

TWENTIETH ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1971

YELLOWSTONE RIVER COMPACT COMMISSION

421 Federal Building  
Helena, Montana

Honorable Stanley K. Hathaway  
Governor of the State of Wyoming  
Cheyenne, Wyoming

Honorable Forrest H. Anderson  
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 submits the following twentieth annual report of activities for the period ending September 30, 1971.

Because of accelerated interest in Yellowstone River water for development of the coal resources of the signatory States, the Commission held two meetings during 1971. At the special meeting at Sheridan, Wyoming on May 6, 1971, Mr. Douglas G. Smith, Director, Montana Water Resources Board, Mr. Floyd A. Bishop, Wyoming State Engineer, the designated representatives of their respective States, and Mr. Robert C. Williams, the designated Federal representative and chairman were all present. Others present were Messrs. Doyl M. Fritz, Wyoming Water Planning Program, Cheyenne, Wyoming; Clarence A. Brimmer, Wyoming Attorney General, Cheyenne, Wyoming; Alvin E. Bielefeld, Office of the Solicitor, U.S. Department of the Interior, Billings, Montana; Phil Q. Gibbs, U.S. Bureau of Reclamation, Billings, Montana; Robert L. Cushman, U.S. Geological Survey, Cheyenne, Wyoming; George M. Pike, U.S. Geological Survey, Helena, Montana; William Long and Paul Kawulok, Wyoming State Board of Control, Sheridan, Wyoming; Myron Goodson, State of Wyoming Department of Economic Planning and Development, Cheyenne, Wyoming; Ronald J. Guse and Jerome T. Leondorf, Montana Water Resources Board, Helena, Montana; and Tom Barker, Wyoming State Engineer's Office, Cheyenne, Wyoming.

At the annual meeting in Sheridan, Wyoming on November 11, 1971, Messrs. Bishop and Williams, Commission members, were present. The Montana member was not present. Others present at the annual meeting were Messrs. George M. Pike and Mrs. Betty L. Dean, U.S. Geological Survey, Helena, Montana; James T. Harrison, Jr.,

Montana Water Resources Board Counsel, Helena, Montana; Mike McCall and Tom Barker, Wyoming State Engineer's Office, Cheyenne, Wyoming; Robert L. Cushman, U.S. Geological Survey, Cheyenne, Wyoming; Paul Kawulok, Donald D. Englert, and William Long, Wyoming State Board of Control, Sheridan, Wyoming; Alvin E. Bielefeld, Office of the Solicitor, U.S. Department of the Interior, Billings, Montana; Phil Q. Gibbs, U.S. Bureau of Reclamation, Billings, Montana; Alan K. Grindberg, North Dakota State Water Commission, Bismarck, North Dakota; Myron Goodson, State of Wyoming Department of Economic Planning and Development, Cheyenne, Wyoming; and Robert B. Hoffman, Montana Water Resources Board, Helena, Montana.

There were no incidents during the year that required administration of water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission feels that a program of intensive water-use regulations is not necessary. However, Commission functions are becoming more important and more time consuming as each signatory State visualizes the time when all of its share of Yellowstone River water will be required for development within its borders. During the reporting period, the Commission kept abreast of developments that would affect the administration of the Compact, and began preparing for implementation of its provisions.

Interest in Yellowstone River water for use in the development of coal resources in the signatory States continues to increase. This is evidenced by the attendance of executives from 85 energy companies at a recent meeting on aqueduct studies conducted by the U.S. Bureau of Reclamation in Denver, Colorado, and by requests to the Bureau for options on 1.7 million acre-feet of Yellowstone River water.

The Commission recognized the necessity for the signatory States to work together to obtain the most benefit from the use of Yellowstone River water. During 1971, a large amount of time and effort was devoted to the exchange of views on provisions of the Compact. In addition to the two Commission meetings, State representatives met at two other meetings to discuss the action necessary to facilitate use of water for development of coal resources. A large part of the discussion at all of the meetings concerned the need to obtain unanimous approval by the signatory States for diversion of water from the Yellowstone River basin. This is of importance because much of the interest shown by the energy industry is related to development of the coal resources in the Gillette, Wyoming area, some of which is outside of the Yellowstone River basin. Correspondence has been initiated between the Attorneys General of the three States concerning this matter. It appears that State legislative action may be required.

During the past year the Commission has directed its attention to State water laws that conflict with provisions of the Compact. It appears there are some, particularly Section 89-846 of the Montana water law, that need legislative action to make them compatible with the Compact. Because it is absolutely necessary that all parties have the same interpretation of terms of the Compact, the Commission has also focused some attention on the ambiguity of some parts of the Compact.

A problem that continues to be of long-range concern is the uncertainty related to the quantity of water to reserve for claims on those streams flowing through Indian reservations. Some studies are underway to determine the potential requirements for water on the reservations; however, the Commission does not believe that there will be an early settlement of the claims.


The Commission continues to recognize the need for expansion of water-measurement activities in the basin; however, the flourish of interest in the use of Yellowstone River water has put a new perspective on the program. The future requirements are being re-evaluated to take into account the possibility that development of the full potential of the river may take place much sooner than was previously expected. At the request of the Commission, the U.S. Geological Survey evaluated data requirements in terms of Compact provisions and Commission needs. The result was an informal report that outlined data deficiencies and made some recommendations for improvement. On the basis of the analysis, a preliminary computation procedure was devised by the chairman and presented to the Commission for consideration.

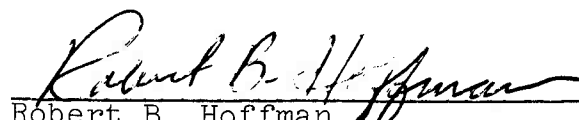
For the fiscal year beginning July 1, 1971, the budget for stream-gaging activities and annual-report publication is \$18,270. The estimate for this work during the fiscal year beginning July 1, 1972, is \$12,370. The decrease reflects the fact that no new work is planned for next fiscal year. The funds required for future Commission activities will depend largely on the outcome of water-development plans and on the degree of water administration required.


Two changes were made in the Commission during 1971. On December 7, 1971, Mr. Robert B. Hoffman, Yellowstone River Compact Coordinator for the Montana Department of Natural Resources and Conservation, was selected as the Montana representative on the Commission to succeed Douglas G. Smith. A small increase in Federal Yellowstone River Compact funds for fiscal year 1972 permitted the services of a stenographer to record minutes of

Commission meetings. Mrs. Betty Dean, U.S. Geological Survey, Helena, Montana, assumed these duties at the November 1971 annual meeting.

Respectfully submitted,

  
Floyd A. Bishop  
Commissioner for Wyoming

  
Robert B. Hoffman  
Commissioner for Montana

  
Robert C. Williams  
Federal Representative

## GENERAL REPORT

### Cost:

The work funded by the Commission, which to date has been primarily concerned with the collection of required hydrologic data, has been financed through cooperative arrangements whereby Montana and Wyoming each bear one-fourth of the cost and the remaining one-half is borne by the United States. The salaries and necessary expenses of the State and Federal representatives, and hydrologic data made available by other agencies, are not evaluated or considered as expenses of the Commission.

The expense of the Commission during the fiscal year ending June 30, 1971, was \$12,930, in accordance with the budget adopted for that year.

The budgets for the fiscal years ending June 30, 1972, and June 30, 1973, were tentatively adopted during the preceding year subject to the availability of appropriations. The 1972 fiscal year budget was confirmed at the 1971 annual meeting.

The budgets for the two fiscal years are summarized as follows:

#### July 1, 1971, to June 30, 1972:

Continuation of existing program	\$11,770
Installation of new A-frames at the gaging station on the Tongue River near Miles City, Montana	900
Purchase and installation of two experimental flow totalizers and related equipment for an undetermined amount, plus the unexpended balance	<u>5,600</u>
Total	\$18,270

#### July 1, 1972, to June 30, 1973:

Continuation of existing program	\$12,370
Total	<u>\$12,370</u>

### Gaging Stations:

Gaging stations at the measuring sites specified in the Compact were continued in operation and satisfactory discharge records collected at each. In addition, a station on Prairie Dog Creek near the State line was operated for Compact administration purposes.

During the year ending September 30, 1970, annual streamflow at the designated points of measurement in Montana was above normal as a result of an above average snowpack and above normal spring precipitation. Flow at the Compact points of measurement ranged from 131 to 201 percent of the 1953-67 averages. In general, precipitation was above normal during the early part of the growing season and below normal during the latter part of the season. Except for a few isolated areas without adequate storage, supplies were generally sufficient to meet needs during the irrigation season because of the large storage carryover from the above normal snowpack and ample spring precipitation.

Details of streamflow for the 1971 water year and bar-graphs showing comparisons with average flows during selected base periods and with the preceding year are given in Appendix B.

#### Diversions:

Opinions expressed by the two State representatives indicated that allocable diversions in Montana and Wyoming initiated since January 1, 1950, did not warrant detailed consideration and that use in the upstream State did not exceed Compact allowances.

The U.S. Bureau of Reclamation completed preliminary pipeline surveys and a report is to be ready in January 1972. Numerous routes and schemes were investigated, including trans-basin diversion from the Green River. Estimated cost of the water delivered at Gillette varies from \$76 to \$132 per acre-foot. The estimated costs at Colstrip vary from \$35 to \$57 per acre-foot.

#### Storage:

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

Bighorn Lake, a U.S. Bureau of Reclamation project on the Bighorn River, and the largest storage project in the basin, contained 1,051,000 acre-feet at the beginning of the year and 1,073,000 acre-feet at the close. It fluctuated from a minimum of 698,400 acre-feet on May 28, 1971, to a maximum of 1,073,000 acre-feet on September 30, 1971. Boysen Reservoir, located on the Wind River and operated by the U.S. Bureau of Reclamation, began the year with 601,300 acre-feet in storage and ended with 680,700 acre-feet. Details regarding these reservoirs are given in Appendix C. The Commission is cognizant of other reservoirs in this general group and considers their aggregate effect to be insufficient to warrant the collection of storage data at this time.

In reservoirs existing on January 1, 1950

As a matter of record and general information, month-end storage data are given in Appendix D for reservoirs in existence above the points of measurement on January 1, 1950. These data are pertinent to allocation under Article V Section C Item 5 of the Compact.



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 near Silesia, Montana and located in NE 1/4 SE 1/4 sec.1, T.4 S., R.23 E., shall be the point of measurement for the Clarks Fork.

2. Eighorn River (exclusive of Little Bighorn River)

The gaging station known as the Bighorn River at Bighorn, Montana and located in NE 1/4 NE 1/4 sec.33, T.5 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 NE 1/4 NE 1/4 sec.19, 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 SW 1/4 sec.14, 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 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

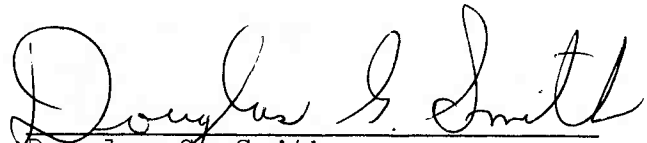
An annual meeting of the Commission shall be held each November at some mutually agreeable point in the Yellowstone River basin for consideration of the annual report for the water year ending the preceding September 30th, and for the transaction of such other business consistent with its authority; 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.

  
Douglas G. Smith  
Commissioner for Montana

  
Floyd A. Bishop  
Commissioner for Wyoming

ATTESTED:

  
Robert C. Williams  
Federal Representative

Adopted November 17, 1953  
Amended November 9, 1970

MONTHLY SUMMARY OF DISCHARGE  
Clarks Fork Yellowstone River near Silesia, Montana

LOCATION.--Lat  $45^{\circ}30'48''$ , long  $108^{\circ}49'41''$ , in NE $\frac{1}{4}$ SE $\frac{1}{4}$  sec.1, T.4 S., R.23 E., Carbon County, on left bank 0.5 mile downstream from Whitehorse Canal intake, 1 mile upstream from Rock Creek, and 3 miles south of Silesia.

DRAINAGE AREA.--2,093 sq mi.

PERIOD OF RECORD.--October 1969 to September 1971. Records for July 1921 to September 1969 (published as Clarks Fork Yellowstone River at Edgar) at site 5 miles upstream not equivalent owing to diversion in Whitehorse Canal during irrigation season.

GAGE.--Water-stage recorder. Altitude of gage is 3,410 ft (from topographic map).

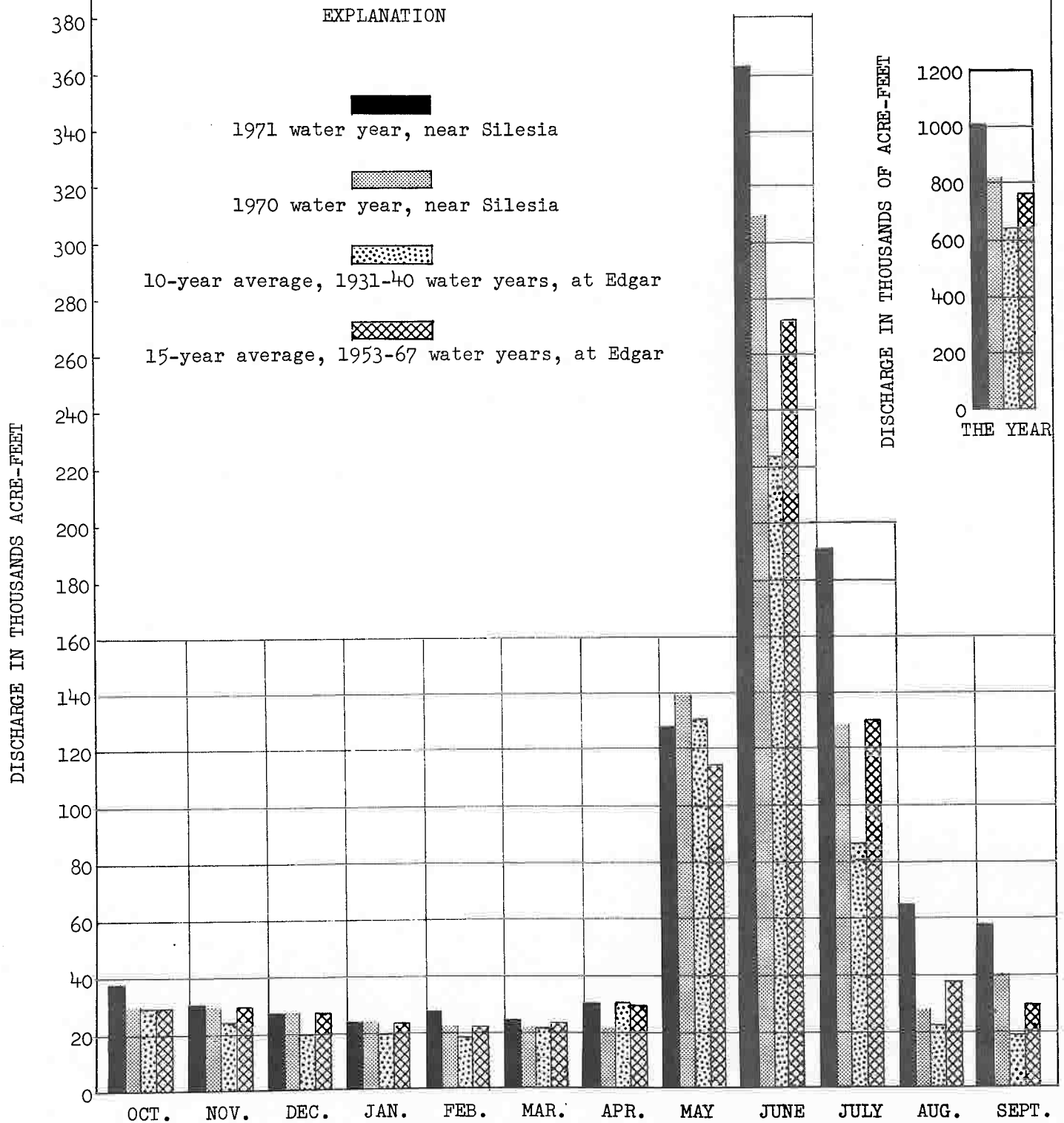
EXTREMES.--Current year: Maximum discharge, 10,200 cfs June 24 (gage height, 7.38 ft); minimum daily, 220 cfs Jan. 14.

Period of record: Maximum discharge 10,200 cfs June 24, 1971 (gage height, 7.38 ft); minimum, 165 cfs Aug. 27, 28, 1970 (gage height, 1.38 ft).

REMARKS.--Records good except those for winter period, which are poor. Diversions for irrigation of about 42,600 acres of which 1,100 acres lies below station. In addition, about 9,000 acres of land above station are irrigated by diversions from the adjoining Rock Creek basin.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>
October 1970	19,306	801	485	623	38,290
November	15,268	625	275	509	30,280
December	13,732	559	270	443	27,240
January 1971	11,885	500	220	383	23,570
February	12,525	550	360	447	24,840
March	12,445	509	320	401	24,680
April	14,953	970	319	498	29,660
May	64,562	4,980	554	2,083	128,100
June	182,760	9,720	3,220	6,092	362,500
July	95,950	4,720	1,770	3,095	190,300
August	32,419	1,740	497	1,046	64,300
September 1971	<u>29,130</u>	1,810	650	971	<u>57,780</u>
Water year 1970-71	504,935	9,720	220	1,383	1,002,000

CLARKS FORK YELLOWSTONE RIVER NEAR SILESIA, MONT.  
 (Replaces Clarks Fork Yellowstone River at Edgar)



Comparison of discharge during 1971 water year with 1970 water year, near Silesia and with average discharge for the water years 1931-40 and 1953-67 at Edgar.

MONTHLY SUMMARY OF DISCHARGE  
Little Bighorn River near Hardin, Montana

LOCATION.--Lat  $45^{\circ}44'08''$ , long  $107^{\circ}33'27''$ , in NE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.19, T.1 S., R.34 E., Big Horn County, on left bank 50 ft downstream from bridge on Sarpy Road, 0.2 mile upstream from terminal wasteway of Agency Canal, 0.6 mile upstream from mouth, and 2.3 miles east of Hardin.

DRAINAGE AREA.--1,294 sq mi.

PERIOD OF RECORD.--June 1953 to September 1971.

GAGE.--Water-stage recorder. Altitude of gage is 2,890 ft (from topographic map). Prior to Oct. 7, 1953, nonrecording 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, nonrecording gage at site 0.4 mile downstream. All at different datums.

AVERAGE DISCHARGE.--18 years, 281 cfs (203,600 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, about 2,000 cfs Feb. 14 (gage height, 7.30 ft, backwater from ice); minimum daily, 100 cfs Dec. 21.

Period of record: Maximum discharge, 4,520 cfs Apr. 2, 1965; maximum gage height, 11.78 ft Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.20 cfs Aug. 7, 1961, result of discharge measurement.

REMARKS.--Records good except those for winter period, which are poor. Flow partly regulated by Willow Creek Reservoir (capacity, 23,000 acre-ft). Diversions for irrigation of about 17,000 acres above station. Figures of discharge given herein 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 1970	7,217	254	213	233	14,310
November	6,794	270	110	226	13,480
December	5,496	300	100	177	10,900
January 1971	5,530	300	120	178	10,970
February	17,090	1,700	170	610	33,900
March	24,558	1,870	330	792	48,710
April	16,706	1,100	373	557	33,140
May	17,507	1,290	425	565	34,730
June	28,575	1,370	467	952	56,680
July	6,710	427	103	216	13,310
August	4,522	206	109	146	8,970
September 1971	<u>5,752</u>	247	165	192	<u>11,410</u>
Water year 1970-71	146,457	1,870	100	401	290,500

MONTHLY SUMMARY OF DISCHARGE  
Bighorn River at Bighorn, Montana

LOCATION.--Lat 46°08'50", long 107°28'00", in NE $\frac{1}{4}$ NE $\frac{1}{4}$  sec.33, T.5 N., R.34 E., Treasure County, on right bank just downstream from bridge on old U.S. Highway 10, 0.3 mile downstream from bridge on Interstate Highway 94, 0.7 mile upstream from mouth, 1.3 mile southwest of Bighorn, and 4.4 miles east of Custer.

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

PERIOD OF RECORD.--May 1945 to September 1971. 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, nonrecording gage, and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 miles upstream at different datum.

AVERAGE DISCHARGE.--26 years, 3,805 cfs (2,757,000 acre-ft per year), unadjusted.

EXTREMES.--Current year: Maximum discharge, 13,600 cfs Feb. 14 (gage height, 6.26 ft); minimum daily, 1,180 cfs Oct. 23.  
Period of record: 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, 14.21 ft Apr. 2, 1965; minimum discharge, about 275 cfs Nov. 15, 1959, result of freezeup; minimum daily, 400 cfs Apr. 4, 1967.

REMARKS.--Records good except those for period of backwater from Yellowstone River, which are poor. Flow regulated by Bighorn Lake beginning November 1965 (usable capacity, 1,356,000 acre-ft). Major regulation prior to November 1965 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). Diversions for irrigation of about 465,000 acres above station.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>	<u>Adjusted runoff in acre-feet*</u>
Oct. 1970	87,330	3,360	1,180	2,817	173,200	195,200
Nov.	102,260	3,740	2,970	3,409	202,800	188,800
Dec.	127,640	4,800	2,930	4,117	253,200	167,500
Jan. 1971	135,370	6,000	3,200	4,367	268,500	212,100
Feb.	148,780	12,800	3,300	5,314	295,100	290,700
Mar.	186,010	8,040	4,600	6,000	369,000	319,000
Apr.	188,540	7,800	4,970	6,285	374,000	288,100
May	232,410	8,740	5,730	7,497	461,000	415,400
June	262,880	9,780	7,620	8,763	521,400	702,900
July	175,800	7,640	4,220	5,671	348,700	489,200
Aug.	99,900	5,060	2,350	3,222	198,200	164,200
Sept. 1971	<u>85,230</u>	3,200	2,530	2,841	<u>169,100</u>	<u>223,100</u>
Water year 1970-71	1,832,150	12,800	1,180	5,020	3,634,000	3,656,000

\* Adjusted for change in contents in Bighorn Lake.



BIGHORN RIVER AT BIGHORN, MONT.  
 ADJUSTED FOR CHANGE IN CONTENTS IN BIGHORN LAKE  
 MINUS  
 LITTLE BIGHORN RIVER NEAR HARDIN, MONT.

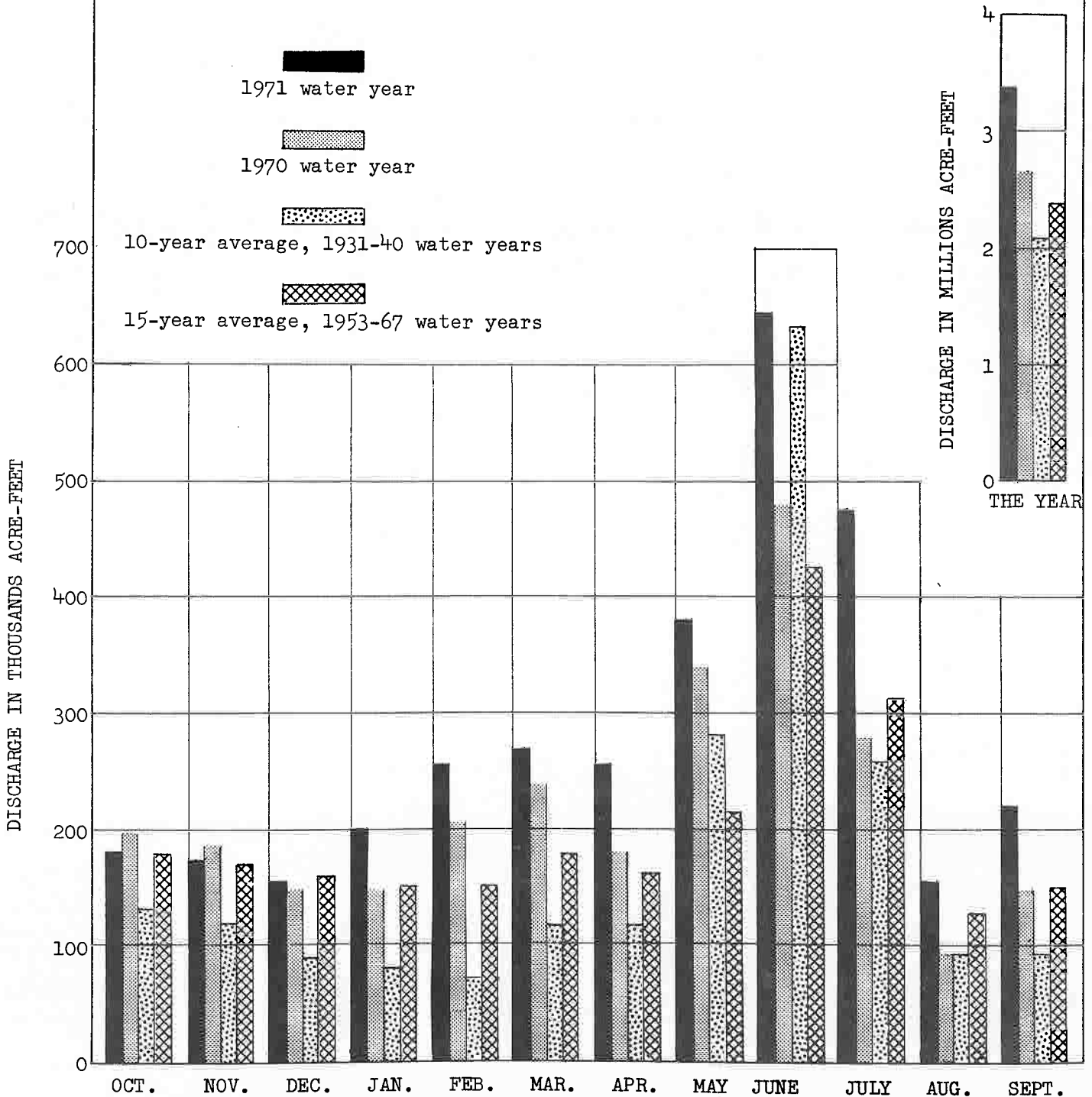
EXPLANATION

1971 water year

1970 water year

10-year average, 1931-40 water years

15-year average, 1953-67 water years



Comparison of discharge during 1971 water year with 1970 water year and with average discharge for water years 1931-40 and 1953-67.

Appendix B

MONTHLY SUMMARY OF DISCHARGE  
Prairie Dog Creek near Acme, Wyoming

LOCATION.--Lat 44°59'02", long 106°50'21", in NE $\frac{1}{4}$ SW $\frac{1}{4}$ SW $\frac{1}{4}$  sec.23, T.58 N., R.83 W., Sheridan County, on right bank 600 ft upstream from county bridge, 0.9 mile upstream from mouth, 2.8 miles downstream from Coutant Creek, and 7.6 miles northeast of Acme.

DRAINAGE AREA.--358 sq mi.

PERIOD OF RECORD.--October 1970 to September 1971. Records for May 1965 to September 1970 in files of Office of Wyoming State Engineer.

GAGE.--Water-stage recorder. Altitude of gage is 3,450 ft (from topographic map).

EXTREMES.--Current year: Maximum discharge, 567 cfs Mar. 28 (gage height, 5.21 ft), from rating curve extended above 90 cfs on basis of step-backwater computation; maximum gage height, 5.62 ft Feb. 16 (backwater from ice); minimum daily discharge, 7.4 cfs Aug. 11, 12, 17.

REMARKS.--Records good except those for winter period, which are poor. Diversions above station for irrigation of about 13,600 acres of which about 50 acres lies below station. Flow supplemented by 3 transbasin diversions from North Piney Creek and South Piney Creek via Prairie Dog ditch, Piney and Cruse ditch and Mead-Coffeen ditch.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>
October 1970	1,378	60	27	44.5	2,730
November	1,047	43	12	34.9	2,080
December	797	42	15	25.7	1,580
January 1971	712	30	15	23.0	1,410
February	1,541	250	20	55.0	3,060
March	2,984	457	28	96.3	5,920
April	3,024	333	46	101	6,000
May	1,286	108	13	41.5	2,550
June	884	91	13	29.5	1,750
July	372.3	19	9.2	12.0	738
August	317.7	18	7.4	10.2	630
September 1971	<u>794.0</u>	39	14	26.5	<u>1,570</u>
Water year 1970-71	15,137.0	457	7.4	41.5	30,020

MONTHLY SUMMARY OF DISCHARGE  
Tongue River at Miles City, Montana

LOCATION.--Lat 46°21'30", long 105°48'24", in SE $\frac{1}{4}$  sec.23, T.7 N., R.47 E., Custer County, on right bank 4 miles south of Miles City and 8 miles upstream from mouth.

DRAINAGE AREA.--5,379 sq mi.

PERIOD OF RECORD.--April 1938 to April 1942, April 1946 to September 1971. Published as "near Miles City" April 1938 to April 1942. Not equivalent to records published as "near Miles City" May 1929 to October 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, nonrecording gage at site 8 miles upstream at different datum. April 1946 to Sept. 30, 1963, at datum 1.00 ft higher.

AVERAGE DISCHARGE.--28 years (1938-41, 1946-71), 417 cfs (302,100 acre-ft per year).

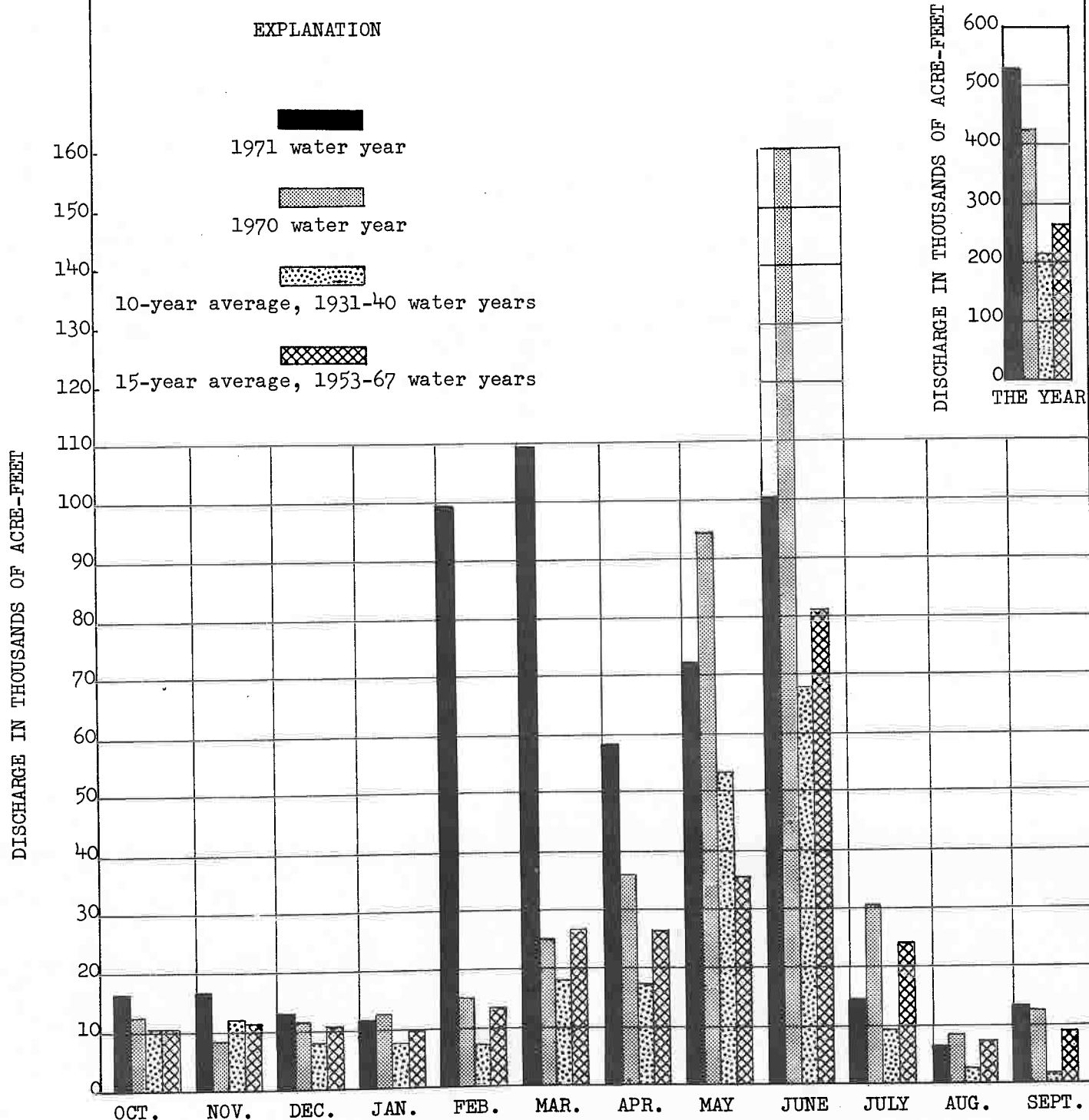
EXTREMES.--Current year: Maximum discharge, about 9,000 cfs Feb. 15 (gage height, 13.27 ft, ice-jam); minimum discharge recorded, 45 cfs July 18.

Period of record: Maximum discharge, 13,300 cfs June 15, 1962 (gage height, 12.33 ft, present datum), from rating curve extended above 5,200 cfs on basis of float measurement; maximum gage height, 13.27 ft (present datum) Mar. 19, 1960, Feb. 15, 1971 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

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

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>
October 1970	8,269	286	220	267	16,400
November	8,500	332	160	283	16,860
December	6,455	260	180	208	12,800
January 1971	5,860	215	170	189	11,620
February	50,220	8,000	200	1,794	99,610
March	55,276	4,300	966	1,783	109,600
April	29,368	1,910	776	979	58,250
May	36,430	1,540	888	1,175	72,260
June	50,674	2,320	776	1,689	100,500
July	7,256	727	47	234	14,390
August	3,196	272	65	103	6,340
September 1971	<u>6,724</u>	420	150	224	<u>13,340</u>
Water year 1970-71	268,228	8,000	47	735	532,000

TONGUE RIVER AT MILES CITY, MONT.



Comparison of discharge during 1971 water year with 1970 water year and with average discharge for water years 1931-40 and 1953-67.

MONTHLY SUMMARY OF DISCHARGE  
Powder River near Locate, Montana

LOCATION.--Lat 46°27'00", long 105°19'00", in SW $\frac{1}{4}$  sec.14, T.8 N., R.51 E., Custer County, on left bank 1.5 miles downstream from bridge on U.S. Highway 12 at present site of Locate (5 miles west of former site of Locate), 1.5 miles upstream from Locate Creek, and 25 miles east of Miles City.

DRAINAGE AREA.--13,194 sq mi. Area at site used prior to Oct. 1, 1965, 13,189 sq mi.

PERIOD OF RECORD.--March 1938 to September 1971. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,390 feet (by barometer). Prior to July 11, 1947, nonrecording gage at bridge 1.5 miles upstream and July 11, 1947, to Sept. 30, 1965, water-stage recorder at sites near bridge at different datum. Oct. 1, 1965, to Oct. 4, 1966, nonrecording gage, and Oct. 5, 1966, to Apr. 15, 1969, water-stage recorder at site 200 ft upstream at present datum.

AVERAGE DISCHARGE.--33 years, 609 cfs (441,200 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 10,200 cfs Feb. 18 (gage height, 7.6 ft); maximum gage height, 9.6 ft Feb. 15 (ice jam); minimum discharge observed, 9.4 cfs Aug. 23.





Period of record: Maximum discharge observed, 31,000 cfs Feb. 19, 1943 (gage height, 11.23 ft, site and datum then in use), 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.

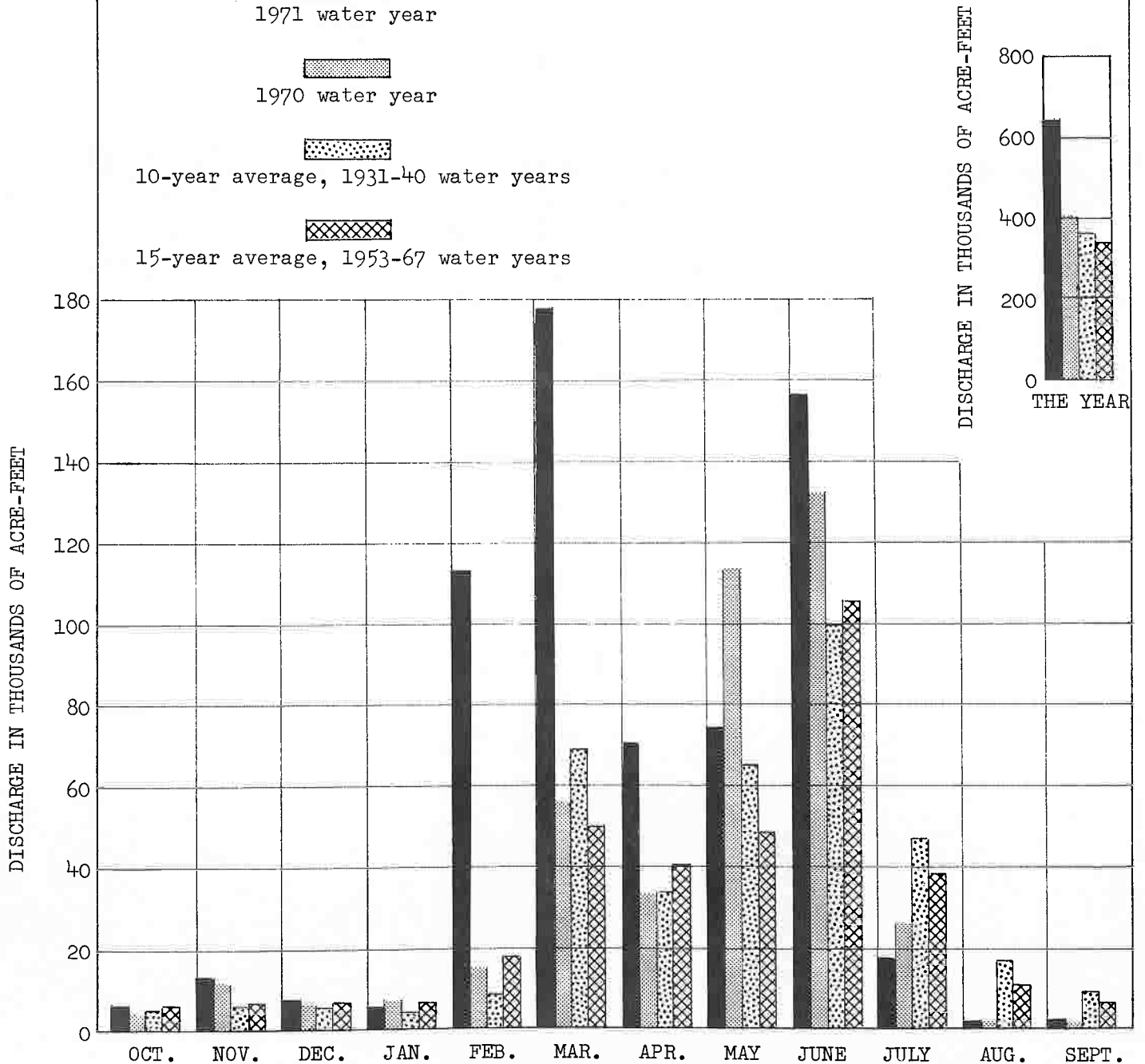
REMARKS.--Records good except those for winter period, which are poor. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft. Diversions for irrigation of about 52,000 acres above station.

<u>Month</u>	<u>Second-foot days</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Mean</u>	<u>Runoff in acre-feet</u>
October 1970	3,296	196	39	106	6,540
November	6,811	275	170	227	13,510
December	3,725	180	75	120	7,390
January 1971	2,750	95	80	88.7	5,450
February	57,114	8,720	95	2,040	113,300
March	89,859	7,920	305	2,899	178,200
April	35,564	3,850	655	1,185	70,540
May	37,585	2,910	711	1,212	74,550
June	79,010	5,620	1,270	2,634	156,700
July	8,946	1,120	43	289	17,740
August	782.2	56	9.4	25.2	1,550
September 1971	<u>1,044</u>	224	12	34.8	<u>2,070</u>
Water year 1970-71	326,486.2	8,720	9.4	894	647,600

POWDER RIVER NEAR LOCATE, MONT.

EXPLANATION

-  1971 water year
-  1970 water year
-  10-year average, 1931-40 water years
-  15-year average, 1953-67 water years



Comparison of discharge for 1971 water year with 1970 water year and with average discharge for water years 1931-40 and 1953-67

## RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

## BOYSEN RESERVOIR

Water-stage recorder at dam on Wind River, 13 miles north of Shoshoni, Wyoming. Reservoir formed by earth-fill dam, construction of which began in 1947. Storage began Oct. 11, 1951. Dead storage, 59,880 acre-ft at elevation 4,657.0 ft. Usable contents, 742,100 acre-ft at elevation 4,725.0 ft (top of gates). Crest of dam at elevation, 4,758 ft.

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.--Current year: Maximum usable contents, 785,100 acre-ft June 29 (elevation, 4,727.15 ft); minimum, 297,800 acre-ft May 13 (elevation, 4,695.65 ft).

Period of record: Maximum usable contents, 862,700 acre-ft July 7, 1967; minimum, 189,800 acre-ft Mar. 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, 1970	4,717.42	603,200	--
October 31	4,717.31	601,300	-1,900
November 30	4,716.83	593,200	-8,100
December 31	4,714.39	552,800	-40,400
January 31, 1971	4,711.80	512,100	-40,700
February 28	4,707.68	450,900	-61,200
March 31	4,701.83	371,500	-79,400
April 30	4,696.33	305,300	-66,200
May 31	4,701.60	368,500	+63,200
June 30	4,726.91	780,300	+411,800
July 31	4,724.62	734,700	-45,600
August 31	4,722.69	697,900	-36,800
September 30, 1971	4,721.77	680,700	-17,200
Water year 1970-71			+77,500

\* Does not include dead storage of 59,880 acre-ft.

## RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

## ANCHOR RESERVOIR

Water-stage recorder at dam on South Fork Owl Creek, 32 miles west of Thermopolis, Wyoming. Reservoir formed by thin concrete-arch dam, construction of which began in 1957. Closure of dam made Nov. 21, 1960. Temporary outlet at elevation 6,304.30 ft still in use. Lowest permanent outlet sill at elevation 6,343.75 ft (contents, 149 acre-feet). Total contents, 17,350 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. 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, 1970	6,304.30	0	-
October 31	6,304.30	0	0
November 30	6,304.30	0	0
December 31	6,304.30	0	0
January 31, 1971	6,304.30	0	0
February 28	6,304.30	0	0
March 31	6,304.30	0	0
April 30	6,304.30	0	0
May 31	6,372.40	1,260	+1,260
June 30	6,385.27	2,510	+1,250
July 31	6,346.00	184	-2,326
August 31	6,351.50	297	+113
September 30, 1971	6,344.00	153	-144
Water year 1970-71			+153

\* Includes dead storage.



## RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

BIGHORN LAKE  
(Formerly published as Yellowtail Reservoir)

Water-stage recorder at dam on Bighorn River, 15.5 miles southwest of St. Xavier, Montana. Reservoir formed by thin concrete-arch dam, construction of which began in 1961. Storage began Nov. 3, 1965. Dead storage, 18,970 acre-ft at elevation 3,296.5 ft. Usable contents, 1,356,000 acre-ft at elevation 3,657.0 ft. Crest of dam at elevation 3,660.0 ft.

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

EXTREMES.--Current year: Maximum daily contents, 1,073,000 acre-ft Sept. 30 (elevation, 3,638.09 ft); minimum, 698,400 acre-ft May 28 (elevation, 3,591.23 ft).

Period of record: Maximum contents, 1,346,000 acre-ft July 6, 1967 (elevation, 3,656.43 ft); minimum since first filling, 660,700 acre-ft Mar. 11, 1970 (elevation, 3,584.45 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, 1970	3,636.18	1,051,000	--
October 31	3,638.07	1,073,000	+22,000
November 30	3,636.87	1,059,000	-14,000
December 31	3,628.82	973,300	-85,700
January 31, 1971	3,622.54	916,900	-56,400
February 28	3,622.02	912,500	-4,400
March 31	3,615.65	862,500	-50,000
April 30	3,603.67	776,600	-85,900
May 31	3,596.60	731,000	-45,600
June 30	3,622.01	912,500	+181,500
July 31	3,636.34	1,053,000	+140,500
August 31	3,633.35	1,019,000	-34,000
September 30, 1971	3,638.09	1,073,000	+54,000
Water year 1970-71			+22,000

\* Does not include dead storage of 18,970 acre-feet.

## 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 monthend contents in acre-feet of four reservoirs are given. The first three reservoirs are in the Bighorn River basin, 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 Water Resources Board, which agency furnished operating data.

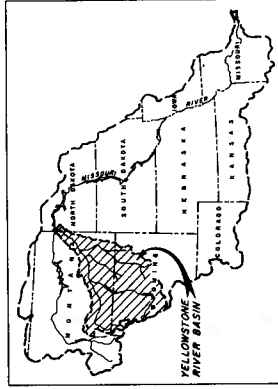
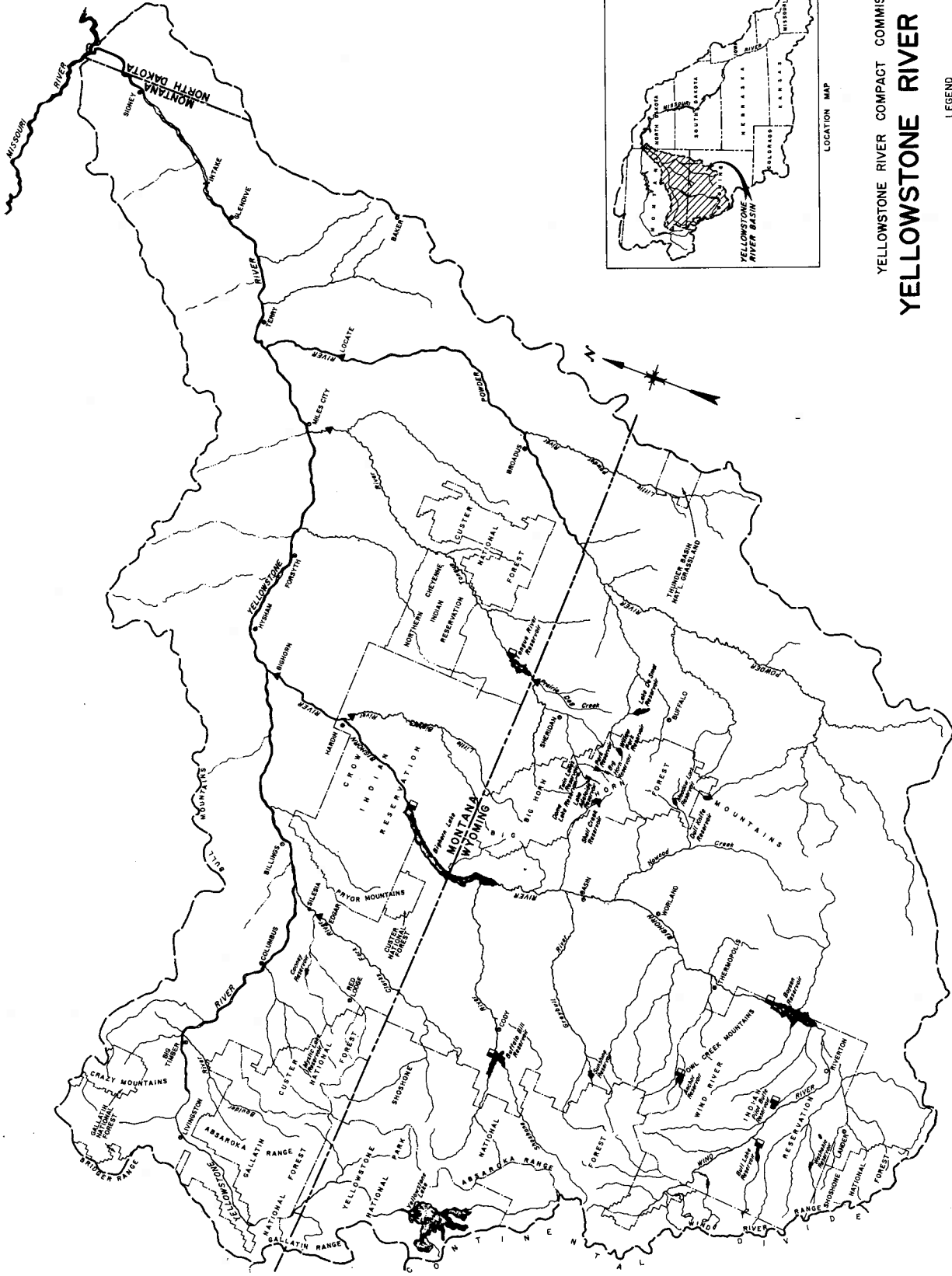
<u>Month</u>	Contents in acre-feet			
	<u>a/Bull Lake</u>	<u>b/Pilot Butte Reservoir</u>	<u>c/Buffalo Bill Reservoir</u>	<u>d/Tongue River Reservoir</u>
September 30 1970	105,400	10,840	291,000	27,400
October 31	103,200	11,410	253,800	26,890
November 30	103,400	11,410	239,600	27,060
December 31	104,300	11,410	223,700	29,820
January 31, 1971	104,500	10,480	209,900	35,800
February 28	104,000	10,370	199,200	44,900
March 31	104,000	10,210	180,500	34,600
April 30	104,500	9,450	159,500	37,220
May 31	106,300	23,340	180,600	32,230
June 30	148,300	24,540	430,100	52,230
July 31	151,800	20,380	430,800	44,400
August 31	145,100	14,660	393,100	28,760
September 30, 1971	146,100	2,830	358,000	23,500
Change in Contents during water year	+40,700	-8,010	+67,000	-3,900

a/ Total contents, from revised capacity table effective Oct. 1, 1965.

b/ Usable contents. Dead storage is 5,360 acre-feet.

c/ Total contents, from revised capacity table based on survey of 1959. Contents prior to October 1960 based on survey of 1941.

d/ Usable contents. Dead storage is 1,400 acre-feet. Contents based upon sedimentation surveys of October 1948.



LOCATION MAP

YELLOWSTONE RIVER COMPACT COMMISSION  
**YELLOWSTONE RIVER BASIN**

**LEGEND**  
 ▲ COMPACT STREAM GAGING STATIONS  
 ■ RESERVOIR CONTENT STATIONS

