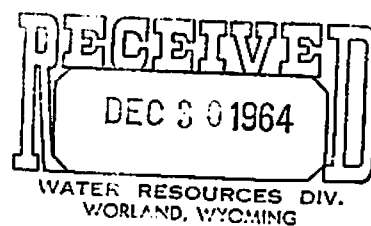


THIRTEENTH ANNUAL REPORT
YELLOWSTONE RIVER COMPACT COMMISSION

1 9 6 4



YELLOWSTONE RIVER COMPACT COMMISSION

408 Federal Building
Helena, Montana

December 21, 1964

Honorable Clifford P. Hansen
Governor of the State of Wyoming
Cheyenne, Wyoming

Honorable Tim M. Babcock
Governor of the State of Montana
Helena, Montana

Honorable William L. Guy
Governor of the State of North Dakota
Bismarck, North Dakota

Sirs:

The thirteenth annual report of the Yellowstone River Compact Commission covering activities during the water year ending September 30, 1964, is submitted. An annual report is required under Article III of the Compact.

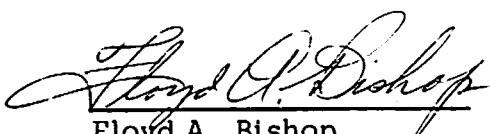
The thirteenth annual meeting of the Commission was held at Billings, Montana, on November 24, 1964, in the offices of the Water Resources Division, U. S. Geological Survey. Mr. F. A. Bishop, Wyoming State Engineer, was the designated representative for Wyoming. Mr. E. V. Darlinton, Montana State Engineer, was the designated representative for Montana. Messrs. A. S. Sollid, U. S. Geological Survey and C. S. Heidel, a former Deputy State Engineer for Montana, were present during all or parts of the meeting. Mr. Frank Stermitz, designated Federal representative, served as chairman and secretary.

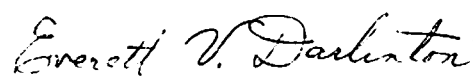
During the 1964 water year, annual streamflow of the several designated streams ranged between 101 and 127 percent of the 1945-60 averages. The flows of the Tongue and Powder Rivers were substantially less than those for 1963 and the Clarks Fork Yellowstone River and Bighorn River discharges were near or greater than those for 1963.


No matters of allocation came to the Commission's attention during the year. The two State representatives were of the opinion that no determination of allocation of water between Wyoming and Montana was necessary.

The expense of the Commission during the fiscal year ending June 30, 1964, was \$9,000 and a like amount is budgeted for the current fiscal year, which will end June 30, 1965.

Respectfully submitted,


Floyd A. Bishop
Commissioner for Wyoming


Everett V. Darlinton
Commissioner for Montana


Frank Stermitz
Federal Representative

GENERAL REPORT

Cost:

Cooperative financial arrangements have continued with Montana and Wyoming each furnishing one-fourth the cost and the remaining one-half is borne by the United States of America. Collection of streamflow records accounts for nearly all the expense. The salaries and necessary expense of the State representatives and hydrologic data furnished through other sources is not evaluated or considered to be an expense of the Commission.

The expense of the Commission during the fiscal year ending June 30, 1964, was \$9,000 and conformed closely to the budget outlined in the last annual report.

The budget for the fiscal year ending June 30, 1965, follows:

	<u>Total Cost</u>	<u>Borne by United States</u>	<u>Borne by</u>	
			<u>Wyoming</u>	<u>Montana</u>
Gaging station operation and miscellaneous measurements of discharge at selected points	\$6,600			
a/ Auxiliary bubbler recorder for Bighorn River at Bighorn, Mont.	\$1,400			
Data assembly and secretarial functions	<u>\$1,000</u>			
	\$9,000	<u>\$4,500</u>	<u>\$2,250</u>	<u>\$2,250</u>

a/ To be undertaken late in the fiscal year if more urgent matters of stream measurement do not arise.

The Commissioners for the States stated they had requested funds for the next biennium on basis of current expenditure level.

Gaging Stations:

Discharge records were collected at the designated points of measurement or practical substitutions therefor as mutually agreed upon in the Rules and Regulations. Miscellaneous measurements of the Clarks Fork Yellowstone River below Edgar and of the Whitehorse Canal were continued to evaluate changes in discharge below the gaging station at Edgar. The complete destruction of the gaging station on the Little Bighorn River near Hardin by the flood of May 2, 1963, and unsuitability of the site prompted a replacement recording station near the new county bridge about a quarter mile upstream. A supplementary re-

recorder was placed on the intervening Agency Canal wasteway. The combination of the two records results in flow of the Little Bighorn River at its mouth. Should degradation of the Bighorn River channel occur as the result of Yellowtail Reservoir operation, it may be practical to again measure the contribution of Little Bighorn River Basin at a single site.

Backwater from high stages on the Yellowstone River affected the records of the Bighorn River at Bighorn, Mont. for about a month. An upstream auxiliary bubbler recording gage would provide a parameter of river slope to improve discharge calculations for such periods. Daily observer service was employed to supplement the generally unsatisfactory recorder record of the Powder River near Locate where shifting sands greatly interfered with recorder operation.

Annual flow at the four designated points of measurement ranged from 101 to 127 percent of the 1945-60 average. The Tongue and Powder River flows were considerably less than those of 1963. Details of streamflow and bar-graph comparisons are given in Appendix B.

Diversions:

The diversions of a priority later than January 1, 1950 were considered to be less than the proportionate shares of the upstream State in this report year. The opinion of the Commissioners for Montana and Wyoming was based upon streamflow and water rights information.

Mr. Darlinton reported a resurvey of the "Water Resources Survey of Carbon County, Montana" would be undertaken in 1965 with publication scheduled for the fall of 1966. The previous survey was made about four years prior to Jan. 1, 1958, which is the base or status for allocation of further water use between the States. The Clarks Fork Yellowstone River drainage in Montana is almost wholly within Carbon County. No resumption of interest in the proposed Cyclone Bar diversion from the Clarks Fork in Wyoming came to the attention of the Commission.

Storage:

In reservoirs completed after January 1, 1950:

Boysen Reservoir on the Wind River, operated by the Bureau of Reclamation, is the principal storage development in this category. There was a net reduction of nearly 100,000 acre feet in content during the water year. Anchor Reservoir, on Owl Creek, contained no water at the beginning and end of the water year. A maximum content of 2,130 acre feet was reported for July 2. Data on these reservoirs are given in Appendix C.

Yellowtail Reservoir, now under construction on the Bighorn River, will also come in this category. There is a bare possibility that storage may begin in the spring of 1965; otherwise, in the fall of 1965. Provision for data collection has been made.

The Commission is aware of other reservoirs of this group and considers their aggregate effect insufficient to justify the collection of storage data that are not readily available.

In reservoirs existing on January 1, 1950:

Compact allocations are affected only by the extent these reservoirs are used for developments completed after January 1, 1950. The extent of pertinent use is still considered to be minor. The month-end storage data for the principal reservoirs in this category are given in Appendix D as a matter of record.

RULES AND REGULATIONS FOR ADMINISTRATION OF
THE YELLOWSTONE RIVER COMPACT

A compact, known as the Yellowstone River Compact between the States of Wyoming, Montana and North Dakota, having become effective on October 30, 1951 upon approval of the Congress of the United States, which apportions the waters of certain interstate tributaries of the Yellowstone River which are available after the appropriative rights existing in the States of Wyoming and Montana on January 1, 1950 are supplied, and after appropriative rights to the use of necessary supplemental water are also supplied as specified in the Compact, the following rules and regulations are adopted subject to the provisions for amendment, revision or abrogation as provided herein.

Article I. Collection of Water Records.

- A. It shall be the joint and equal responsibility of the members of the states of Wyoming and Montana to collect, cause to be collected or otherwise furnish records of tributary stream flow at the points of measurement specified in Article V (B) of the Compact, or as near thereto as is physically or economically feasible or justified.

1. Clarks Fork

The gaging station known as Clarks Fork at Edgar, Montana and which is located in SW 1/4, sec. 24, T.4 S., R.24 E., shall temporarily be the point of measurement for the Clarks Fork, subject to whatever mutually agreeable corrections to the stream-flow records at this point as may be deemed practical to meet the terms of the Compact.

2. Bighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River near Custer, Montana and located near the center of sec. 10, T.4 N., R.34 E., shall temporarily be the designated point of measurement on that stream. The flow of the Little Bighorn River as measured at the gaging station near Hardin, Montana and located in S 1/2, SE 1/4 sec. 18, T.1 S., R.34 E., shall be considered the point of measurement for that stream, except that if or when satisfactory records are not available, the records for the nearest upstream station with practical corrections for intervening inflow

or diversion shall be used.

3. Tongue River

The gaging station known as the Tongue River at Miles City, Montana and located in SE 1/4, sec. 23, T.7 N., R.47 E., shall temporarily be the point of measurement for that stream.

4. Powder River

The gaging station known as the Powder River near Locate, Montana and located in NE 1/4, sec. 26, T.8 N., R.51 E., shall temporarily be the designated point of measurement for that stream.

- B. Records of total annual diversion in acre-feet above the points of measurement designated in the Compact for irrigation, municipal and industrial uses developed after January 1, 1950 shall be furnished by the members of the Commission for their respective states, at such time as the Commission deems necessary for interstate administration as provided by the terms of the Compact. Providing that if it be acceptable to the Commission, reasonable estimates thereof may be substituted.
- C. Annual records of the net change in storage in all reservoirs, not excluded under Article V (E) of the Compact, above the specified point of measurement specified in the Compact and completed after January 1, 1950, and the annual net change in reservoirs existing prior to January 1, 1950, which is used for irrigation, municipal and industrial purposes developed after January 1, 1950, shall be the primary responsibility of the member of the Commission in whose state such works are located; providing, such data is not furnished by federal agencies under the provisions of Article III (D) of the Compact, or, collected by the Commission.

Article II. Office and Officers.

- A. The office of the Commission shall be located, and be that of the United States Geological Survey in Helena, Montana.
- B. The Chairman of the Commission shall be the federal representative as provided in the Compact.
- C. The Secretary of the Commission shall be as provided for in Article III of these rules.
- D. The credentials of each member of the Commission shall be placed on file in the office of the Commission.

Article III. Secretary

- A. The Commission, subject to the approval of the Director of the United States Geological Survey, shall enter into cooperative agreements with the U. S. Geological Survey for such engineering and clerical services as may reasonably be necessary for the administration of the Compact. Said agreements shall provide that the Geological Survey shall:
1. Maintain and operate gaging stations at or near the points of measurement specified in Article V (A) of the Compact.
 2. Assemble factual information on stream flow, diversion and reservoir storage for the preparation of an annual report to the Governors of the signatory states.
 3. Make such investigations and reports as may be requested by the Commission in aid of its administration of the Compact.
- B. Act as Secretary to the Commission.

Article IV. Budget

- A. At the annual meeting of each even numbered year or prior thereto, the Commission shall adopt a budget for operation during the ensuing biennium beginning July first. Such budget shall set forth the total cost of construction, maintenance and operation of gaging stations, the cost of engineering and clerical aid, and other necessary expenses excepting the salaries and personal expenses of the Commissioners. On odd-numbered years revisions of the budget shall be considered.
- B. It shall be the obligation of the Commissioners of the States of Montana and Wyoming to endeavor to secure from the Legislature of their respective states sufficient funds with which to meet the obligations of this Compact, except insofar as provided by the federal government.

Article V. Meetings

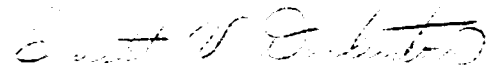
An annual meeting of the Commission shall be held on the third Tuesday of each November at some mutually agreeable point in the Yellowstone River Basin for consideration of the annual report for the water year ending the preceding September 30th, and for the trans-

action of such other business consistent with its authority; provided that by unanimous consent of the Commission the date and place of the annual meeting may be changed. Other meetings as may be deemed necessary shall be held at a time and place set by mutual agreement, for the transaction of any business consistent with its authority.

No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

Article VI. Amendments, Revisions and Abrogations.

The Rules and Regulations of the Commission may be amended or revised by a unanimous vote at any meeting of the Commission.

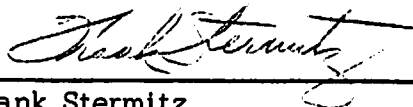


Everett V. Darlinton
Commissioner for Montana



Floyd A. Bishop
Commissioner for Wyoming

ATTESTED:



Frank Stermitz
Federal Representative

Adopted November 17, 1953
Amended November 16, 1959

MONTHLY SUMMARY OF DISCHARGE
Clarks Fork Yellowstone River at Edgar, Montana

Location.--Lat. $45^{\circ}28'00''$, long. $108^{\circ}50'30''$, in SE 1/4, SE 1/4, sec. 23, T.4 S., R.23 E., on right bank just downstream from highway bridge, half a mile east of Edgar and 6 miles upstream from Rock Creek.

Drainage area.--2,032 sq mi.

Records available.--July, 1921 to September, 1964. Monthly discharge only for some periods, published in WSP 1309. Records since January, 1950 available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 3,440 ft (by barometer). Prior to Sept. 18, 1940, chain gage and Sept. 18, 1940 to Aug. 31, 1953 wire-weight gage, at same site and datum.

Average discharge.--43 years; 1,036 cfs (750,000 acre-ft per year).

Extremes.--Maximum discharge during year, 7,280 cfs June 28 (gage height, 7.14 ft); minimum, 90 cfs Mar. 24 (gage height, 0.93 ft).

1921-64: Maximum discharge observed, 10,900 cfs June 2, 1936 (gage height, 8.62 ft); minimum, 36 cfs Apr. 22, 1961.

Remarks.--Records good except those for periods of ice effect, which are poor. Upstream diversions for irrigation of about 41,500 acres, of which 840 acres lie below the station. In addition, about 6,300 acres of land lying above station are irrigated by diversions from the adjoining Rock Creek basin. See next page for data on the flow of Whitehorse Canal and Clarks Fork Yellowstone River near mouth.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in Acre-feet</u>
October 1963	12,688	657	310	409	25,170
November	14,196	582	403	473	28,160
December	11,885	500	200	383	23,570
January 1964	9,380	430	220	303	18,600
February	9,050	340	260	312	17,950
March	9,733	355	140	314	19,310
April	15,090	2,910	300	503	29,930
May	59,687	3,770	480	1,925	118,400
June	132,840	6,920	2,500	4,428	263,500
July	96,407	5,820	893	3,110	191,200
August	14,806	988	210	478	29,370
Sept. 1964	<u>9,342</u>	411	238	311	<u>18,530</u>
Water year 1963-64	395,104	6,920	140	1,080	783,700

MONTHLY SUMMARY OF DISCHARGE
Clarks Fork Yellowstone River at Edgar, Montana

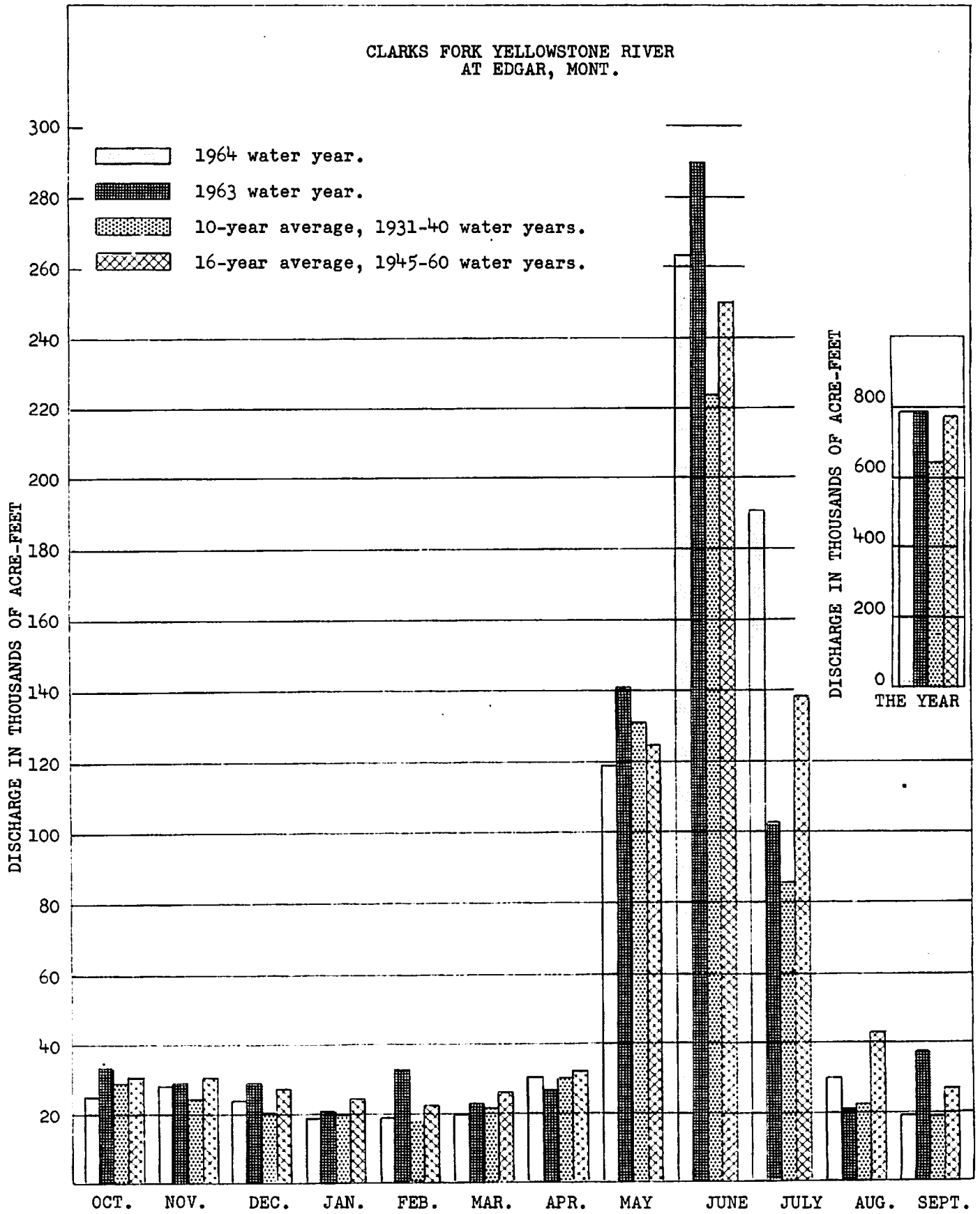
Supplementary Data

The Compact specified the official point of measurement of the Clarks Fork Yellowstone River shall be just above the mouth of Rock Creek about 6 miles downstream from the gaging station at Edgar. The known intervening diversion is the Whitehorse Canal which begins in SW 1/4, sec. 1, T.4 S., R.23 E., about 4 miles downstream from the gaging station. The canal serves about 1,000 acres. Based upon periodic discharge measurements of the diversion and information on canal operation, that seasonal diversion is estimated at about 10,000 acre-feet.

Periodic discharge measurements of the Clarks Fork Yellowstone River in SE 1/4, sec. 1, T.4 S., R.23 E., about half a mile downstream from the Whitehorse Canal diversion and the Whitehorse Canal are tabulated below. Concurrent discharge shown for the gaging station at Edgar is approximately adjusted for lag time. The apparent inflow may generally be return flow from irrigated lands served by Rock Creek water.

Discharge in cfs at selected points

<u>Date</u>	<u>Clarks Fork at Edgar</u>	<u>Whitehorse Canal</u>	<u>Clarks Fork at SE 1/4, sec. 1</u>	<u>Apparent inflow in reach</u>
Oct. 14, 1963	383	18.9	374	+ 10
Nov. 13	470	3.0	467	0
Apr. 24, 1964	347	0	354	+ 7
May 13	711	0	716	+ 5
June 25	4,540	52.7	4,630	+140
July 28	942	41.6	952	+ 52
Aug. 30	442	30.4	455	+ 43
Sept 23	262	18.5	291	+ 48



Comparison of discharge during 1964 water year with 1963 water year and with average discharge for water years 1931-40 and 1945-60.

MONTHLY SUMMARY OF DISCHARGE
Little Bighorn River near Hardin, Montana

Location.--Lat $45^{\circ}44'10''$, long $107^{\circ}33'25''$, in NE 1/4 NW 1/4, sec. 19, T.1 S., R.34 E., on left bank, 50 ft downstream from bridge on Sarpy Road, a quarter of a mile upstream from terminal wasteway of Agency Canal, half a mile upstream from mouth, and 2-1/2 miles east of Hardin.

Drainage area.--1,294 sq mi.

Records available.--June 1953 to September 1964.

Gage.--Water-stage recorder. Altitude of gage is 2,890 ft (from topographic map). Prior to Oct. 7, 1953, wire-weight gage at site 0.4 mile downstream, Oct. 7, 1953 to May 6, 1963, water-stage recorder at site 0.3 mile downstream. May 6, 1963 to Nov. 6, 1963, staff gage at site 0.4 mile downstream. All at different datums.

Average discharge.--11 years, 218 cfs (157,800 acre-ft per year).

Extremes.--Maximum discharge during year, about 3,400 cfs June 12; minimum, 57 cfs Aug. 19.

1953-64: Maximum discharge, 3,750 cfs April 30, 1963 (gage height, 8.76 ft, site and datum then in use); maximum gage height, 11.78 ft Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.2 cfs Aug. 7, 1961, result of discharge measurement.

Remarks.-- Records good except those for periods of ice effect or fragmentary gage-height record, which are poor. Diversions for irrigation of about 17,000 acres above station. Flow partly regulated by Willow Creek Reservoir (capacity, 23,000 acre-ft). Discharges given include flow of terminal wasteway of Agency Canal.

<u>Month</u>	<u>Second foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in Acre-feet</u>
October 1963	3,019	140	71	97.4	5,990
November	4,351	165	111	145	8,630
December	3,912	166	76	126	7,760
January 1964	3,737	151	90	121	7,410
February	3,548	136	101	122	7,040
March	4,455	195	101	144	8,840
April	15,165	2,550	207	506	30,080
May	26,084	1,630	403	841	51,740
June	56,189	3,270	768	1,873	111,400
July	22,247	1,880	257	718	44,130
August	7,508	654	74	242	14,890
September 1964	<u>6,456</u>	403	181	215	<u>12,810</u>
Water year 1963- 1964	156,671	3,270	71	428	310,700

MONTHLY SUMMARY OF DISCHARGE
Bighorn River at Bighorn, Montana

Location.--Lat 46°08'50", long 107°28'00", in NE 1/4 NE 1/4, sec. 33, T.5 N., R.34 E., on right bank half a mile downstream from bridge on Interstate Highway 94, three-quarters of a mile upstream from mouth, 1 mile southwest of Bighorn, and 4 miles east of Custer.

Drainage area.--22,885 sq mi. At site used prior to Oct. 7, 1955, 22,410 sq mi.

Records available.--May 1945 to September 1964. Published as "near Custer," 1945-55. Records since January 1950, available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,690 ft (by barometer). May 11 to Dec. 6, 1945, wire-weight gage and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 miles upstream at different datum.

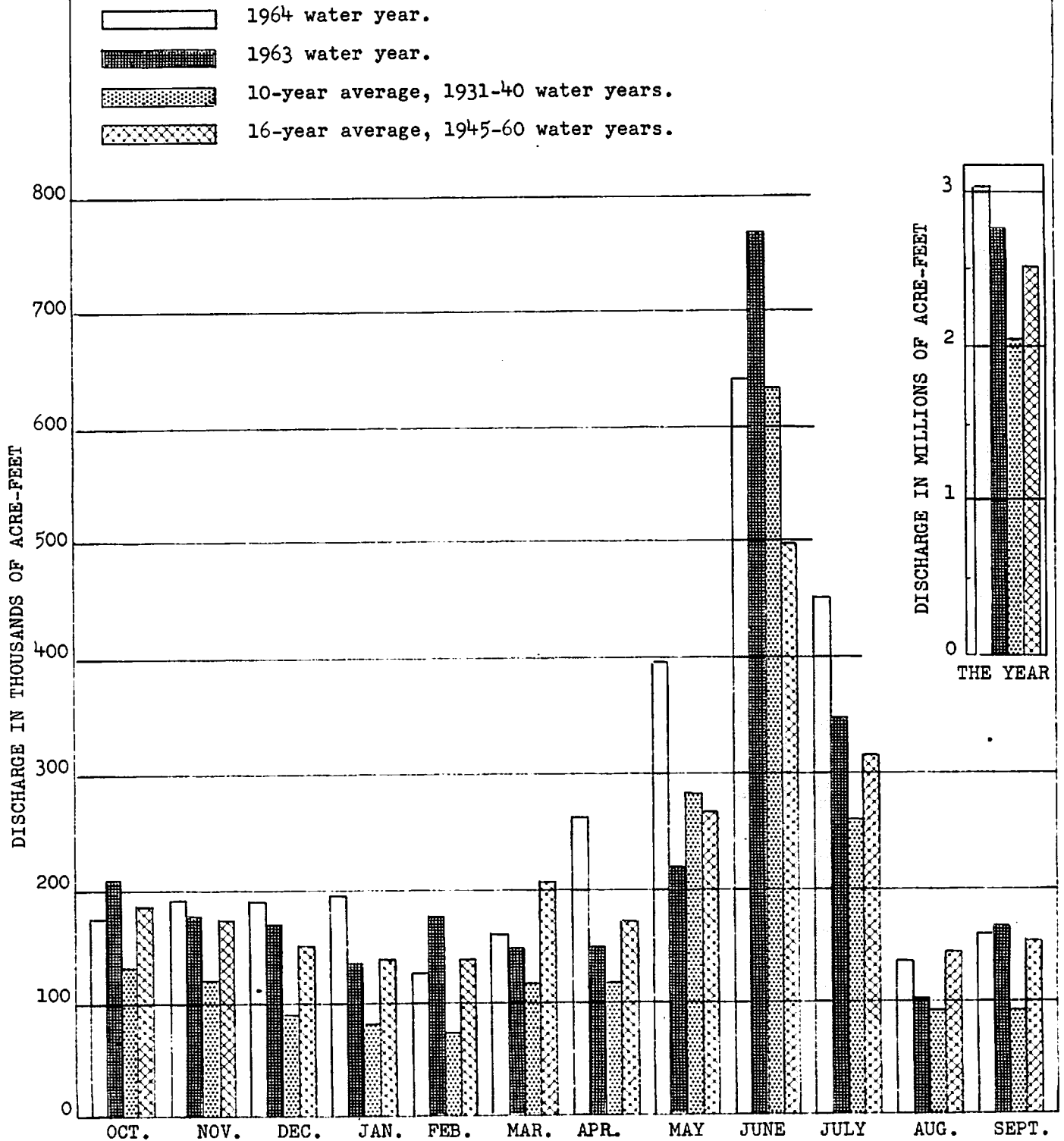
Average discharge.--19 years, 3,673 cfs (2,659,000 acre-ft per year).

Extremes.--Maximum discharge during year, 25,300 cfs June 11 (gage height, 10.17 ft); minimum, 1,490 cfs Aug. 18 (gage height, 1.83 ft). 1945-64: Maximum discharge, 26,200 cfs June 24, 1947 (gage height, 8.79 ft, site and datum then in use), from rating curve extended above 12,500 cfs by logarithmic plotting; maximum gage height recorded, 10.65 ft, Mar. 20, 1947 (ice jam), site and datum then in use; minimum discharge, about 275 cfs Nov. 15, 1959, result of freezeup; minimum daily, 540 cfs July 22, 1960.

Remarks.--Records good except those for periods of ice effect or backwater from Yellowstone River, which are poor. Diversions for irrigation of about 465,000 acres above station. Major regulation by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft (see Appendices C and D).

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in Acre-feet</u>
October 1963	92,410	3,830	2,660	2,981	183,300
November	100,500	4,150	2,390	3,350	199,300
December	99,100	3,790	2,200	3,197	196,600
January 1964	101,500	3,700	2,800	3,274	201,300
February	68,100	3,000	1,900	2,348	135,100
March	84,960	3,670	1,920	2,741	168,500
April	146,620	14,500	3,090	4,887	290,800
May	225,980	10,800	4,600	7,290	448,200
June	380,170	22,800	6,180	12,670	754,100
July	249,800	14,000	2,490	8,058	495,500
August	76,790	5,660	1,530	2,477	152,300
September 1964	<u>86,910</u>	4,110	2,520	2,897	<u>172,400</u>
Water year 1963-1964	1,712,840	22,800	1,900	4,680	3,397,000

BIGHORN RIVER AT BIG HORN, MONT.
MINUS
LITTLE BIGHORN RIVER NEAR HARDIN, MONT.



Comparison of discharge during 1964 water year with 1963 water year and with average discharge for water years 1931-40 and 1945-60.

MONTHLY SUMMARY OF DISCHARGE
Tongue River at Miles City, Montana

Location.--Lat 46°21', long 105°48', in SE 1/4 sec. 23, T.7 N., R.47 E., on right bank 4 miles south of Miles City and 8 miles upstream from mouth.

Drainage area.--5,379 sq mi.

Records available.--April 1938 to April 1942, April 1946 to September 1964. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to September 1932. Monthly discharge only for some periods, published in WSP 1309. Records since January 1950 available in annual report of Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,370 ft (by barometer). April 1938 to April 1942, wire-weight gage at site 8 miles upstream at different datum. April 1946 to September 30, 1963, at datum 1.00 ft higher.

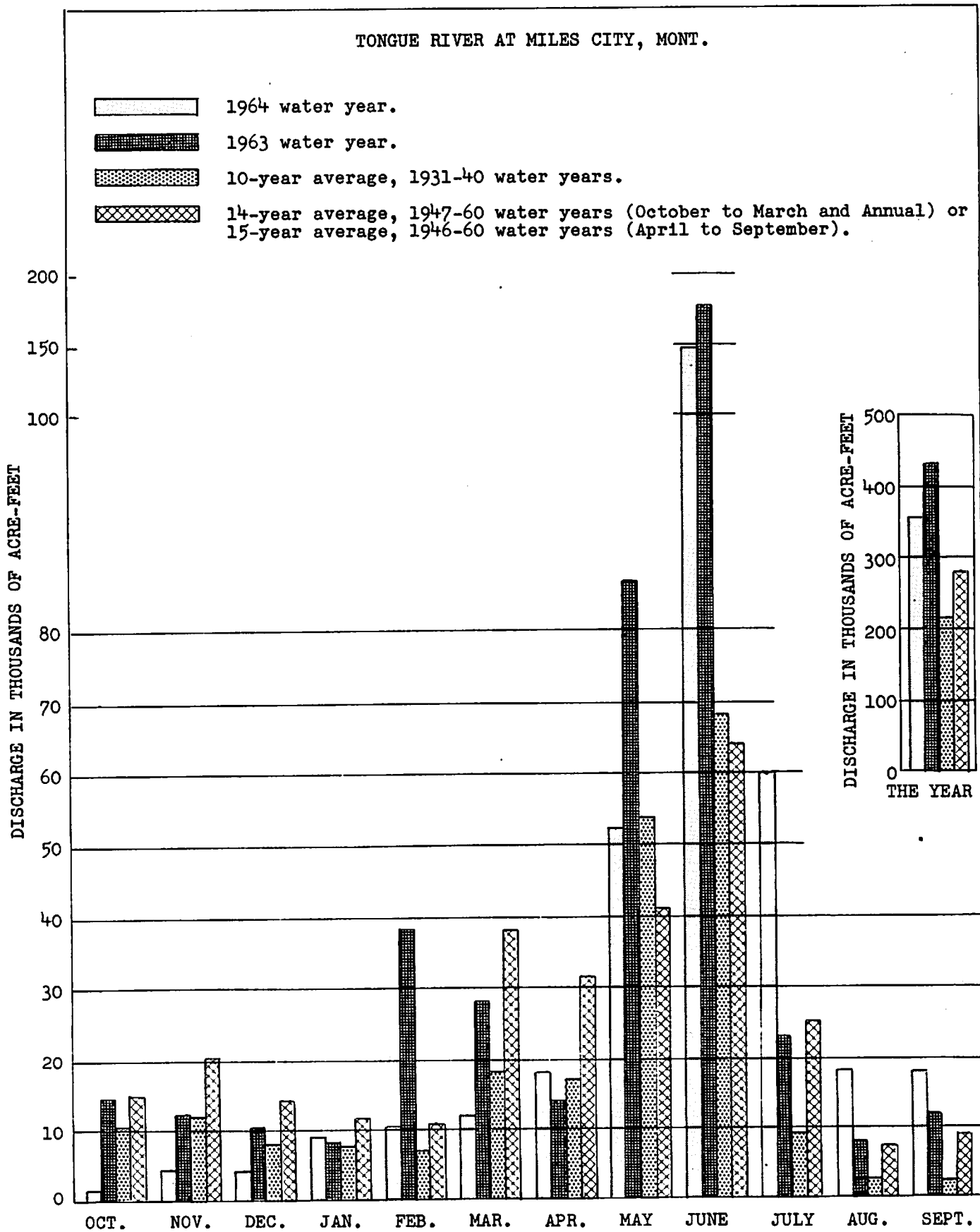
Average discharge.--21 years (1938-41, 1946-64), 366 cfs (265,000 acre-ft per year).

Extremes.--Maximum discharge during year, 5,540 cfs June 19 (gage height, 7.76 ft); minimum daily, 21 cfs Oct. 25-27.

1938-42, 1946-64: Maximum discharge, 13,300 cfs June 15, 1962 (gage height 12.33 ft, present datum), from rating curve extended above 3,200 cfs on basis of float measurement; maximum gage height, 13.27 ft (present datum) March 19, 1960 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

Remarks.--Records good except those for periods of ice effect, which are poor. Diversions for irrigation of about 90,000 acres above station. Flow regulated by Tongue River Reservoir (Appendix C) and many small reservoirs (combined capacity, about 15,000 acre-ft).

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in Acre-feet</u>
October 1963	790	46	21	25.5	1,570
November	2,304	110	22	76.8	4,570
December	2,160	120	30	69.7	4,280
January 1964	4,415	160	110	142	8,760
February	5,225	190	150	180	10,360
March	6,040	260	160	195	11,980
April	9,067	593	150	302	17,980
May	26,244	2,000	240	847	52,050
June	74,873	4,760	591	2,496	148,500
July	30,246	2,880	233	976	59,990
August	9,021	2,000	122	291	17,890
September 1964	<u>8,903</u>	379	240	297	<u>17,660</u>
Water year 1963-1964	179,288	4,760	21	490	355,600



Comparison of discharge during 1964 water year with 1963 water year and with average discharge for water years 1931-40 and 1947-60.

MONTHLY SUMMARY OF DISCHARGE
Powder River near Locate, Montana

Location.--Lat $46^{\circ}26'$, long $105^{\circ}18'$, in NE 1/4 sec. 26, T.8 N., R.51 E., on right bank 50 ft downstream from bridge on U.S. Highway 12 at present site of Locate (5 miles west of former site of Locate), 3 miles upstream from Locate Creek, and 25 miles east of Miles City.

Drainage area.--13,189 sq mi.

Records available.--March 1938 to September 1964. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

Gage.--Water-stage recorder and wire-weight gage. Altitude of gage is 2,400 ft (by barometer). Prior to July 11, 1947, wire-weight gage at bridge 50 ft upstream at same datum.

Average discharge.--26 years, 595 cfs (430,800 acre-ft per year).

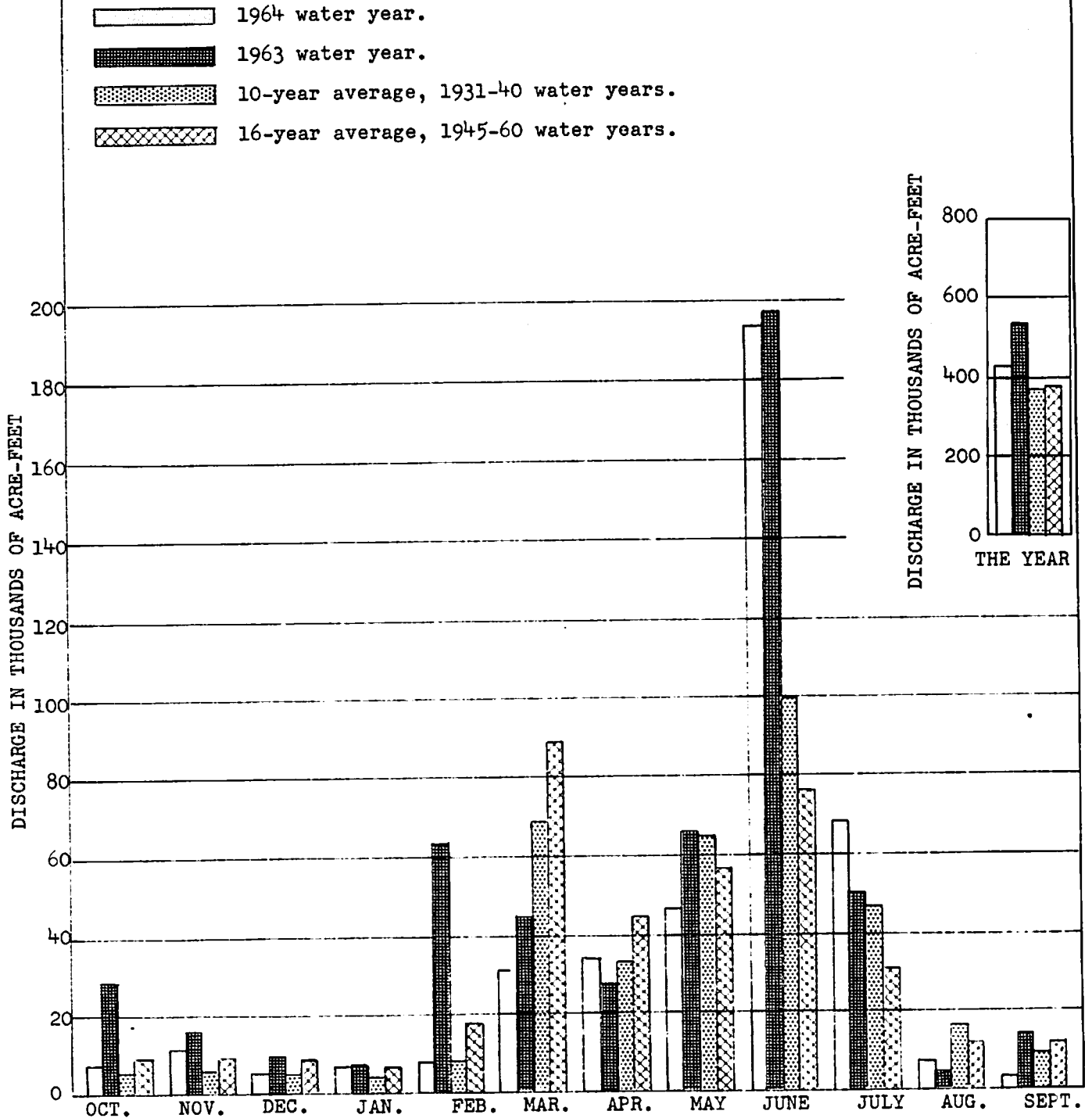
Extremes.--Maximum discharge during year, about 13,000 cfs June 25; minimum observed, 18 cfs Aug. 20 (gage height, 1.38 ft).

1938-64: Maximum discharge observed, 31,000 cfs Feb. 19, 1943 (gage height 11.23 ft), from rating curve extended above 17,000 cfs; no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

Remarks.--Records fair except those for periods of ice effect or no gage-height record, which are poor. Diversions for irrigation of about 52,000 acres above station. Some regulation by tributary reservoirs with combined usable capacity of 36,800 acre-ft.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in Acre-feet</u>
October 1963	3,816	275	84	123	7,570
November	5,678	307	50	189	11,260
December	2,860	200	25	92.3	5,670
January 1964	3,685	155	80	119	7,310
February	3,755	165	110	129	7,450
March	15,169	900	140	489	30,090
April	17,272	960	400	576	34,260
May	23,687	1,700	397	764	46,980
June	97,780	11,500	650	3,259	193,900
July	34,930	4,000	102	1,127	69,280
August	3,644	893	20	118	7,230
September 1964	<u>1,682</u>	142	24	56.1	<u>3,340</u>
Water year 1963-1964	213,958	11,500	20	585	424,300

POWDER RIVER NEAR LOCATE, MONT.



Comparison of discharge for 1964 water year with 1963 water year and with average discharge for water years 1931-40 and 1945-60.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

BOYSEN RESERVOIR

Water-stage recorder at dam on Wind River, about 21 miles south of Thermopolis, Wyoming. Reservoir formed by earth-fill dam, construction of which began in 1947. Storage began October 11, 1951. Dead storage, 62,000 acre-feet at elevation 4,657.0. Usable contents, 758,000 acre-feet at elevation 4,725.0 (top of gates). Crest of dam at elevation, 4,758.

Records given herein represent usable contents. Water is used for irrigation and power development. Allocation for flood control provided. Data furnished by U. S. Bureau of Reclamation.

Extremes.-- Maximum usable contents during year, 759,600 acre-feet July 19 (elevation, 4,725.09 ft); minimum, 404,600 acre-feet May 17 (elevation 4,703.56).

1953-64: Maximum usable contents, 857,400 acre-feet, July 5, 1957 (elevation, 4,729.85 ft); minimum, 189,800 acre-ft March 18, 19, 1956 (elevation, 4,684.18 ft).

<u>Month</u>	<u>Water-surface elevation in feet</u>	<u>*Contents in Acre-feet</u>	<u>Change in contents during month in acre-feet</u>
September 30, 1963	4,724.21	742,400	
October 31	4,723.04	719,900	-22,500
November 30	4,720.15	666,400	-53,500
December 31	4,715.17	580,200	-86,200
January 31, 1964	4,710.36	503,600	-76,600
February 29	4,709.65	492,800	-10,800
March 31	4,708.98	482,700	-10,100
April 30	4,705.85	436,700	-46,000
May 31	4,705.94	438,200	+ 1,500
June 30	4,719.50	654,700	+216,500
July 31	4,724.09	740,000	+85,300
August 31	4,721.27	686,800	-53,200
September 30, 1964	4,718.88	643,700	-43,100
Water year 1963-64			-98,700

* Does not include dead storage of 62,000 acre-feet.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

ANCHOR RESERVOIR

Water-stage recorder at dam on South Fork Owl Creek, 31 miles west of Thermopolis, Wyoming. Reservoir formed by thin concrete arch dam, construction of which began in 1957. Closure of dam made November 21, 1960. Temporary outlet at elevation 6,304.30 ft still in use. Lowest permanent outlet sill at elevation 6,343.75 ft, total contents, 148 acre-feet. Total contents, 17,420 acre-feet at upper active capacity level of 6,441 ft. Crest of dam at elevation 6,452.5 ft.

Records given in this report are total contents. Water is used for irrigation. Data furnished by U. S. Bureau of Reclamation.

<u>Month</u>	<u>Water-surface elevation in feet</u>	<u>* Contents in Acre-feet</u>	<u>Change in contents during month in acre-feet</u>
September 30, 1963	6,304.30	0	
October 31	6,304.30	0	0
November 30	6,304.30	0	0
December 31, 1963	6,304.30	0	0
January 31, 1964	6,304.30	0	0
February 29	6,304.30	0	0
March 31	6,304.30	0	0
April 30	6,304.30	0	0
May 31	6,304.30	0	0
June 30	6,380.27	1,985	+1,985
July 31	6,304.30	0	-1,985
August 31	6,304.30	0	0
September 30, 1964	6,304.30	0	0
Water year 1963-64			0

* Includes dead storage.

RESERVOIRS IN EXISTENCE ON JANUARY 1, 1950

The extent, if any, of the use of reservoirs in this category which may be subject to Compact allocations was not determined. As a matter of hydrologic interest, the month-end contents in acre-feet of four reservoirs are given. The first three reservoirs are in the Bighorn River Basin in Wyoming and data on contents were furnished by the U. S. Bureau of Reclamation. Tongue River Reservoir in Montana is operated under the supervision of the Montana State Water Conservation Board, which agency furnished operating data.

Contents in Acre-feet

<u>Month</u>	<u>Bull Lake</u>	<u>Pilot Butte Reservoir</u>	<u>a/ Buffalo Bill Reservoir</u>	<u>b/ Tongue River Reservoir</u>
September 30, 1963	116,800	5,400	227,200	c/ 25,000
October 31	116,800	0	226,000	29,100
November 30	117,500	6,200	226,100	c/ 36,300
December 31, 1963	114,300	7,500	218,200	40,400
January 31, 1964	108,600	9,400	208,600	c/ 40,700
February 29	102,500	15,900	199,300	41,100
March 31	96,400	24,500	173,700	41,100
April 30	88,700	30,600	146,100	c/ 43,000
May 31	105,100	28,800	215,100	41,600
June 30	147,800	30,800	436,500	64,800
July 31	152,300	23,100	420,500	57,600
August 31	125,900	11,100	341,300	43,400
September 30, 1964	94,800	4,800	277,300	30,000
Change in Contents during year	-22,000	-600	+100	+5,000

a/ Revised capacity table based on survey of 1959; contents prior to October 1960 based on survey of 1941.

b/ Contents based upon sedimentation surveys of October 1948.

c/ Contents estimated on basis of irregular readings of reservoir stage and discharge records above and below the reservoir.