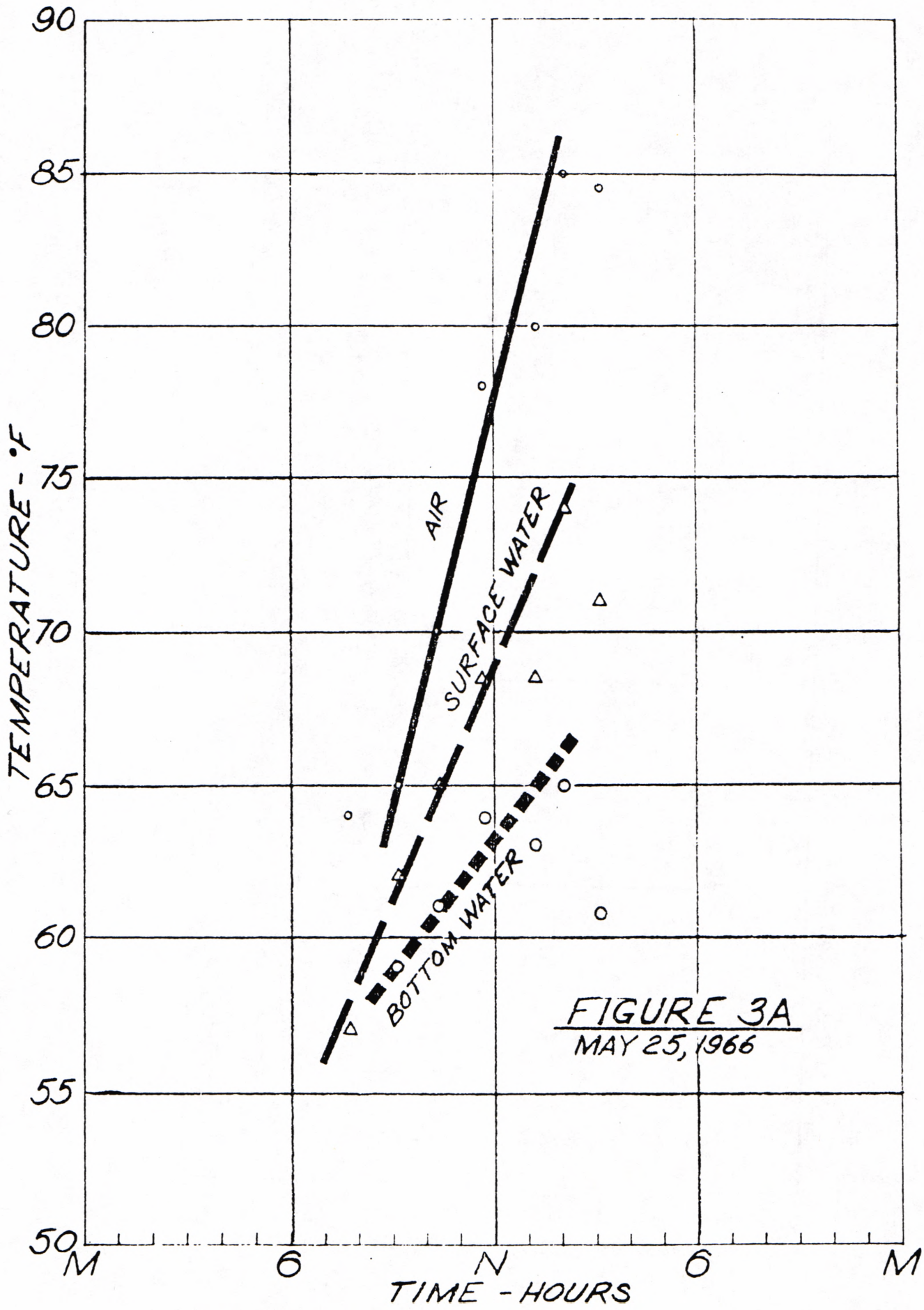

FIGURE 3A
MAY 25, 1966

atures of 67 and 65°F, respectively. Generally, mean daily temperatures of relatively shallow bodies of water approximate mean daily air temperatures. From the data collected during the survey, the average surface water temperature of Goose Lake, 66°F, compares favorably with the average summer air temperature at Lakeview. Also the maximum air temperature for May 25, 1966, is the same as the average maximum air temperature at Lakeview.

Therefore the average summer water temperature is estimated to be about 63°F although the shallow fringe areas of the lake may approach 85°F (the average maximum summer air temperature) and the deeper parts of the lake may have temperatures in the 50°F range (minimum observed temperature during the study was 57°F).

Dissolved Oxygen

Sixty-eight dissolved oxygen determinations were made during the study. The average dissolved oxygen content of Goose Lake was 8.1 mg/l (median 8.2 mg/l) and the maximum and minimum amounts determined were 8.5 and 7.3 mg/l, respectively. The average and median dissolved oxygen values agree with the dissolved oxygen content of 8.1 mg/l computed by using the average water temperature (63°F) during the study and assuming that the water is completely saturated with oxygen.

At the elevation of Goose Lake, 4,700 feet above mean sea level, saturated water can only hold 84 per cent of the amount of oxygen that is contained in saturated water at sea level. The dissolved oxygen saturation of lake water ranged from 85 per cent to 121 per cent. The average dissolved oxygen saturation of Goose Lake during the study was a respectable 100 per cent.

Hydrogen Ion Concentration

The hydrogen ion concentration in water is expressed in pH units. Of 42 pH determinations made in the field, 36 were equal to 9.0 units. Five measurements made with one pH meter resulted in 8.9 units each. One pH value of 9.1 units was recorded.

The pH measurements, made throughout the daylight period, essentially remained constant (9.0 ± 0.1). The pH of Goose Lake remained constant regardless of sample depth and solar radiation. The constant pH phenomenon illustrates that the lake has a tremendous buffering capacity. This great buffering capacity is probably due to the high alkalinity of the lake which has been reported in excess of 700 mg/L expressed as $CaCO_3$.

Turbidity

The average turbidity of Goose Lake during the study, as determined by 66 measurements, was 210 Jackson Candle Units (JCU). The turbidity ranged from 160 to 270 JCU, with the higher values observed in the southern end of the lake. As shown by the table below, differences in turbidity with respect to depth are insignificant.

Goose Lake Turbidity

Location	Turbidity in JCU		
	Maximum	Minimum	Average
Surface	260	160	190
Mid-depth	270	180	220
Bottom	250	160	200

During the survey, Secchi disc readings ranged from 3 to 4 inches with

THE MEDIAN READING EQUAL TO 4 INCHES.

TURBIDITY IN THE LAKE REDUCES PENETRATION BY SUNLIGHT AND THEREBY ENHANCES DEVELOPMENT OF A THERMOCLINE, WHICH IN TURN ALLOWS THE DEEPER WATER TO REMAIN RELATIVELY COOL AND CAPABLE OF SUPPORTING FISHLIFE.

FISHERMEN BEGIN TO COMPLAIN ABOUT TURBIDITY AT LEVELS OF 20-25 JCU AND USUALLY STOP FISHING WHEN LEVELS EXCEED 50 JCU. WITH AN AVERAGE TURBIDITY OF OVER 200 JCU, GOOSE LAKE APPARENTLY DOES NOT APPEAL TO FISHERMEN.

SPECIFIC CONDUCTANCE

THE TABLE BELOW SHOWS THE AVERAGES AND RANGES OF 65 SPECIFIC CONDUCTANCE MEASUREMENTS MADE DURING THE STUDY.

SPECIFIC CONDUCTANCE

LOCATION	SPECIFIC CONDUCTANCE IN MICRO-MHOS		
	MAXIMUM	MINIMUM	AVERAGE
SURFACE	2,200	1,600	1,970
MID-DEPTH	2,100	1,400	1,890
BOTTOM	2,020	1,400	1,880
ALL	2,200	1,400	1,920

THE LOWEST SPECIFIC CONDUCTANCE VALUES OBSERVED IN GOOSE LAKE WERE GENERALLY ON THE EASTERN SIDE OF THE LAKE FROM PINE CREEK SOUTH TO DAVIS CREEK. ALSO, THE LOWEST READINGS OBSERVED WERE GENERALLY AT THE BOTTOM OF THE WATER COLUMN. SPECIFIC CONDUCTANCE DIFFERENCES AS GREAT AS 300 MICRO-MHOS WERE OBSERVED WITH THE LOWEST VALUES RECORDED AT THE MUD-WATER INTERFACE. THESE DATE ARE INDICATIVE OF GOOD QUALITY GROUND WATER MOVEMENT INTO THE LAKE.

THIS WATER QUALITY SURVEY AND PREVIOUS SAMPLING SHOW THAT LOCALIZED CONDITIONS OCCUR IN THE LAKE DURING PERIODS OF STRATIFICATION WHICH RESULT IN SUBSTANTIAL DIFFERENCES (UP TO 25 PER CENT) IN MINERAL CONCENTRATIONS OF SAMPLES COLLECTED IN DIFFERENT PARTS OF THE LAKE AT THE SAME TIME. THIS MEANS THAT GRAB SAMPLES MUST BE COLLECTED AT VARIOUS POINTS ON THE PERIPHERY OF THE LAKE AND COMPOSITED, OR SAMPLE RESULTS AVERAGED, IF REASONABLY RELIABLE RESULTS ARE TO BE REPORTED.

Bottom Sediments

OBSERVATIONS OF LAKE BOTTOM SEDIMENTS AT 10 LOCATIONS INDICATE THAT THE NORTHEASTERN AND CENTER PORTIONS OF THE LAKE BOTTOM CONTAIN A GREAT DEAL OF ORGANIC MATTER IN VARIOUS STAGES OF DECOMPOSITION WHILE THE WESTERN AND SOUTHERN PORTIONS ARE PRIMARILY SANDY AREAS.

THE ENTIRE LAKE BOTTOM IS COVERED BY A SLIME LAYER WHICH IS GENERALLY VERY THIN, APPROXIMATELY 0.1 INCH, BUT WAS ABOUT 3 INCHES THICK IN THE CENTER, AND DEEPEST, PART OF THE LAKE. THIS UPPER GELATINOUS MASS UNDOUBTEDLY IS RESUSPENDED IN THE WATER DURING PERIODS OF VIGOROUS WIND ACTION AND CONTRIBUTES TO THE COLOR AND TURBIDITY OF THE LAKE AT THAT TIME.

TULES GROW IN A NUMBER OF THE SHALLOW AREAS IN THE LAKE ADDING TO THE DEPOSITION OF ORGANIC MATERIAL TO THE LAKE BED.

Fishery Survey

PRELIMINARY EVALUATION OF THE FISHERY DATA INDICATES THAT THE LAKE ABOUNDS IN TUI CHUB, A NONGAME FISH (MINNOW) THAT MAY REACH 10 INCHES IN LENGTH AND A POUND IN WEIGHT. SUCKERS, BROWN BULLHEADS, LAMPREYS AND RAINBOW TROUT ALSO ARE RESIDENT, BUT IN MUCH SMALLER NUMBERS.

There was a minor fishery on the lake prior to 1926, at which time the lake went dry. There does not appear to be a significant fishery on the lake at this time, although a rainbow trout fishery may be developing. Goose Lake is important to fishing in the basin because it is an integral part of the rainbow trout fishery of tributary streams, primarily Willow and Lassen Creeks in California.

A warm water fishery has not developed in Goose Lake even though many species of warm water fishes abound in the basin such as: yellow perch, black crappie, brown bullhead, blue gill, pumpkinseed, largemouth bass, and suckers. The reason for the lack of a warm water fishery appears to be the relatively low water temperature of the lake. The average summer temperature of Goose Lake is estimated to be about 63°F and therefore less than the temperature, 65°F, at which warm water fish commonly cease feeding.

Conclusion

This report covers only the field observations made during the survey. Sanitary and mineral analyses results of samples collected during the study are not available at this time and therefore are not reported herein. Laboratory results will be reported in the "Goose Lake Water Quality Control Policy Basic Data Report" and this report on field observations will be included as an addendum to the basic data report.

Goose Lake refs - cont.

8 Cosby, E.D. 1963. On the recent [illegible] pliocene lakes of the western part of the Great Basin, and of the Idaho pliocene lake. 35: 134-167.

9 Harding, D.T. 1965. Recent variations in the water supply of the western Great Basin. Calif. Univ. Water Res. Cntr. Archives. Archives Series Report 16. 226 pp.

not useful for Goose Lake trib flow etc, does have lake levels.