

TWELFTH ANNUAL REPORT  
YELLOWSTONE RIVER COMPACT COMMISSION

1963

YELLOWSTONE RIVER COMPACT COMMISSION

408 Federal Building  
Helena, Montana

December 20, 1963

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 Commission, created in accordance with Article III of the Yellowstone River Compact, submits the following twelfth annual report on activities for the water year ending September 30, 1963.

The twelfth annual meeting of the Yellowstone River Compact Commission was held at the Sheridan Inn at Sheridan, Wyoming on November 19, 1963. Mr. Everett V. Darlington, Montana State Engineer, was the duly designated representative for Montana. Mr. Floyd A. Bishop, Wyoming State Engineer, was the duly designated representative for Wyoming. Mr. E. J. Van Camp, Director of the Division of Water Resources of the Wyoming Natural Resource Board, participated in the meeting. Mr. W. A. Long, of Sheridan, Wyoming, an engineer for Reynolds Aluminum Company, Mr. A. O. Fordyce, a member of the Wyoming Natural Resource Board from Big Horn, Wyoming and C. S. Heidel of Helena, Montana, a former Deputy State Engineer of Montana, were present during all or parts of the meeting. Mr. Frank Stermitz, Federal representative on the Commission, presided and acted as secretary.

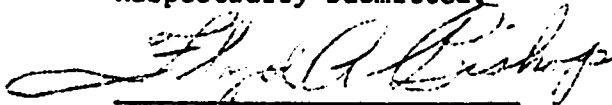
Stream runoff at the designated points of measurement was above average and slightly less than in 1962. August flow was somewhat below average. Storage at major reservoirs in the Bighorn River basin increased by 25,000 acre-feet. A satisfactory irrigation supply was indicated. The Commission was of the opinion that prescribed shares were available and no attempt at detailed inter-state administration of the waters was made.

The two State representatives had received copies of an application for Federal assistance of the U.S. Soil Conservation Service for the construction of irrigation diversion facilities on the Clark's Fork of Yellowstone River in Wyoming. Under this proposal, the major portion of the water would be used as a supplemental supply for lands presently irrigated from tributaries of the Clark's Fork. It was not clear whether

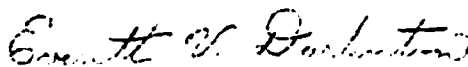
some new land would be served. It was reported that some Montana irrigators were concerned over greater use in Wyoming. The two State Engineers indicated they would keep in touch with plans and the attitude of irrigators in both States.

During the fiscal year ending June 30, 1963, the expense of the Commission was \$8,000. The States of Wyoming and Montana each bore one-fourth of that amount and the Federal Government bore the remaining half. A total budget of \$9,000 is in effect in the current fiscal year, a substantial part of which will be used for the repair of gaging facilities on the Little Bighorn River near Hardin, which were destroyed by floods of May-June 1963. A tentative budget of \$9,000 was considered to be necessary in the fiscal year beginning July 1, 1964.

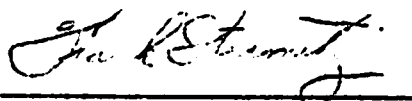
Respectfully submitted,



Floyd A. Bishop  
Commissioner for Wyoming



Everett V. Darlington  
Commissioner for Montana



Frank Stermitz  
Federal Representative

## GENERAL REPORT

### Cost:

The payment of the expense of the Commission is arranged through annual cooperative agreements between the States of Montana and Wyoming and the United States of America. The salaries and necessary expenses of the State representatives and the cost of hydrologic data furnished through other sources is not considered under the cooperative agreements. The expense of the Commission during the fiscal year ending June 30, 1963 conformed with the total budget of \$8,000 as outlined in the last annual report. The expected expenses of the Commission during the fiscal year ending June 30, 1964 are outlined:

	<u>Total Cost</u>	<u>Borne by United States</u>	<u>Borne by Wyoming</u>	<u>Montana</u>
Gaging station operation exclusive of major repair	\$4,700			
Replacement of gaging station on Little Bighorn River near Hardin and major repair at Tongue River & Powder River gages	\$3,300			
Data assembly and administration	<u>\$1,000</u>			
Total	<u>\$9,000</u>	<u>\$4,500</u>	<u>\$2,250</u>	<u>\$2,250</u>

A tentative total budget of \$9,000 was favored for the fiscal year beginning July 1, 1964. The specific gaging station repair or improvements to be conducted will depend on needs and the participation of Federal agencies where they have a strong interest.

### Gaging Stations:

Discharge records were collected at the designated points of measurement. Miscellaneous measurements of the Clark's Fork Yellowstone River near Edgar, Montana and the Whitehorse Canal were made to evaluate the change in discharge below the gaging station at Edgar. The records of discharge are given in Appendix B.

The annual flows at the four designated points of measurement ranged from 122 to 201 percent of the 1931-40 average and 70 to 127 percent of those for 1962. Monthly distribution of flow was about average except for high June flow and generally somewhat below average flow in August. The bar graphs of Appendix B depict the monthly and annual flows in comparison to various bases.

## Diversions:

The Commissioners for Montana and Wyoming were agreed that uses allocable under the Compact appeared to be less than proportionate shares in either State. Only those uses originating after January 1, 1950 fall within Compact allocation.

Mr. Bishop supplied Commission files with recent biennial reports of the Wyoming State Engineer which list the status of water right applications and permits. Some tabulations of pertinent adjudicated water rights were also furnished from Wyoming. Mr. Darlington indicated he would summarize the recent information available on pertinent Montana water right filings.

The application of the Cody and Powell Clark's Fork Soil Conservation Districts of Wyoming to U.S. Department of Agriculture for Federal assistance in the planning and construction of improved diversion and canal facilities on the Clark's Fork Yellowstone River in Wyoming came to the attention of the Commission at the twelfth annual meeting. The application did not describe the tentative plans which may provide for irrigation to some new lands. The two State representatives indicated they would keep the Commission informed of plans as they develop and endeavor to keep in touch with irrigation interests in their respective States. As the water rights of the Clark's Fork in Montana have not been clearly defined or adjudicated, it appears that difficulty may arise in determining the effect of the proposed project upon the allocable shares as specified in the Compact.

## Storage:

### In reservoirs completed after January 1, 1950:

Boysen Reservoir on the Wind River, operated by the U.S. Bureau of Reclamation, is the principal storage development, of direct concern to the Commission. There was a net gain of about 60,000 acre-feet in the content of this reservoir during the water year. Month-end storage data as supplied by the U.S. Bureau of Reclamation are given in Appendix C.

Anchor Reservoir on Owl Creek in the Bighorn River basin continued in a non-operation status as sealing operations continued. The data on content furnished by the U.S. Bureau of Reclamation is given in Appendix C.

The Commission is aware of some other reservoirs within this category. At present their aggregate effect is considered to be 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 use of these reservoirs for developments completed after January 1, 1950. The extent of pertinent use is 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 $\frac{1}{4}$  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 $\frac{1}{2}$ , SE $\frac{1}{4}$  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 $\frac{1}{4}$  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 $\frac{1}{4}$  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

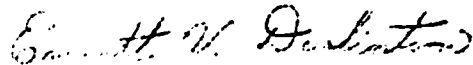


the transaction of such other business consistent with its authority; provided that by unanimous consent of the Commission the date and place of the annual meeting may be changed. Other meetings as may be deemed necessary shall be held at a time and place set by mutual agreement, for the transaction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

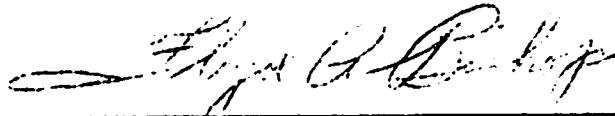
No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

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.

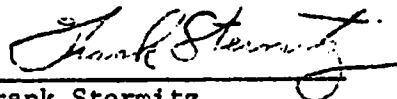


Everett V. Darlington  
Commissioner for Montana



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°28'00", long 108°50'30", in SE $\frac{1}{4}$ SE $\frac{1}{4}$  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 1963. 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.--42 years, 1,035 cfs (749,300 acre-ft per year).

Extremes.--Maximum discharge during year, 7,910 cfs June 16 (gage height, 7.55 ft); minimum daily, 144 cfs Aug. 29.

1921-63: Maximum discharge observed, 10,900 cfs June 2, 1936 (gage height, 8.62 ft); minimum, 36 cfs Apr. 22, 1961.

Remarks.--Records excellent except those for periods of ice effect, which are fair. 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 1962	16,780	681	438	541	33,280
November	14,790	610	415	493	29,340
December	14,702	576	320	474	29,160
January 1963	10,420	470	200	336	20,670
February	16,342	1,500	370	584	32,410
March	11,318	428	318	365	22,450
April	12,975	2,180	225	432	25,740
May	71,206	5,300	675	2,297	141,200
June	145,990	7,670	2,930	4,866	289,600
July	51,729	2,750	717	1,669	102,600
August	10,000	633	144	323	19,830
September 1963	19,068	1,660	198	636	37,820
Water year 1962-63	395,320	7,670	144	1,083	784,100

## 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 $\frac{1}{4}$  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 10,000 acre-feet.

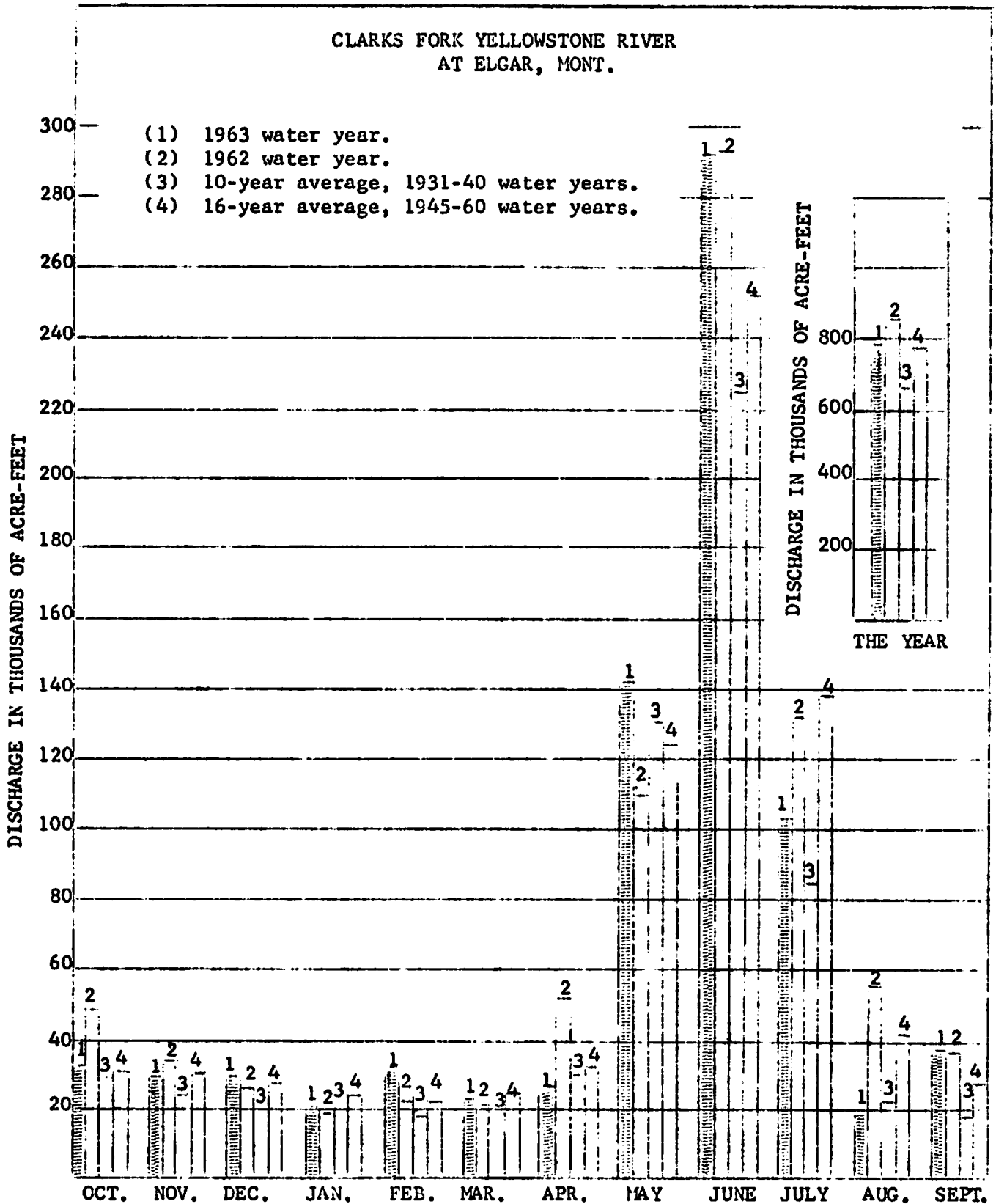
Periodic discharge measurements of the Clarks Fork Yellowstone River in SE $\frac{1}{4}$  sec.1, T.4 S., R.23 E., about half a mile downstream from the Whitehorse Canal diversion and the Whitehorse Canal are tabulated below. Concurrent discharge shown for the gaging station at Edgar is approximately 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<math>\frac{1}{4}</math> sec.1</u>	<u>Apparent inflow in reach</u>
Oct. 25, 1962	480	0	504	+24
Nov. 26	593	0	626	+33
Dec. 23	<u>a/360</u>	0	314	-46
Mar. 23, 1963	332	0	348	+16
Apr. 23	282	<u>b/0.5</u>	311	+29
May 27	4,130	51.6	4,790	+710
June 26	2,770	28.5	2,540	-200
July 11	2,780	49.6	2,550	-180
July 30	808	27.8	790	+10
Aug. 21	230	12.3	283	+65
Sept. 11	485	44.0	480	+39
Sept. 23	1,110	23.6	1,160	+74

a/ Estimated mean daily flow during ice effect

b/ Estimated



Comparison of discharge during 1963 water year with 1962 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°44'20", long 107°33'40", in SE½SE½ sec.18, T.1 S., R.34 E., on right bank 425 ft upstream from highway bridge, half a mile upstream from mouth, and 2 miles east of Hardin.

Drainage area.--1,294 sq mi.

Records available.--June 1953 to September 1963, in reports of the Geological Survey and in annual reports of the Yellowstone River Compact Commission.

Gage.--Water-stage recorder to May 2, when loss through flood damage was imminent. Once-daily staff-gage readings to different datum at bridge May 7 to Sept. 30. Altitude of gage is 2,880 ft (by barometer). Prior to Oct. 7, 1953 wire-weight gage on bridge 425 ft downstream at different datum.

Average discharge.--10 years, 197 cfs (142,600 acre-ft per year).

Extremes.--Maximum discharge during year, 3,750 cfs Apr. 30 (gage height, 8.76 ft); maximum recorded gage height, 9.72 ft Feb. 6 (backwater from ice); minimum daily discharge, 40 cfs Jan. 12.

1953-63: Maximum discharge, that of Apr. 30, 1963; maximum gage height, 11.78 ft Mar. 20, 1960 (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 no gage-height record, which are poor. Diversions for irrigation of about 17,000 acres above station. Flow partly regulated since about 1940 by Willow Creek Reservoir (capacity, 23,000 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 1962	3,936	141	104	127	7,810
November	3,403	147	83	114	6,760
December	2,963	132	50	95.6	5,880
January 1963	2,508	110	40	80.9	4,970
February	7,123	900	140	254	14,130
March	5,379	232	145	174	10,670
April	10,804	3,430	123	360	21,430
May	25,552	1,370	520	824	50,680
June	44,940	2,700	620	1,498	89,140
July	7,510	600	109	242	14,900
August	2,997	148	67	96.7	5,940
September 1963	<u>3,661</u>	210	77	122	<u>7,260</u>
Water year 1962-63	102,781	3,430	40	331	239,600

## MONTHLY SUMMARY OF DISCHARGE

## Bighorn River at Bighorn, Montana

Location.--Lat 46°08'50", long 107°28'00", in NE½NE½ sec.33, T.5 N., R.34 E., on right bank just downstream from bridge on U. S. Highway 10, 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 1963. 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.--18 years, 3,617 cfs (2,619,000 acre-ft per year).

Extremes.--Maximum discharge during year, 23,400 cfs June 19 (gage height, 9.95 ft); minimum daily, 700 cfs Jan. 14.

1945-63: 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.

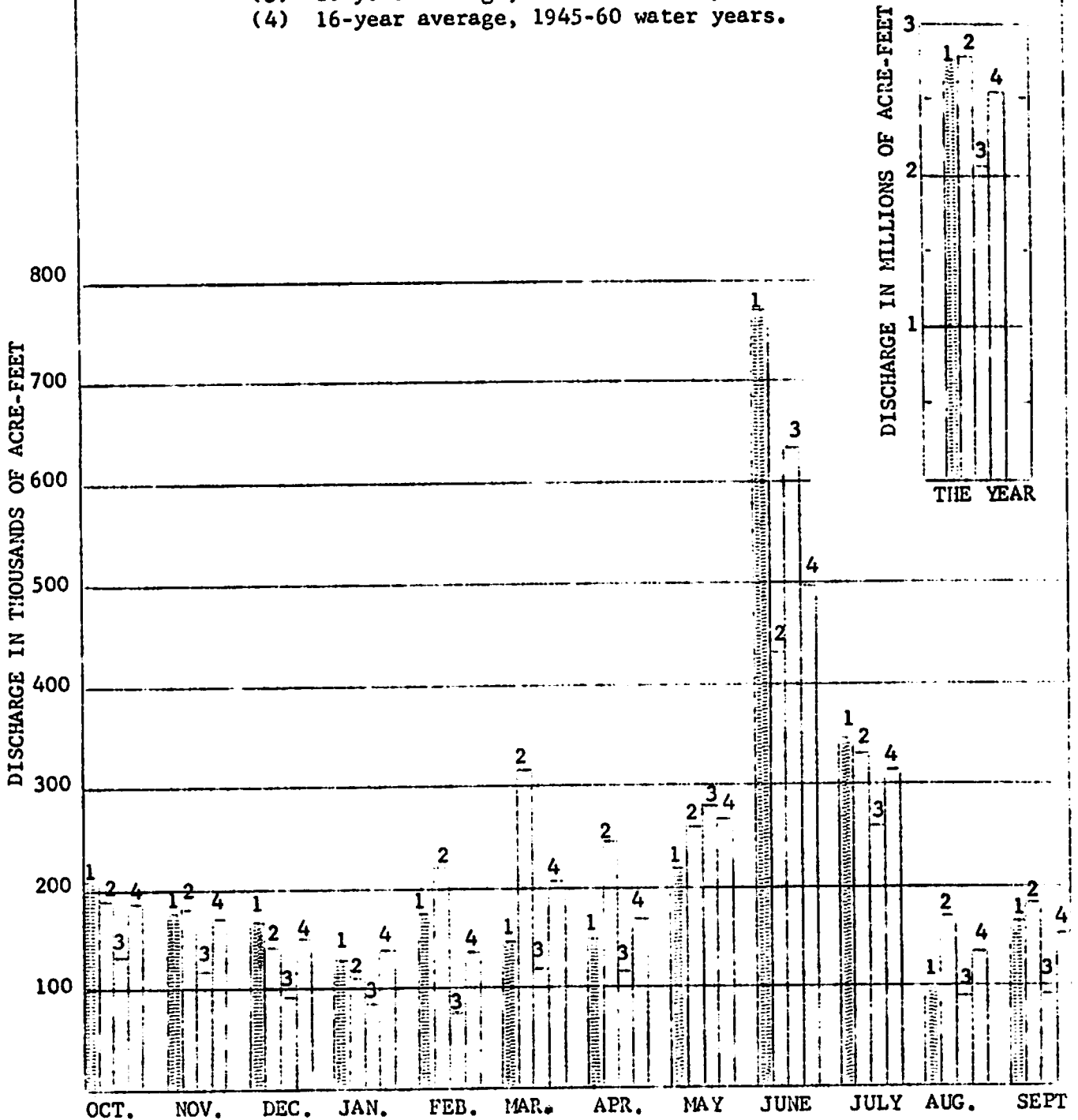
Remarks.--Records good except those for periods of ice effect or backwater from Yellowstone River, which are poor. Diversions for irrigation of about 465,000 acres above station. Major regulation by 14 reservoirs in Wyoming and 1 in Montana with combined usable capacity of about 1,400,000 acre-ft (see 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 1962	109,390	3,930	3,110	3,529	217,000
November	92,500	3,290	2,800	3,083	183,500
December	88,040	3,400	1,600	2,840	174,600
January 1963	67,900	3,600	700	2,190	134,700
February	96,400	6,000	2,200	3,443	191,200
March	79,870	3,550	2,320	2,576	158,400
April	85,980	15,700	1,520	2,866	170,500
May	135,990	8,940	3,010	4,387	269,700
June	431,910	22,800	6,760	14,400	856,700
July	182,710	14,300	1,700	5,894	362,400
August	53,800	1,920	1,490	1,735	106,700
September 1963	<u>88,050</u>	4,760	1,980	2,935	<u>174,600</u>
Water year 1962-63	1,512,540	22,800	700	4,144	3,000,000

BIGHORN RIVER AT BIG HORN, MONT.  
MINUS

LITTLE BIGHORN RIVER NEAR HARDIN, MONT.

- (1) 1963 water year.
- (2) 1962 water year.
- (3) 10-year average, 1931-40 water years.
- (4) 16-year average, 1945-60 water years.



Comparison of discharge during 1963 water year with 1962 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 SE¼ 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 1963. 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.

Average discharge.--20 years (1938-41, 1946-63), 360 cfs (260,600 acre-ft per year).

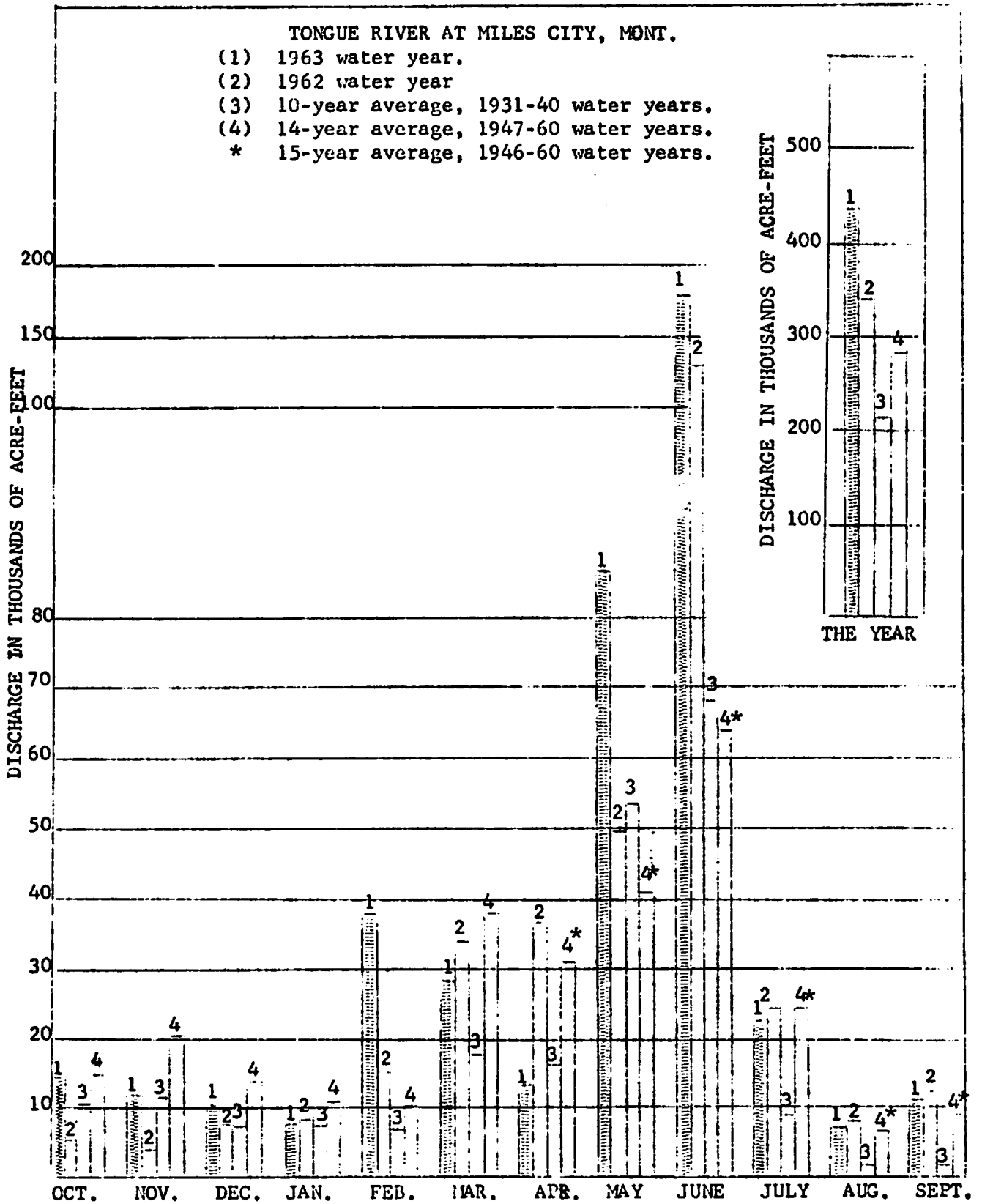
Extremes.--Maximum discharge during year, 5,090 cfs June 22 (gage height, 6.69 ft); minimum daily, 10 cfs Aug. 13.

1938-42, 1946-63: Maximum discharge, 13,300 cfs June 15, 1962 (gage height 11.33 ft); from rating curve extended above 3,200 cfs on basis of float measurement; maximum gage height, 12.27 ft Mar. 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 1962	7,360	433	144	237	14,600
November	6,169	238	144	206	12,240
December	5,319	220	95	172	10,550
January 1963	4,135	220	60	133	8,200
February	19,321	2,500	70	690	38,320
March	14,271	575	219	460	28,310
April	6,900	528	162	230	13,690
May	43,697	2,030	283	1,410	86,670
June	88,990	4,530	1,540	2,966	176,500
July	11,515	1,370	17	371	22,840
August	3,918	400	10	126	7,770
September 1963	<u>5,817</u>	1,050	35	194	<u>11,540</u>
Water year 1962-63	217,412	4,530	10	596	431,200





Comparison of discharge during 1963 water year with 1962 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°26', long 105°18', in NE¼ 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 1963. 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.--25 years, 596 cfs (431,500 acre-ft per year).

Extremes.--Maximum discharge during year, 12,300 cfs June 6 (gage height, 8.30 ft); minimum, 12 cfs Aug. 29 (gage height, 1.33 ft).

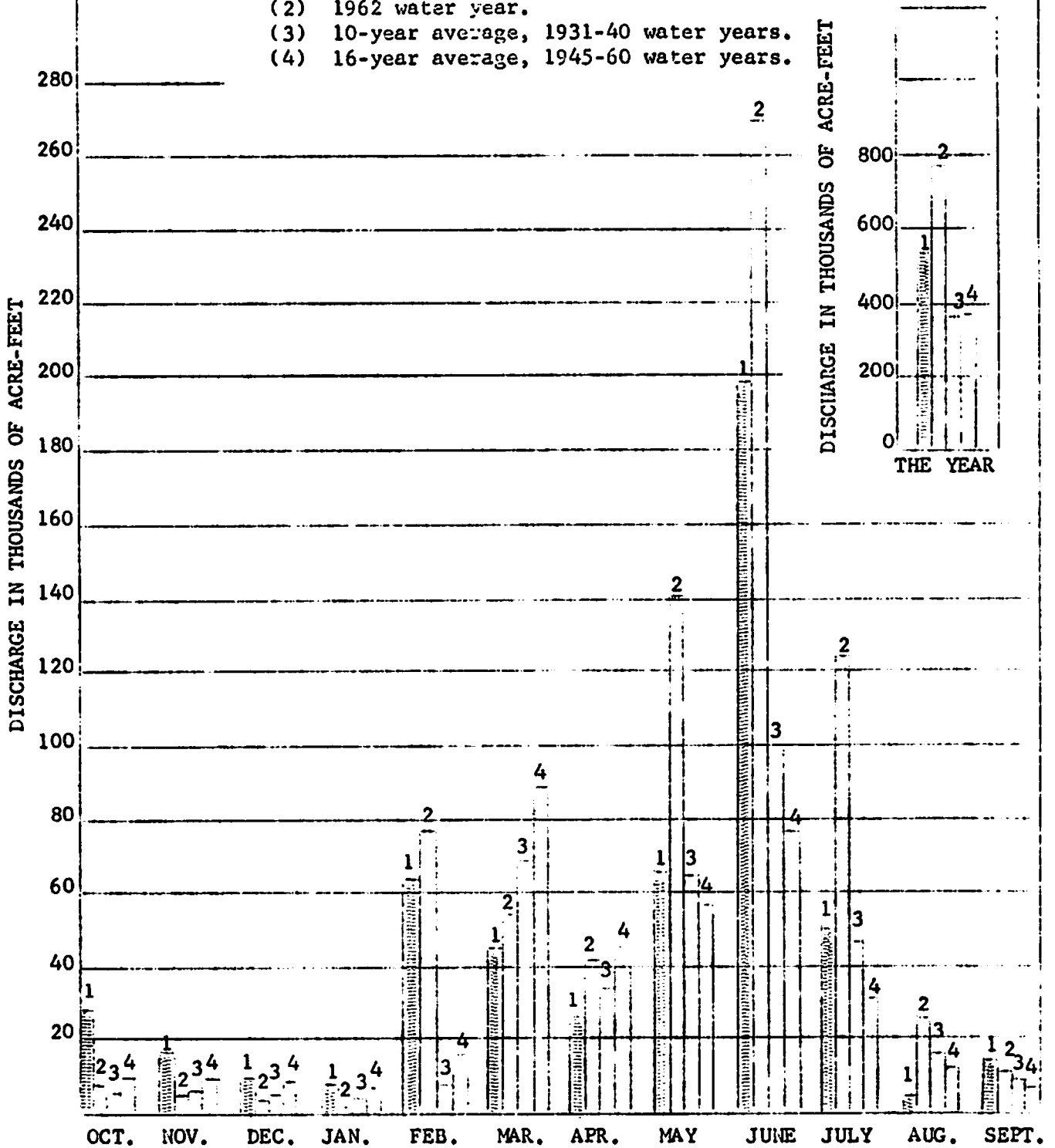
1938-63: Maximum discharge observed, 31,000 cfs Feb. 19, 1943 (gage height 11.23 ft), from rating curve extended above 17,000 cfs; no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

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-ft</u>
October 1962	14,433	1,730	282	466	28,630
November	8,204	310	196	273	16,270
December	5,000	300	40	161	9,920
January 1963	3,800	180	30	123	7,540
February	32,133	3,000	160	1,148	63,730
March	23,101	2,380	418	745	45,820
April	13,736	718	324	458	27,240
May	33,515	1,460	574	1,081	66,480
June	99,620	7,560	1,220	3,321	197,600
July	25,514	2,250	200	823	50,610
August	2,252	180	19	72.6	4,470
September 1963	<u>7,175</u>	750	64	239	<u>14,230</u>
Water year 1962-63	268,483	7,560	19	736	532,500

POWDER RIVER NEAR LOCATE, MONT.

- (1) 1963 water year.
- (2) 1962 water year.
- (3) 10-year average, 1931-40 water years.
- (4) 16-year average, 1945-60 water years.



Comparison of discharge for 1963 water year with 1962 water year and with average discharge for water years 1931-40 and 1945-60.

Appendix C

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, 810,300 acre-feet June 22 (elevation, 4,727.61 ft); minimum, 525,400 acre-feet Apr. 26 (elevation, 4,711.77).

1953-63: Maximum usable contents, 857,400 acre-feet, July 5, 1957 (elevation, 4,729.35 ft); minimum, 189,800 acre-ft March 18, 19, 1956 (elevation, 4,684.13 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, 1962	4,721.02	682,200	
October 31	4,719.23	649,900	-32,300
November 30	4,717.82	625,100	-24,800
December 31	4,714.54	569,800	-55,300
January 31, 1963	4,712.60	538,500	-31,300
February 28	4,712.58	533,200	-300
March 31	4,712.13	531,100	-7,100
April 30	4,712.00	529,000	-2,100
May 31	4,714.20	564,300	+35,300
June 30	4,726.31	783,900	+219,600
July 31	4,723.80	734,400	-49,500
August 31	4,723.03	720,700	-13,700
September 30, 1963	4,724.21	742,400	+21,700
Water year 1962-63			+60,200

\* 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 to reflect storage changes below normal dead storage level. Water is to be 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, 1962	6,304.30	0	
October 31	6,304.30	0	0
November 30	6,304.30	0	0
December 31, 1962	6,304.30	0	0
January 31, 1963	6,304.30	0	0
February 28	6,337.00	72	+72
March 31	6,348.25	223	+151
April 30	6,347.45	208	-15
May 31	6,361.75	632	+424
June 30	6,388.40	2,952	+2,320
July 31	6,304.30	0	-2,952
August 31	6,304.30	0	0
September 30, 1963	6,304.30	0	0
Water year 1962-63			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

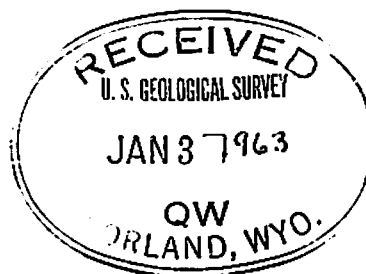
	<u>Bull Lake</u>	<u>Pilot Butte</u> <u>Reservoir</u>	<u>a/ Buffalo Bill</u> <u>Reservoir</u>	<u>b/ Tongue River</u> <u>c/ Reservoir</u>
September 30, 1962	109,400	5,000	319,000	27,000
October 31	104,300	6,400	272,800	26,000
November 30	102,900	7,400	253,200	26,000
December 31, 1962	102,200	3,000	241,200	27,000
January 31, 1963	95,600	13,600	222,900	30,000
February 28	93,100	18,600	216,400	39,000
March 31	91,300	25,500	200,600	30,000
April 30	90,800	30,200	181,900	45,000
May 31	105,000	28,300	286,800	37,000
June 30	150,700	29,300	437,700	46,000
July 31	151,500	21,600	405,100	45,000
August 31	126,100	11,500	320,000	31,000
September 30, 1963	116,800	5,400	277,200	25,000
Change in contents during year	+7,400	+400	-41,800	-2,000

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 stage and discharge records above and below the reservoir.

ELEVENTH ANNUAL REPORT  
YELLOWSTONE RIVER COMPACT COMMISSION  
1962



YELLOWSTONE RIVER COMPACT COMMISSION

408 Federal Building

Helena, Montana

December 21, 1962

Honorable Jack R. Gage  
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:

Pursuant to Article III of the Yellowstone River Compact, the Commission created according to the terms of said Compact, makes the following eleventh annual report on activities for the period ending September 30, 1962.

The eleventh annual meeting of the Yellowstone River Compact Commission was held in the conference room of the U. S. Bureau of Reclamation at Billings, Montana on November 28, 1962. Mr. Earl Lloyd represented Wyoming and Mr. C. S. Heidel, deputy State Engineer for Montana was designated to act for Mr. F. E. Buck, Montana State Engineer. Others in attendance were Mr. E. J. Van Camp, of Wyoming Natural Resources Board and A. S. Sollid of the U. S. Geological Survey at Billings, Montana. Mr. J. W. Ross, attorney-at-law of Fromberg, Montana appeared. Mr. Frank Stermitz, Federal representative, presided.


Stream flow was above average at all designated points of measurement for the water year as a whole. Flows of the fall and winter months were generally greater than usual. June and July flows were high and more than adequate for demands in the remainder of the water year. Storage during the water year increased by about 320,000 acre feet in the Bighorn River Basin in Wyoming.

The substantial flows of the year were indicative that the prescribed shares of Wyoming were not exceeded and no attempts at detailed administration were made. Mr. J. W. Ross told the Commission that critical situations of water supply arose on the Clark's Fork of Yellowstone River during 1961 and may be expected again with greater severity. He had no information to indicate that Wyoming has exceeded its prorata share. He stated new pumping installations have been made or are ready for installation in both states. Mr. Ross said clarification of water rights in Montana should be undertaken for proper administration of the Compact when that should become necessary and also for apportionment of limited flows in Montana. The Commission assured him of its desire to assist in matters pertinent to the Compact, but suggested the division of waters within either State was a matter of local or State control.



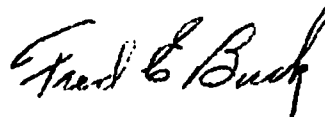
During the fiscal year ending June 30, 1962, the expense of the Commission was \$8,000. Contributions of \$2,000 each were made by the States of Wyoming and Montana and the Federal Government expended \$4,000. A like budget is in force for the fiscal year ending June 30, 1963. A tentative budget of \$9,000 was considered as being reasonable for each year of the succeeding biennium.

Respectfully submitted



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Earl Lloyd  
Commissioner for Wyoming



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Fred E. Buck  
Commissioner for Montana



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Frank Stermitz  
Federal Representative

## GENERAL REPORT

### Cost:

The work of the Commission is financed through annual cooperative agreements between the States of Montana and Wyoming and the United States of America. The costs considered do not include the salaries and necessary expenses of the State representatives which are borne by the respective States, nor the cost of the collection of hydrologic data now being made available through other sources. The expense of the Commission during the fiscal year ending June 30, 1962 is given:

	<u>Total Cost</u>	<u>Borne by United States</u>	<u>Borne by Wyoming Montana</u>
Gaging Station operation, Maintenance	\$7,000		
Data assembly and administration	<u>1,000</u>		
Total	\$8,000	\$4,000	\$2,000 \$2,000

The budget for the fiscal year ending June 30, 1963 was adopted for the above amount and the same proportionate shares. It is expected the auxiliary gage on the Bighorn River at Big Horn, Montana will be installed after delays incident to the construction of the interstate highway in this vicinity.

At the eleventh annual meeting, tentative budgets of \$9,000 were suggested for each year of the coming biennium. It is anticipated that the rising cost index, additions to data collection and items relating to administration will require this sum.

### Gaging Stations:

Discharge records were generally collected at the designated points of measurement. Supplementary data were collected on the Clark's Fork Yellowstone River near Edgar, Montana to evaluate the change in discharge below the gaging station at Edgar. The records of discharge are given in Appendix B.

The annual flows at the points of measurement ranged from 131 to 206 percent of the 1931-40 average and 145 to 1,320 percent of those for 1961. The least relative increase was on the Clark's Fork Yellowstone River and the greatest on the Powder River. Flows of the first six months of the water year were generally above average. April flows were low on some streams. Rains of June and July resulted in a sharp upturn in stream flow and a higher base flow level. The bar graphs of Appendix B illustrate the relative magnitude of the monthly and annual flows in comparison with various bases.

### Diversions:

The Commissioners for Montana and Wyoming were agreed that allocable uses under the Compact were less than the proportionate shares in either State. The Compact only provides for the allocation of water uses originating after January 1, 1950.

Mr. Buck furnished a list of reported water right filings in Montana for the period November 21, 1961 through October 31, 1962. Three previous listings are on file. Mr. Lloyd stated he would soon furnish another list to supplement the furnished listing of 1957. The printed biennial reports of the Wyoming State Engineer carry complete lists for all of Wyoming.

Storage:

In reservoirs completed after January 1, 1950:

Boysen Reservoir on the Wind River, operated by the U. S. Bureau of Reclamation, is the principal reservoir in this category. There was a net gain of 279,000 acre feet of storage during the water year. Month-end storage data are given in Appendix C.

The sealing operation of Anchor Reservoir on Owl Creek in the Bighorn River basin continued. The limited use is illustrated in the data furnished by the U. S. Bureau of Reclamation in Appendix C.

The Commission is aware of some small reservoirs which may properly come in this category. At present their aggregate effect is considered to be insufficient to justify the collection of storage data that is not readily available.

In reservoirs existing on January 1, 1950

Compact allocations are only affected by the storage in these reservoirs as it may be used for developments completed after January 1, 1950. The extent of pertinent use is considered to be minor. The quantities in storage in the principal reservoirs in this category are given in Appendix D as a matter of hydrologic information.

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 $\frac{1}{4}$  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 $\frac{1}{2}$ , SE $\frac{1}{4}$  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 $\frac{1}{4}$  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 $\frac{1}{4}$  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**

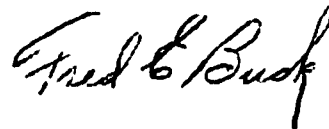
An annual meeting of the Commission shall be held on the third Tuesday of each November at some mutually agreeable point in the Yellowstone River Basin for consideration of the annual report for the water year ending the preceding September 30th, and for

the transaction 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.



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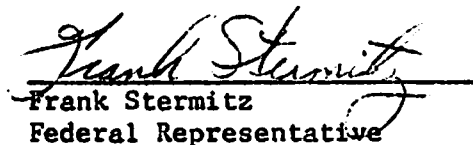
Fred E. Buck  
Commissioner for Montana



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Earl Lloyd  
Commissioner for Wyoming

Attested:



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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°28'00", long 108°50'30", in SE<sup>1</sup>/<sub>4</sub>SE<sup>1</sup>/<sub>4</sub> 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 1962. 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.--41 years, 1,034 cfs (748,600 acre-ft per year).

Extremes.--Maximum discharge during year, 7,830 cfs June 16 (gage height, 7.40 ft); minimum daily, 200 cfs Jan. 20, Feb. 23, 28.

1921-62: Maximum discharge observed, 10,900 cfs June 2, 1936 (gage height, 8.62 ft); minimum, 36 cfs Apr. 22, 1961.

Remarks.--Records excellent 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. Information similar to that previously given herein for Whitchorse Canal will be found on page 10.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in Acre-feet</u>
October 1961	25,159	1,020	693	812	49,900
November	17,310	780	440	577	34,330
December	12,935	510	280	417	25,660
January 1962	9,825	460	200	317	19,490
February	11,195	800	200	400	22,200
March	11,043	480	230	356	21,900
April	26,768	2,040	335	892	53,090
May	54,830	2,650	748	1,769	108,800
June	146,980	7,210	2,260	4,899	291,500
July	66,390	4,250	1,200	2,142	131,700
August	28,197	1,960	407	910	55,930
September 1962	<u>18,629</u>	<u>779</u>	<u>456</u>	<u>621</u>	<u>36,950</u>
Water year 1961-62	429,261	7,210	200	1,176	851,400



## MONTHLY SUMMARY OF DISCHARGE

## Clarks Fork Yellowstone River at Edgar, Montana

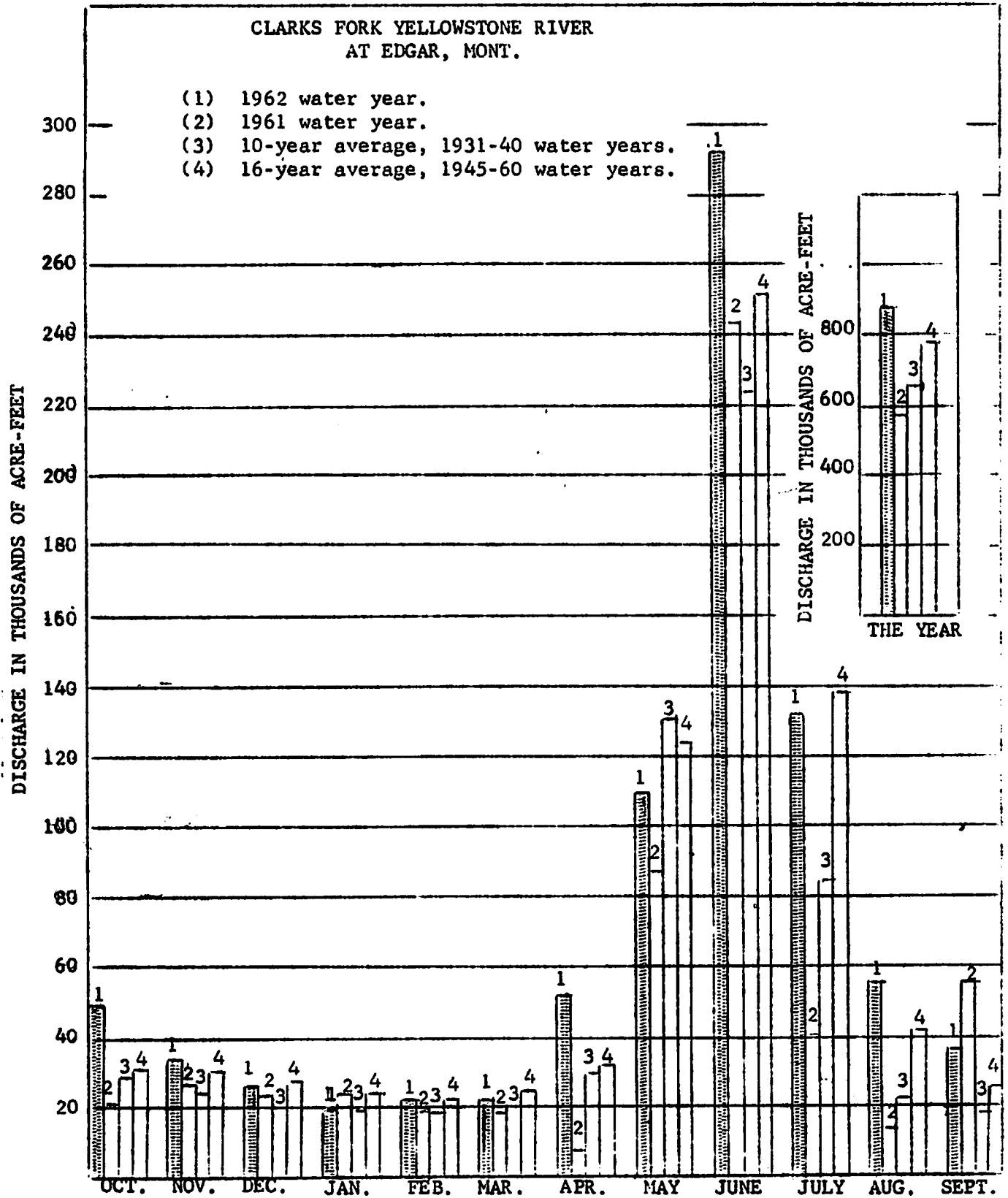
## Supplementary Data

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 $\frac{1}{4}$  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 6,000 acre-feet.

A cableway for discharge measurements was constructed across the Clarks Fork Yellowstone River about half a mile downstream from the Whitehorse Canal in SE $\frac{1}{4}$  sec.1, T.4 S. R.23 E. The periodic measurements of discharge of the stream at this point, those of the Whitehorse Canal and concurrent daily discharge flow at the gaging station are presented. No adjustment has been made to the mean daily flow at Edgar which could be a factor at times of significantly changing stage. The apparent inflow may generally be return flow from irrigated lands served by Rock Creek.

## Discharge in cfs at selected points

<u>Date</u>	<u>Clarks Fork at Edgar</u>	<u>Whitehorse Canal</u>	<u>Clarks Fork at SE<math>\frac{1}{4}</math> sec.1</u>	<u>Apparent inflow in reach</u>
Dec. 18, 1961	445	0.	466	+21
Apr. 30 1962	1,170	0.	1,160	-10
June 11	3,760	-	3,760	-
June 21	5,880	12.7	5,870	0
July 11	2,260	41.6	2,080	-138
Aug. 2	1,590	18.8	1,470	-100
Aug. 27	446	19.6	505	+79
Sept. 15	705	7.3	754	+56



Comparison of discharge during 1962 water year with 1961 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°44'20", long 107°33'40", in SE½SE½ sec.18, T.1 S., R.34 E., on right bank 425 ft upstream from highway bridge, half a mile upstream from mouth, and 2 miles east of Hardin.

Drainage area.--1,294 sq mi.

Records available.--June 1953 to September 1962, in reports of the Geological Survey and in annual reports of the Yellowstone River Compact Commission.

Gage.--Water-stage recorder. Altitude of gage is 2,880 ft (by barometer). Prior to Oct. 7, 1953, wire-weight gage on bridge 425 ft downstream at different datum.

Average discharge.--9 years, 182 cfs (131,800 acre-ft per year).

Extremes.--Maximum discharge during year, 1,300 cfs June 17; maximum recorded gage height, 8.99 ft Mar. 19 (backwater from ice); minimum daily discharge, 10 cfs Dec. 12, 13.

1953-62: Maximum discharge, about 3,000 cfs Mar. 21, 1960; maximum gage height, 11.78 ft Mar. 20, 1960 (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, no gage-height record, and those for period June 14-17, which are poor. Diversions for irrigation of about 17,000 acres above station. Flow partly regulated since about 1940 by Willow Creek Reservoir (capacity, 23,000 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 1961	3,499	175	68	113	6,940
November	3,436	167	55	115	6,820
December	2,129	142	10	68.7	4,220
January 1962	2,545	190	.20	82.1	5,050
February	6,180	360	.65	221	12,260
March	6,103	377	.70	197	12,110
April	7,651	450	175	255	15,180
May	10,767	476	222	347	21,360
June	15,947	1,120	339	532	31,630
July	5,099	340	52	164	10,110
August	2,390	157	38	77.1	4,740
September 1962	<u>3,496</u>	<u>177</u>	<u>90</u>	<u>117</u>	<u>6,930</u>
Water year 1961-62	69,242	1,120	10	190	137,400

## MONTHLY SUMMARY OF DISCHARGE

## Bighorn River at Bighorn, Montana

Location.--Lat 46°08'50", long 107°28'00" (revised), in NE~~NE~~ sec.33, T.5 N., R.34 E., on right bank just downstream from bridge on U. S. Highway 10, 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 1962. 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.

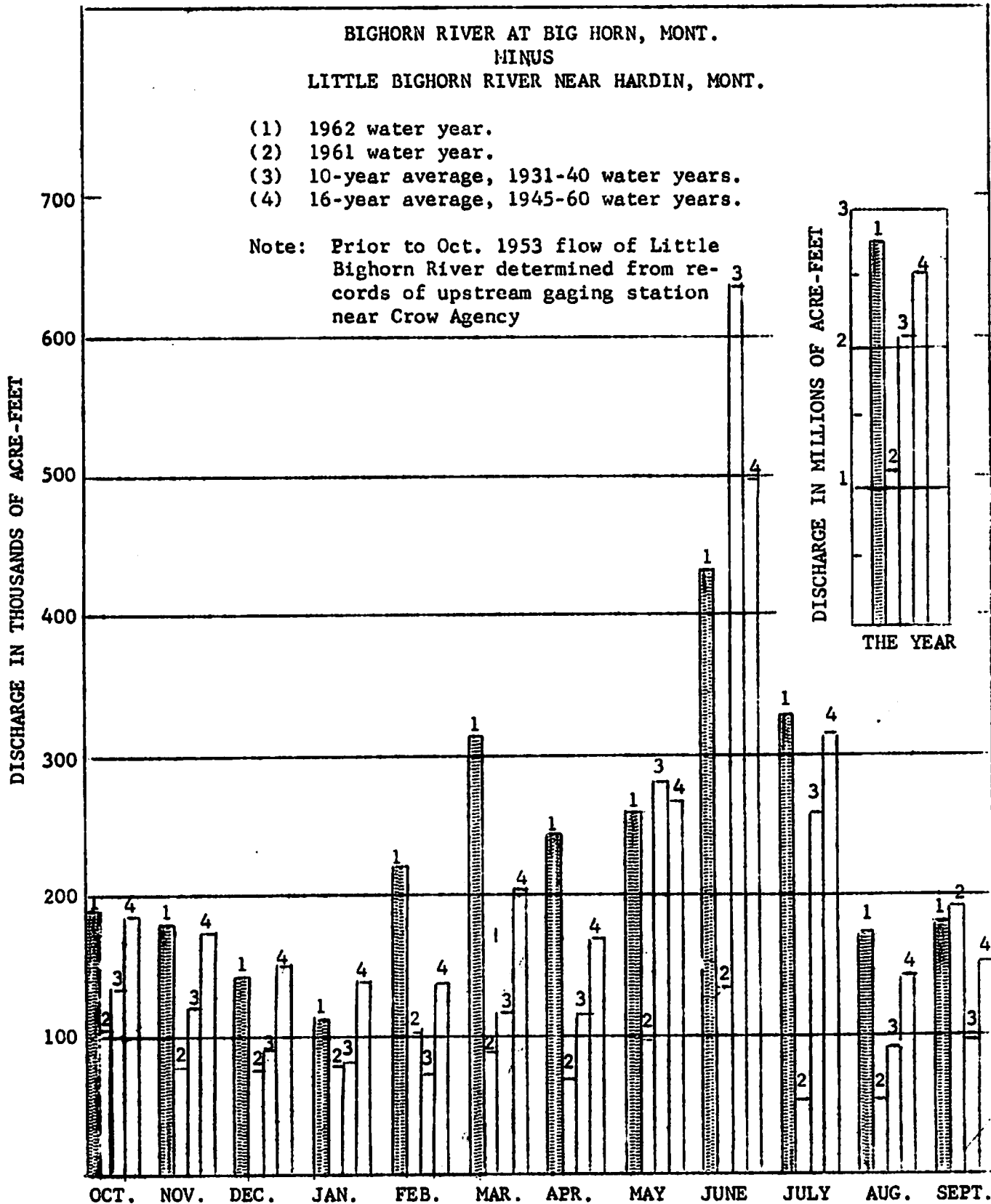
Average discharge.--17 years, 3,586 cfs (2,596,000 acre-ft per year).

Extremes.--Maximum discharge during year, about 15,000 cfs Feb. 15 (gage height, 10.29 ft, backwater from ice); minimum recorded, 767 cfs Dec. 10 (gage height, 0.94 ft).

1945-62: 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 1961	99,160	6,550	2,620	3,199	196,700
November	93,680	3,430	2,720	3,123	185,800
December	73,790	3,010	1,400	2,380	146,400
January 1962	58,800	2,700	1,000	1,897	116,600
February	118,070	13,000	1,810	4,217	234,200
March	165,220	10,400	2,000	5,330	327,700
April	129,950	6,200	2,630	4,332	257,800
May	141,460	10,100	3,310	4,563	280,600
June	234,380	12,600	3,930	7,813	464,900
July	171,740	10,700	2,090	5,540	340,600
August	89,130	5,510	1,870	2,875	176,800
September 1962	<u>95,040</u>	<u>3,870</u>	<u>2,720</u>	<u>3,168</u>	<u>188,500</u>
Water year 1961-62	1,470,420	13,000	1,000	4,029	2,917,000



Comparison of discharge during 1962 water year with 1961 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 SE¼ 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 1962. 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.

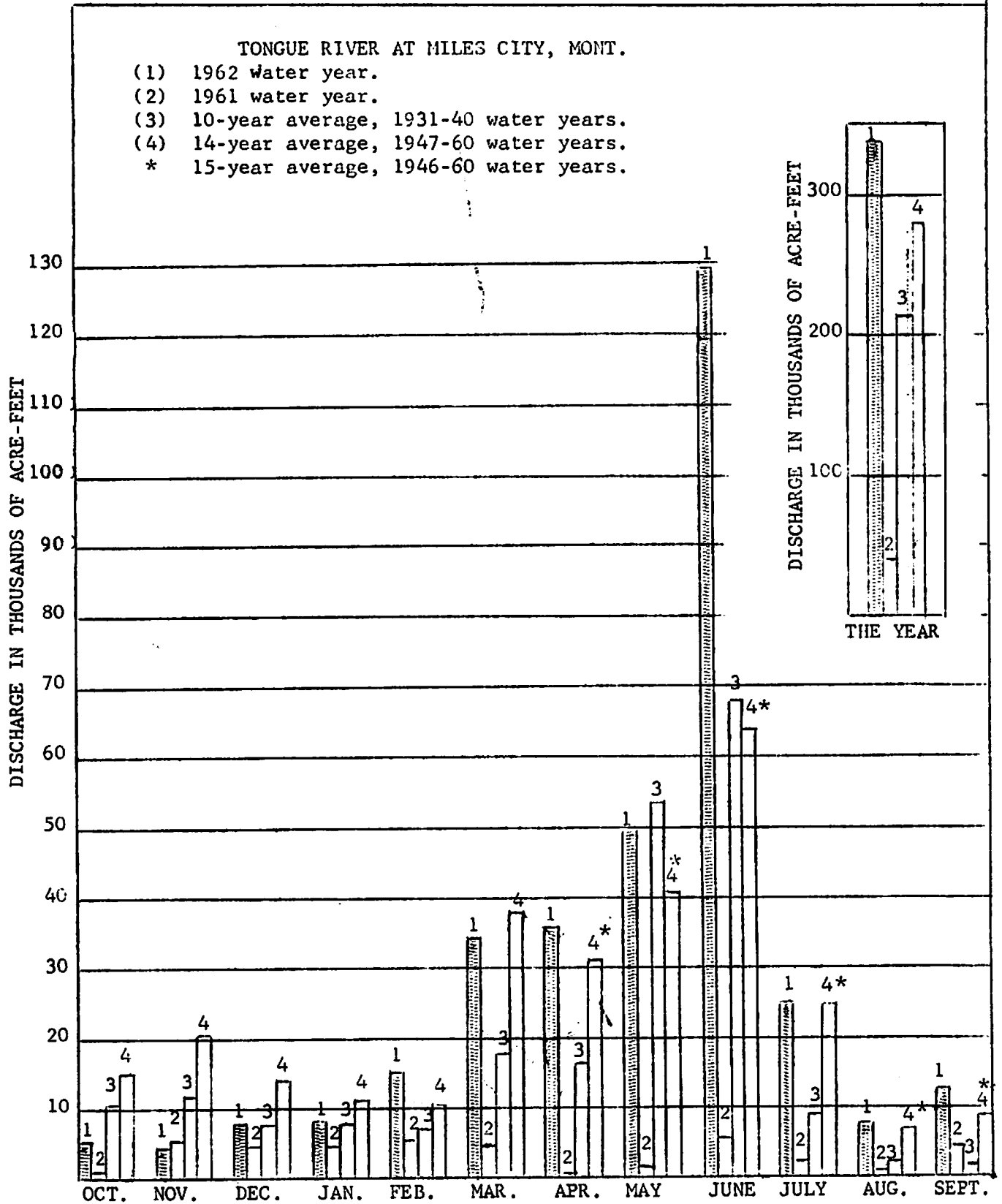
Average discharge.--19 years (1938-41, 1946-62), 347 cfs (251,200 acre-ft per year).

Extremes.--Maximum discharge during year, 13,300 cfs June 15 (gage height, 11.33 ft); From rating curve extended above 3,200 cfs on basis of float measurement; minimum daily, 15 cfs Nov. 17.

1938-42, 1946-62: Maximum discharge, that of June 15, 1962; maximum gage height, 12.27 ft Mar. 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 1961	2,475	139	45	79.8	4,910
November	2,375	199	15	79.2	4,710
December	4,121	180	90	133	3,170
January 1962	4,215	220	85	136	8,360
February	7,650	460	180	273	15,170
March	17,563	1,600	290	567	34,840
April	18,503	1,140	274	617	36,700
May	24,961	1,540	191	805	49,510
June	65,293	9,290	833	2,176	129,500
July	12,707	1,610	73	410	25,200
August	4,060	220	35	131	8,050
September 1962	<u>6,698</u>	<u>270</u>	<u>155</u>	<u>223</u>	<u>13,290</u>
Water year 1961-62	170,621	9,290	15	467	338,400



Comparison of discharge during 1962 water year with 1961 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°26', long 105°18', in NE¼ 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 1962. 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.--24 years, 590 cfs (427,100 acre-ft per year).

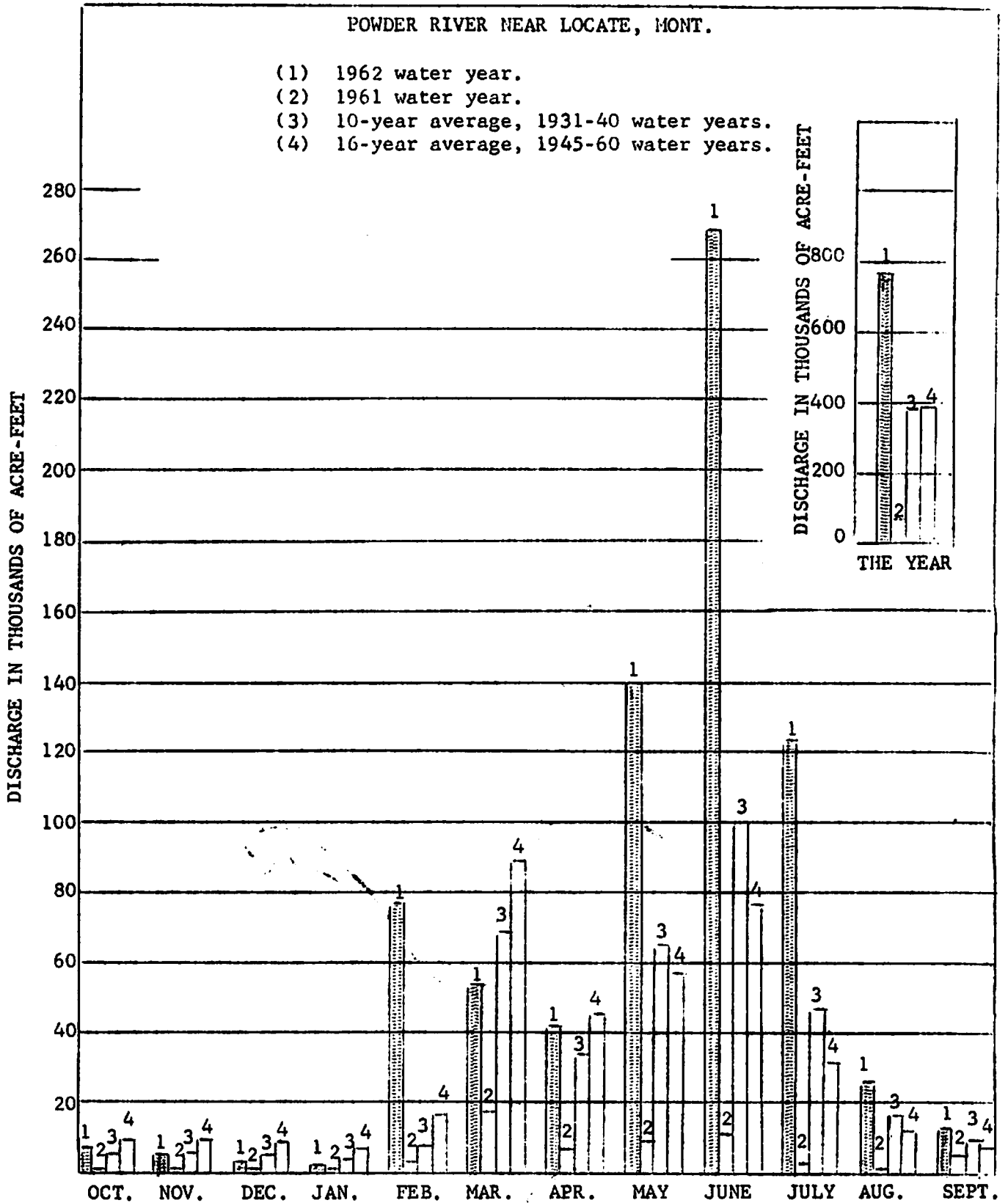
Extremes.--Maximum discharge during year, 19,400 cfs June 20 (gage height, 8.75 ft); minimum daily, 4 cfs Dec. 28.

1938-62: 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-ft</u>
October 1961	3,628	301	58	117	7,200
November	2,680	150	60	89.3	5,320
December	1,559	150	4	50.3	3,090
January 1962	990	100	5	31.9	1,960
February	38,905	10,000	45	1,389	77,170
March	26,990	3,800	95	871	53,530
April	21,115	1,530	383	704	41,880
May	70,538	9,780	572	2,275	139,900
June	135,540	15,000	1,640	4,518	268,800
July	62,136	11,200	505	2,004	123,200
August	13,187	1,170	161	425	26,160
September 1962	6,500	723	117	217	12,890
Water year 1961-62	383,768	15,000	4	1,051	761,100





Comparison of discharge for 1962 water year with 1961 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 4657.0. Usable contents, 758,000 acre-feet at elevation 4725.0 (top of gates). Crest of dam at elevation 4758.

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

Extremes.--Maximum usable contents during year, 757,400 acre-feet Aug. 2, 3 (elevation, 4,724.98 ft); minimum, 319,100 acre-feet Apr. 19 (elevation, 4,696.73 ft).

1953-62: 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, 1961	4,703.45	403,100	
October 31	4,704.10	412,000	+8,900
November 30	4,703.49	403,600	-8,400
December 31	4,701.55	377,900	-25,700
January 31, 1962	4,700.17	360,300	-17,600
February 28	4,703.32	401,300	+41,000
March 31	4,698.17	336,000	-65,300
April 30	4,697.88	332,500	-3,500
May 31	4,702.03	384,100	+51,600
June 30	4,720.55	673,600	+289,500
July 31	4,724.92	756,200	+82,600
August 31	4,722.71	713,600	-42,600
September 30, 1962	4,721.02	682,200	<u>-31,400</u>
Water year 1961-62			+279,100

\* 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 to reflect storage changes below normal dead storage level. Water is to be 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, 1961	6,339.00	89	
October 31	6,347.85	215	+126
November 30	6,344.88	163	-52
December 31, 1961	6,335.00	55	-108
January 31, 1962	6,332.09	40	-15
February 28	6,343.61	146	+106
March 31	6,353.19	339	+193
April 30	6,354.50	375	+36
May 31	6,304.30	0	-375
June 30	6,357.03	454	+454
July 31	6,340.00	98	-356
August 31	6,304.30	0	-98
September 30, 1962	6,304.30	0	0
Water year 1961-62			-89

\* 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.

Revisions.--Data received subsequent to publication of the Tenth Annual Report, reveals some interpolated month-end contents for Tongue River Reservoir are incorrect in the 1961 report. A revised yearly table is given herewith:

September 30, 1960	800	April 30, 1961	22,600
October 31	1,000	May 31	40,700
November 30	4,100	June 30	50,400
December 31, 1960	7,200	July 31	35,700
January 31, 1961	9,800	August 31	22,400
February 28	16,500	September 30, 1961	20,400
March 31	22,600	Change in contents during year	+19,600

## Contents in Acre-feet

	<u>Bull Lake</u>	<u>Pilot Butte Reservoir</u>	<u>a/ Buffalo Bill Reservoir</u>	<u>b/ Tongue River c/ Reservoir</u>
September 30, 1961	89,800	4,600	285,200	20,400
October 31	94,500	6,200	294,400	30,700
November 30	97,500	6,200	282,200	39,000
December 31, 1961	95,600	8,900	255,400	39,900
January 31, 1962	88,700	10,600	228,500	41,100
February 28	85,600	12,700	204,300	48,600
March 31	78,000	23,700	176,200	47,300
April 30	84,100	28,400	212,800	40,600
May 31	107,500	28,700	249,200	46,500
June 30	151,000	27,600	443,600	46,900
July 31	151,600	19,700	420,300	47,400
August 31	139,700	5,200	369,100	33,000
September 30, 1962	109,400	5,000	319,000	27,000
Change in contents during year	+19,600	+400	+33,800	+6,600

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 for April, May, June, and July interpolated from readings made near end of month. Contents for February, August, and September 1962, estimated.