

MONTANA FISH AND GAME DEPARTMENT
FISHERIES DIVISION
HELENA, MONTANA

JOB COMPLETION REPORT
RESEARCH PROJECT SEGMENT

State of Montana

Project No. F-7-R-15

Name: Northwest Montana Fishery Study

Job No. III

Title: Survey of Cutthroat Trout and Dolly Varden in The Flathead River and Tributaries Above Flathead Lake -

Period: July 1, 1965 to June 30, 1966

ABSTRACT:

Major emphasis was on the monitoring of Flathead River Water quality at sampling stations established in 1963. Data presented represent the yearly variation and trends in several water quality criteria for two consecutive years. Data also illustrate the changes that are brought about by water releases from a 500-foot peaking power dam on the free flowing river below. These data will also be a basis for determining basic water quality for future industrial development along this river.

Data were collected on pH, total alkalinity, specific conductance, dissolved oxygen concentration and water temperatures. Water samples were collected twice a month from January 1963 through July 1965 and once a month through December 1966.

Discharges from Hungry Horse Reservoir differ in both chemistry and temperature from those for the Flathead River above the South Fork junction. Large year long discharges from the reservoir into the free flowing river tempered both the existing water chemistry and temperature.

RECOMMENDATIONS:

Water quality characteristics of the Flathead River have been measured since 1963 and an obvious change in the pattern of yearly discharges from Hungry Horse Reservoir has occurred since late in 1965. During 1966 large reservoir discharges in August, September and October have changed water quality in the free flowing river. It is recommended the water monitoring be continued so as to document the effects the changes in discharge will have on the river below the South Fork junction. This information will also be a basis for comparison of the data on age and growth, seasonal distribution and migration of the fish population presently being investigated in Flathead Lake.

TECHNIQUES USED:

Major emphasis was placed on the monitoring of water quality at sampling stations on the Flathead River above Flathead Lake. Standard water quality techniques were used to determine: 1. dissolved oxygen concentrations; 2. total alkalinity; 3. standard conductance; 4. pH; 5. daily maximum-minimum water temperatures. Water discharges at the time of sampling were determined at two stations from United States Geological Survey water gauging instruments. Samples were collected at two-week intervals from July 1963 through July 1965. From August through December 1966 samples were taken monthly. Water samples were collected at the upper station (Blankenship Bridge) first and then at successive downstream stations (South Fork of the Flathead River, Columbia Falls and Holt Bridge). The time of the day the data were collected varied less than one hour. Water temperatures at sampling time were taken with a pocket thermometer in addition to thirty-day Taylor Recording Thermographs used to collect continuous temperature recordings at two stations.

OBJECTIVE:

The Flathead River and tributary streams above Flathead Lake provide a nationally important fishery for cutthroat trout and Dolly Varden. Recruitment of these fish is dependent on spawning areas found over 100 miles upstream from Flathead Lake. The North and Middle Forks of the Flathead River with their tributaries provide the present spawning areas. This is a total of approximately 120 miles of stream. Movements of cutthroat trout and Dolly Varden into these streams have been documented by returns of tagged fish. It is the objective of this investigation to monitor the present water quality of the Flathead River above Flathead Lake in an effort to determine the factors that affect the migration of game fish to their spawning areas.

FINDINGS:

Water Quality. Since the completion of Hungry Horse Dam in 1951, the annual upstream spawning migration of cutthroat trout and Dolly Varden from Flathead Lake has been restricted to the North and Middle Forks of the Flathead River and their tributaries. The demand for peaking power at Hungry Horse Dam creates violent fluctuations of water discharges into the Flathead River. Information is needed to further understand the effect these rapid changes in water flows have on water temperature and water chemistry and on game fish and their spawning runs.

Efforts are being made to maintain adequate water quality and make recommendations for flow releases to benefit the production of salmonid fish in the Flathead River.

Water quality data have been collected from four stations in the Flathead River drainage in Montana above Flathead Lake as follows: (1) the Blankenship Bridge on the Flathead River just below the confluence of the North and Middle Forks; (2) the U.S.G.S. gauging station on the South Fork of the Flathead River at Hungry Horse; (3) the U.S.G.S. gauging station on the Flathead River at Columbia Falls; (4) the Old Holt Bridge on the Flathead River approximately three miles above Flathead Lake.

Water samples were collected at each station to determine the dissolved oxygen concentration, total alkalinity, pH, and standard conductance. On each sampling day throughout the study water samples were collected in numerical sequence starting at the upstream station first and were collected at approximately the same time of day (within one hour). Sample collections were made at two week intervals from July 1963 through July 1965 and once a month from August 1965 through December 1966. Water temperatures were recorded at stations No. 2 and No. 4 on a thirty day recording thermograph. At stations No. 1 and No. 3 a pocket thermometer was used when samples were collected.

This report will summarize data collected from January 1965 through December 1966; previous water quality data (July 1963 - December 1965) have been presented in Completion Report, F-7-R-13, Job III, by Delano A. Hansel.

It should be noted that large discharges in the months of September and October were released from Hungry Horse Reservoir during 1965 - 1966 seasons. These were the first discharges of this size during these months since the dam has been in operation.

Water Chemistry. The water chemistry data collected during 1965 through 1966 at the four stations along the Flathead River are presented in Figures 1, 2, 3, and 4. The figure numbers coincide with the sampling stations as they are described above.

pH. During the two year period, the pH values ranged from 7.2 to 8.2 at the four stations. Readings at the South Fork station below Hungry Horse Reservoir (station No. 2) averaged 0.1 to 0.2 below the same readings at Blankenship Bridge (station No. 1) for 1965 and 1966. Averages for stations No. 1, 2, 3, and 4 for the two years were 7.7, 7.6, 7.6, 7.6 pH units, respectively. No yearly pattern of pH values was apparent for the two-year period. The average values for the year 1966 were 0.1 units higher than those in 1965.

Total Alkalinity. Total alkalinity (0.00 ppm phenolphthalein) readings from the stations range from 40 to 103 ppm. Two year averages for stations No. 1, 2, 3, and 4 were 76, 70, 74, and 78 ppm, respectively. Station averages for 1966 were less than those readings in 1965; the difference being 8, 10, 5, and 6 ppm, respectively. Waters from Hungry Horse Reservoir, as measured at station No. 2, continued to have lower total alkalinity than water from any other station. This was also true for the 1963-64 data. A yearly pattern is displayed by the alkalinity readings. Low readings at all stations, except station No. 2, occurred at peak run-off, or during mid-May in the Flathead River drainage. By August or September, the readings were at the maximum, followed by a drop of approximately 20 ppm

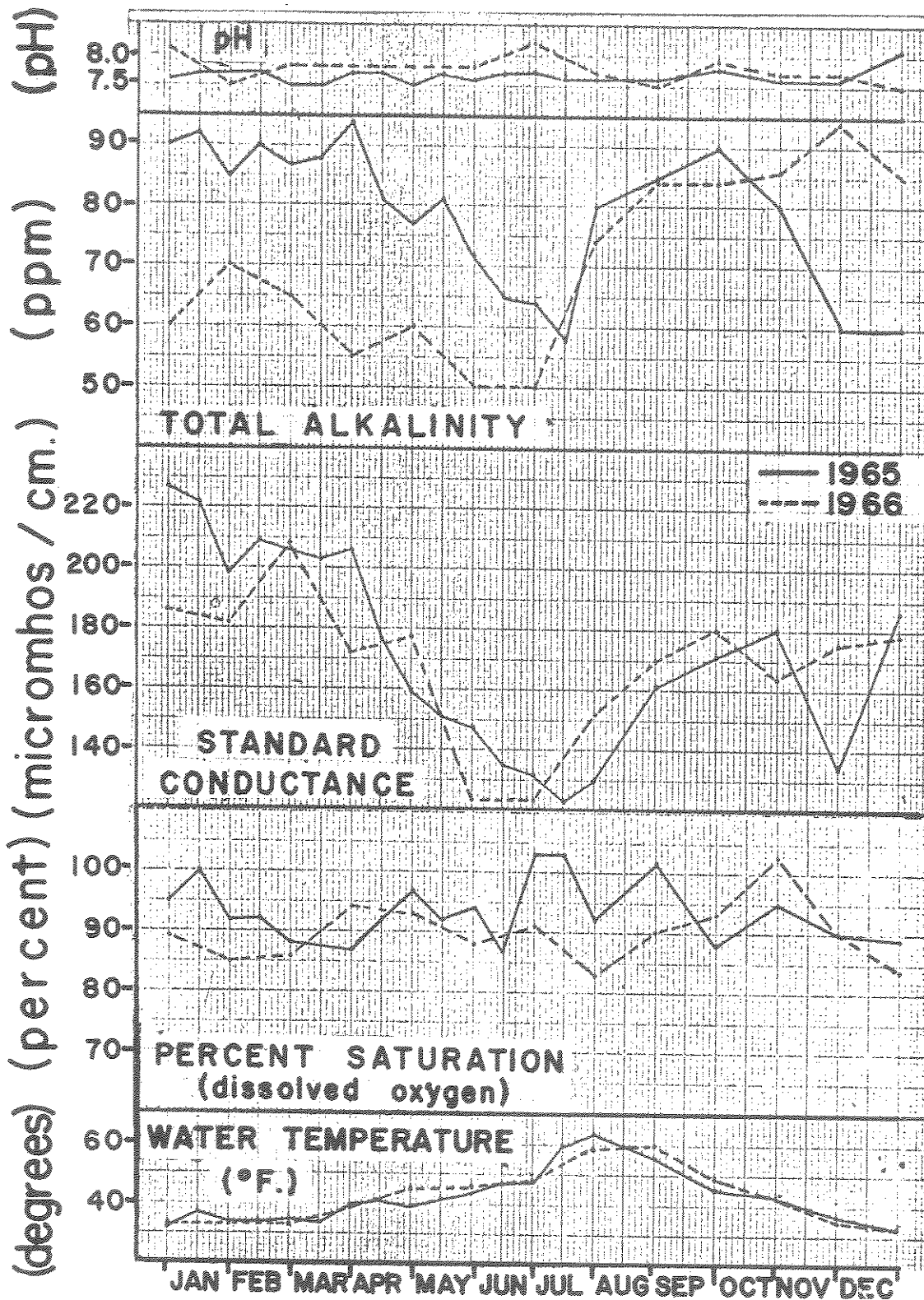


Figure 1. Water quality measurements taken at station No. 1, Blankenship Bridge on the Flathead River; 55 miles above Flathead Lake. 1965 - 1966

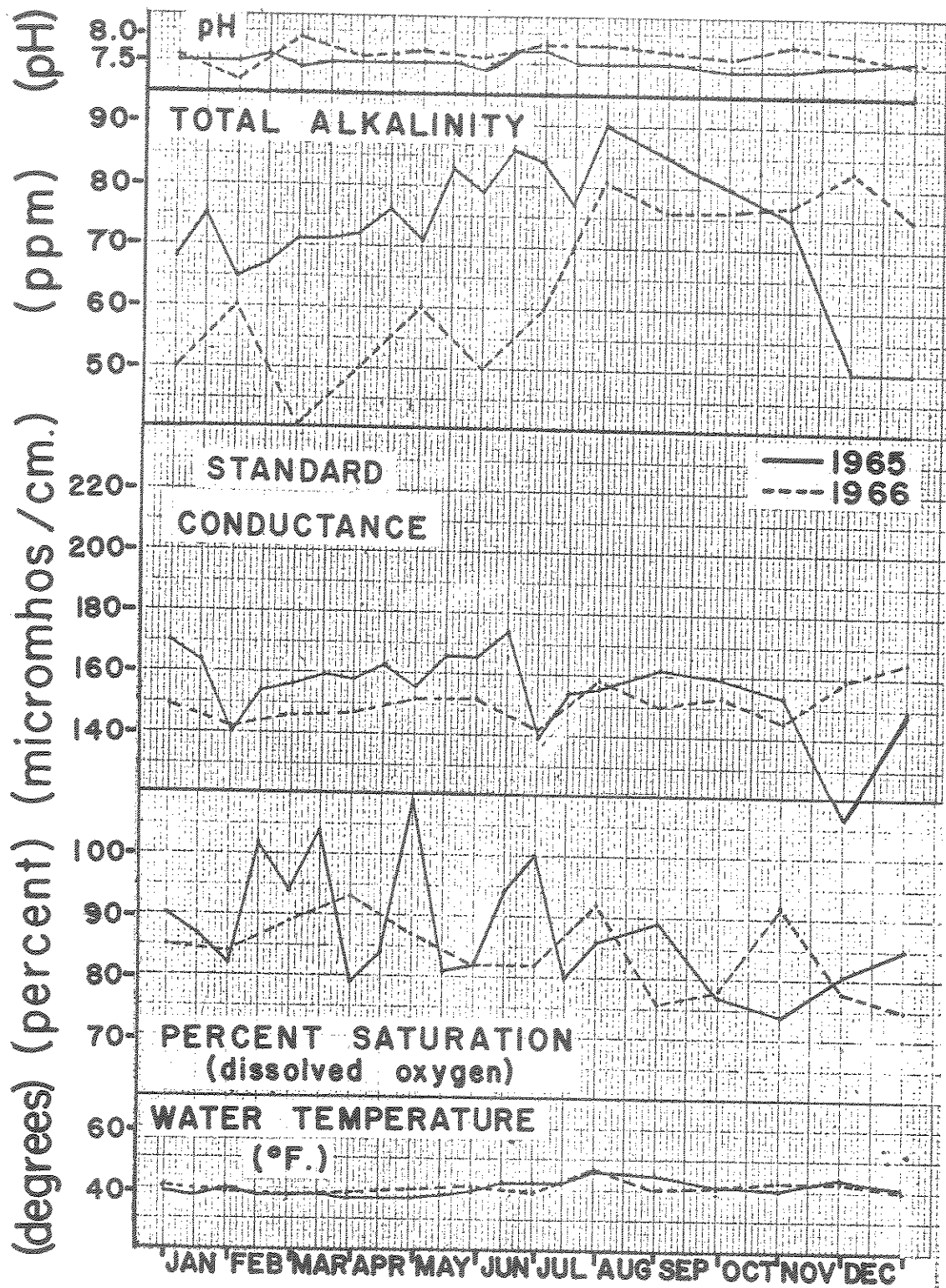


Figure 2. Water quality measurements taken at station No. 2, the U.S.G.S. gauging station on the South Fork of Flathead River; 1 mile below Hungry Horse Dam. 1965 - 1966

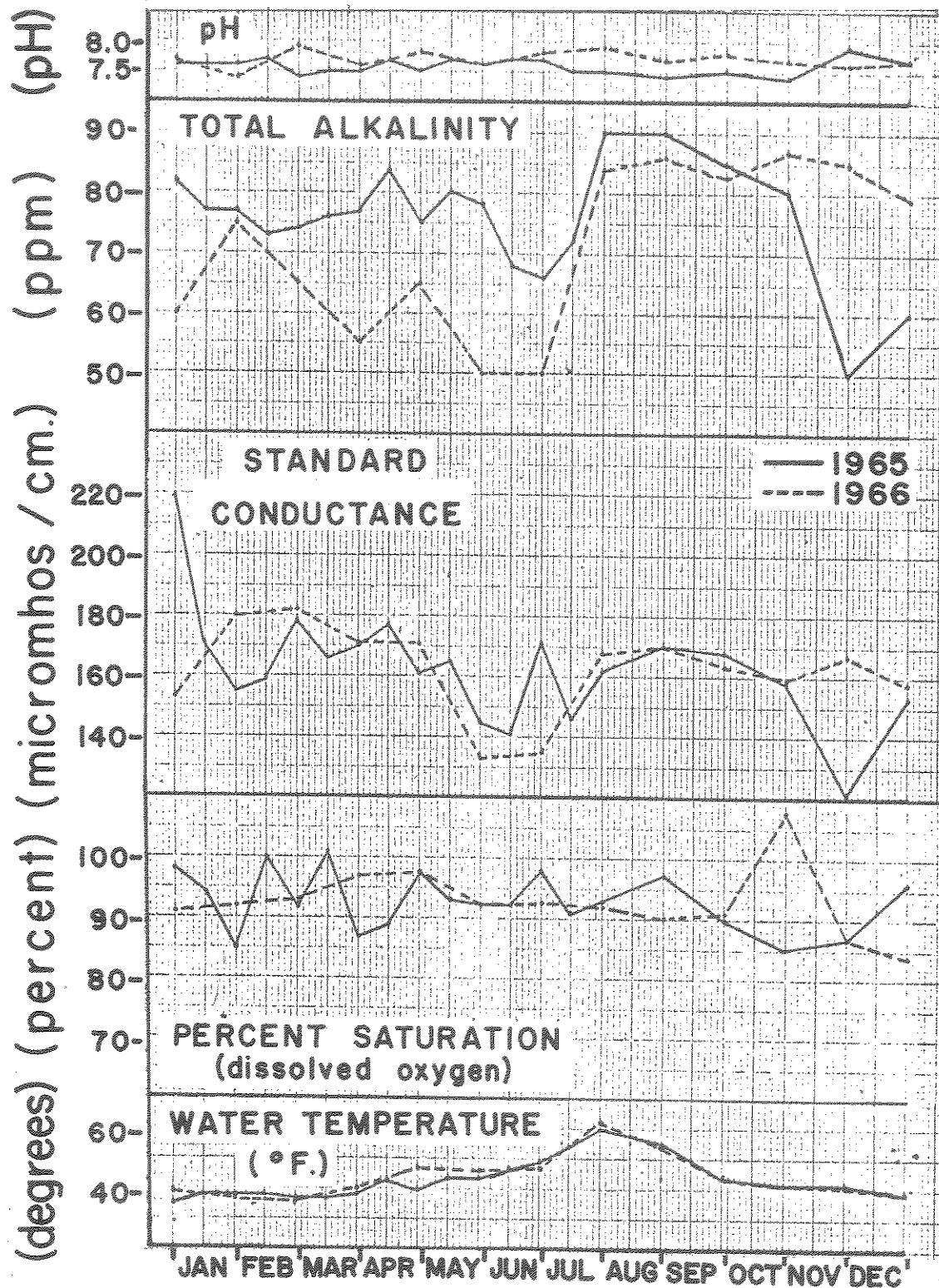


Figure 3. Water quality measurements taken at station No. 3, the U.S.G.S. gauging station on Flathead River, Columbia Falls, Montana; 40 miles above Flathead Lake. 1965 - 1966

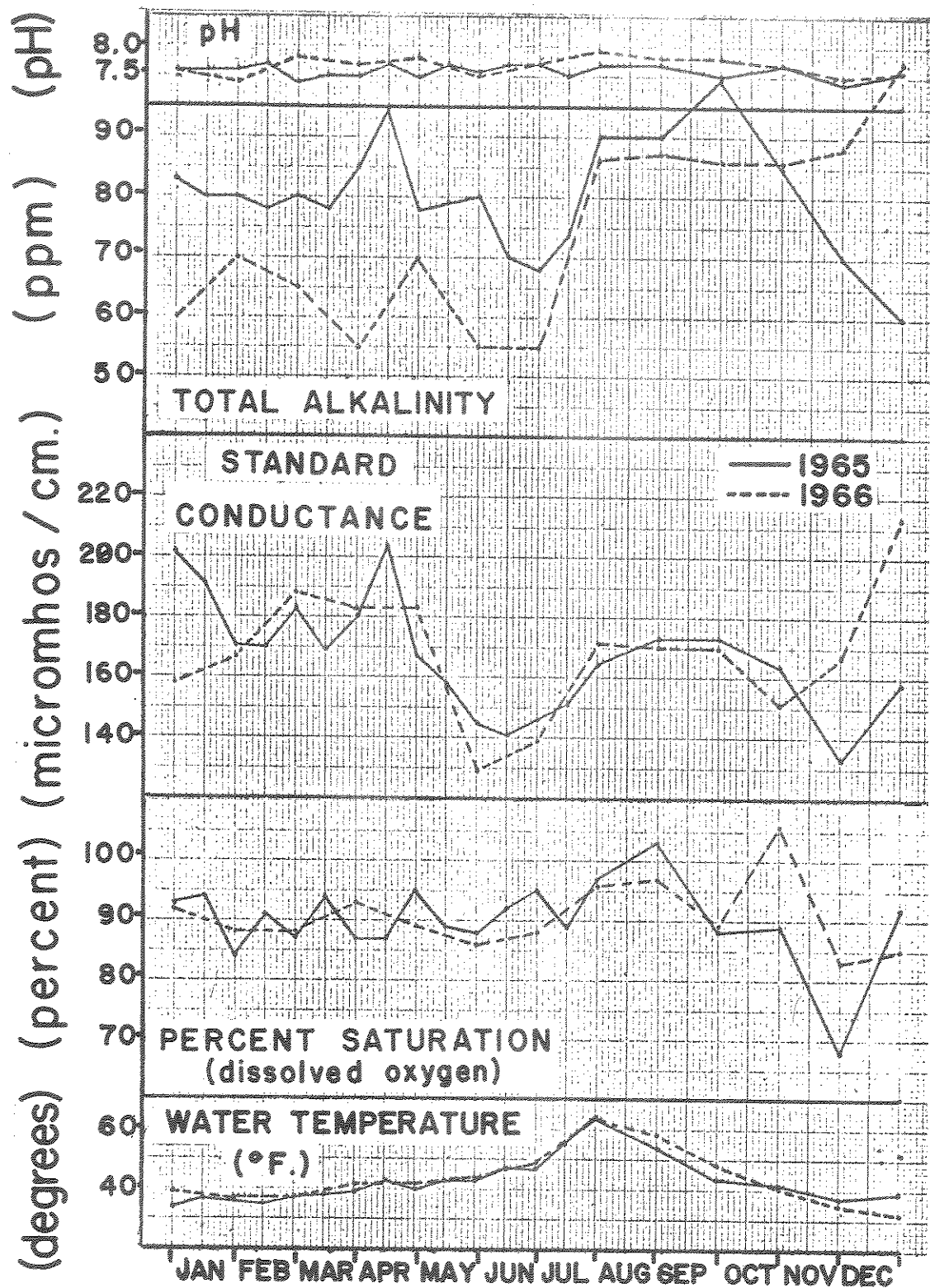
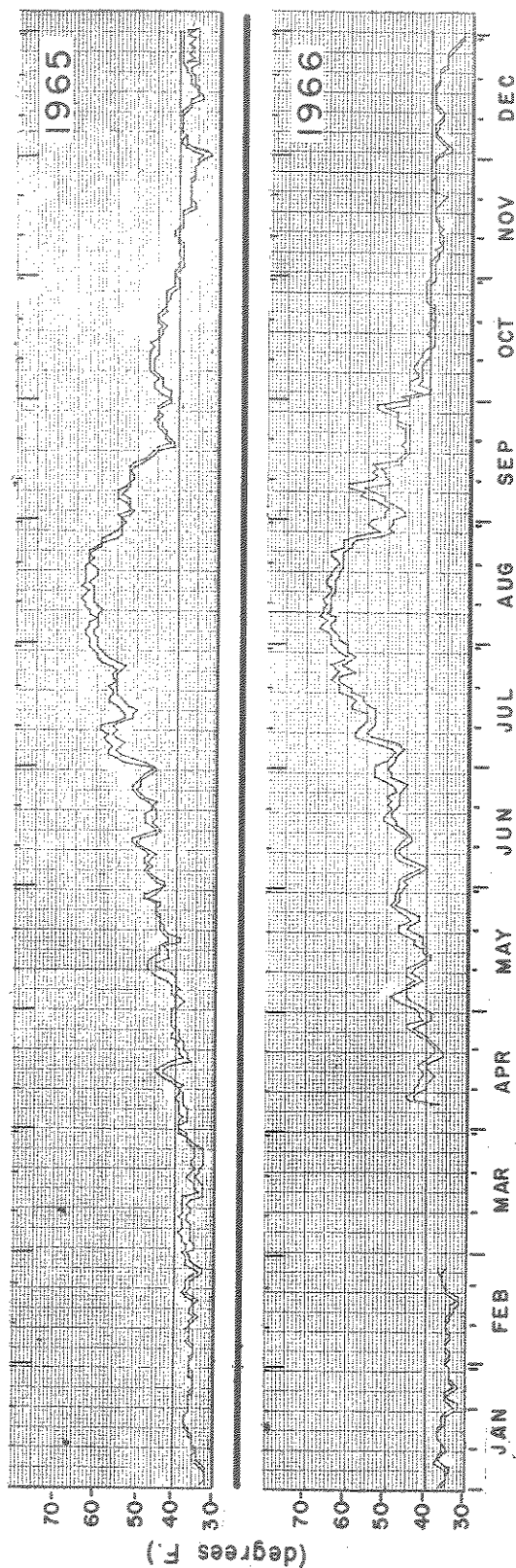


Figure 4. Water quality measurements taken at station 4, Holt Bridge on the Flathead River; 3 miles above Flathead Lake. 1965 - 1966

Station No. 4 Flathead River - Holt Bridge



Station No. 2 South Fork Flathead River - U.S.G.S. Gauging Station

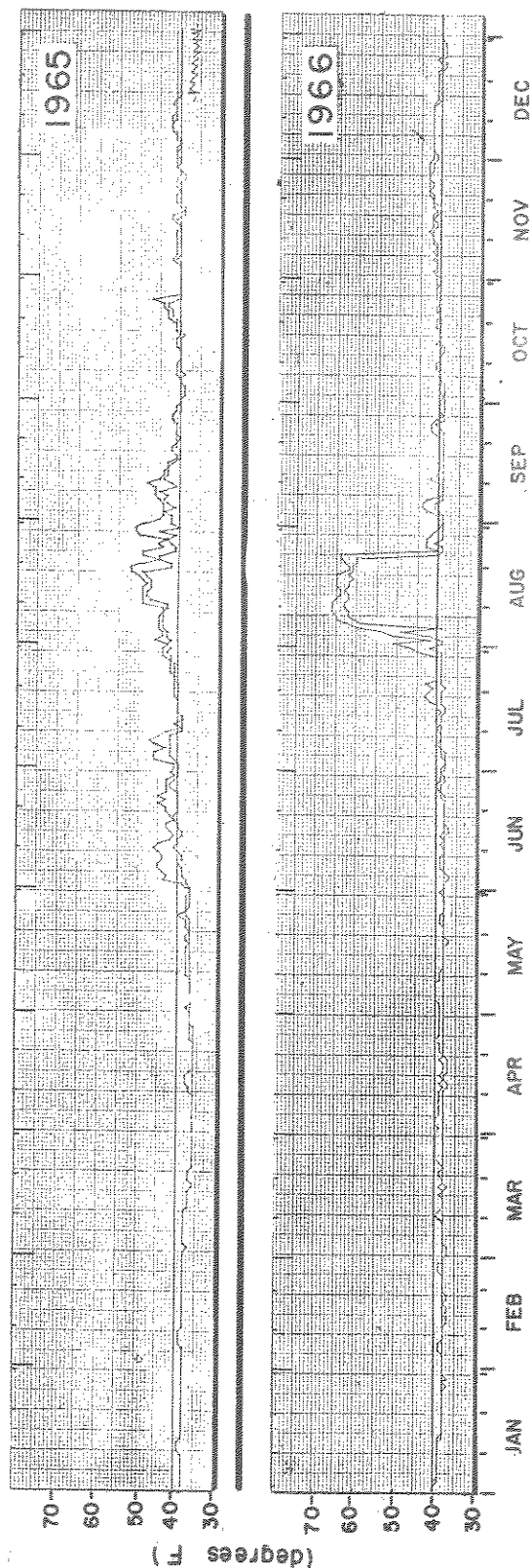


Figure 5. Daily maximum-minimum water temperatures from two stations along the Flathead and South Fork of the Flathead Rivers during 1965 and 1966.

during the winter months. Late winter and spring readings exhibited different norms for all stations for the two years.

Standard Conductance. All water conductance readings were standardized to 77° F. Readings range from 113 to 227 microhms/cm. Two-year averages for stations No. 1, 2, 3, and 4 were 171, 154, 163, and 168 micromhos/cm., respectively. There was little variation between averages of 1965 and 1966 data. Average readings at stations No. 1, 2, 3, were: 5; 4; 1; micromhos/cm. less in 1966. At station No. 4, the 1966 average reading was 1 micromhos/cm. greater than in 1965. The yearly pattern of specific conductance at any station during the period is more evident than the pattern resulting from the total alkalinity data, (Figures 1, 2, 3, and 4). There were also less variation in conductance between years. Readings below Hungry Horse Reservoir (station No. 2) showed less seasonal variation, range 113 to 172, whereas the Blankenship Bridge (station No. 1) ranged 123 to 227.

Dissolved Oxygen. All oxygen concentrations were titrated with a standardized sodium thiosulfate solution and converted to percent saturation at an elevation of 3,000 feet above sea level. There is a 220-foot difference in elevation between the upper and lower stations (3,105 - 2,885 feet). The percent of saturation on the Flathead River ranged from 68 to 109 percent. The highest reading occurred at station No. 2 in early May and lowest at station No. 4 in early December. The two year averages for stations No. 1, 2, 3, and 4 were 92, 86, 93, and 90 percent saturation, respectively. The yearly averages dropped only slightly (1 to 4 percent) at stations No. 1, 2, and 3 between 1965 and 1966. Station No. 4 averages remained constant for both years.

Water Temperature. Daily maximum-minimum water temperatures at station No. 2 (South Fork of the Flathead River below Hungry Horse Reservoir) and station No. 4 (Flathead River at Holt Bridge, three miles above Flathead Lake) are graphically shown in Figure 5. A 40° F. reference line has been drawn on each of the temperature charts. The yearly temperature pattern for station No. 4 (Holt Bridge) remained relatively constant for the two year period. Figure 5 illustrates the temperature patterns of the water released from the dam. This results in the cooling of summer water temperatures and warming of winter water temperatures of 45 miles of the Flathead River above the lake.

Maximum temperatures for station No. 4 during 1965 and 1966 were 64° and 67° F., respectively. Both were reached in mid-August. During 1966 waters in the South Fork station No. 2 were 40° F. or warmer for the month of August. During the rest of the year, reservoir releases held the temperatures at approximately 39° F. It is anticipated that the releases such as that which occurred in 1966 will become the operational pattern of the dam.

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