TWENTY-FIRST ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1972

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 twenty-first annual report of activities for the period ending September 30, 1972.

The Commission held the annual meeting at Billings, Montana, on November 1, 1972. Mr. Grant W. Buswell, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, 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: Tom Barker, Wyoming State Engineer's Office, Cheyenne, Wyoming; William Long, Wyoming State Board of Control, Sheridan, Wyoming; Phil Q. Gibbs, U.S. Bureau of Reclamation, Billings, Montana; Ted J. Doney and Gary Wicks, Department of Natural Resources and Conservation, Helena, Montana; James F. Wilson, U.S. Geological Survey, Cheyenne, Wyoming; Cliff M. Jochim and Vern Fahy, North Dakota State Water Commission, Bismarck, North Dakota; Alvin E. Bielefeld, Field Solicitor's Office, Department of the Interior, Billings, Montana; Ed Imhoff, Missouri River Basin Commission, Omaha, Nebraska; and George M. Pike and Betty L. Dean, U.S. Geological Survey, 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 prepares for 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 continued preparing for implementation of its provisions.

Interest in Yellowstone River water for use in the development of coal resources in the signatory States remains at a high level. An appraisal of water-distribution systems is given in a report by the Bureau of Reclamation that was released in April 1972. The report, "Appraisal Report on the Montana-Wyoming Aquaducts," identifies water that may be available for development of the coal resources of the region, and presents results of studies of alternate aquaduct systems to convey water from the sources to points of possible use. As pointed out in the report, further studies will be required to develop firm water-distribution plans for development in the area. The Yellowstone River system was the primary source of water considered in the studies. The projected ultimate water requirement for development of the coal resource is given in the report as 2.6 million acre-feet per year. Contracts executed by the Bureau of Reclamation and requests for options total about 1.7 million acre-feet per year and could be accommodated by the alternatives studied; however, interest in additional water has been shown by energy companies. The Bureau of Reclamation report gives approximate amounts of water that would be available under Compact allocations from the four major tributaries during a critical period. The shares given are 1.4 million acre-feet per year for Wyoming and 0.6 million acre-feet per year for Montana. Wyoming water planning estimates indicate that with adequate storage capacity the Compact allocation for Wyoming would be 2.94 million acre-feet per year.

The Commission recognized the necessity for the signatory States to work together to obtain the most benefit from the use of Yellowstone River water. Again during 1972, a large amount of time and effort was devoted to the exchange of views on provisions of the Compact. A large part of the discussion at the annual meeting concerned the need for 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. Because it will be necessary for the Commission to act on applications for water to be used outside of the basin in the near future, the Commission attempted to promote action on development of a procedure for gaining the unanimous consent of the signatory States as required by Article X of the Compact. In that regard, a letter, which presented a resolution requesting your assistance, was sent to you and the governors of the other signatory States in November 1972.

There has been some progress made during the past year on updating the Montana water-right records. Legislation to be considered by the 1973 Montana Legislature would centralize record

keeping in the Department of Natural Resources and Conservation, which would enable Montana to eventually be on a par with Wyoming in this respect. The Commission strongly supports passage of this legislation.

A problem that continues to be of long-range concern to the Commission is the uncertainty related to the quantity of water to be used by Indians from those streams flowing through Indian reservations. Some studies are underway to determine the potential requirements for water on the reservations; however, the Commission believes that action should be taken toward early quantification of such uses.

For Fiscal Year 1973 the budget for stream-gaging activities and annual-report publication is $13,850; for Fiscal Year 1974 the estimate is $15,540; and for Fiscal Year 1975 the estimate is $16,480. The amount of funds required for future Commission activities will depend largely on the outcome of water-development plans and on the degree of water administration required.

One change was made in Commission membership during 1972. On March 24, 1972, Mr. Grant W. Buswell, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, was selected as the Montana representative on the Commission to succeed Robert B. Hoffman.

Respectfully submitted,

Floyd A. Bishop
Commissioner for Wyoming

Grant W. Buswell
Commissioner for Montana

Robert C. Williams
Federal Representative

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 Fiscal Year 1972 was $12,670, in accordance with the budget adopted for the year.

The budgets for Fiscal Years 1974 and 1975 were tentatively adopted subject to the availability of appropriations, and the budget for Fiscal Year 1973 was confirmed at the annual meeting November 1, 1972.

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

July 1, 1972, to June 30, 1973 (Fiscal Year 1973):	
Continuation of existing stream-gaging program	$13,850
July 1, 1973, to June 30, 1974 (Fiscal Year 1974):	
Continuation of existing stream-gaging program	$15,540
July 1, 1974, to June 30, 1975 (Fiscal Year 1975):	
Continuation of existing stream-gaging program	$16,480

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 Montana-Wyoming State line was operated for Compact administration purposes.

During the Water Year ending September 30, 1972, 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. Following the snowmelt runoff, moderate rainfall at frequent intervals maintained streamflow at adequate levels.

Flow at the Compact points of measurement ranged from 133 to 211 percent of the 1953-57 averages. Except for a few isolated areas without adequate storage, supplies were generally sufficient to meet needs during the irrigation season because of above-average runoff and large storage carryover from the 1971 season.

Details of streamflow for Water Year 1972 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.

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 1,073,000 acre-feet at the beginning of the year and 1,069,000 acre-feet at the close. It fluctuated from a minimum of 705,500 acre-feet on May 18, 1972, to a maximum of 1,090,000 acre-feet on October 20, 1971. Boysen Reservoir, located on the Wind River and operated by the U.S. Bureau of Reclamation, began the year with 680,700 acre-feet in storage and ended with 637,800 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. Bighorn 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°30'48", long 108°49'41", in NE¼SE¼ 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 1972. 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.

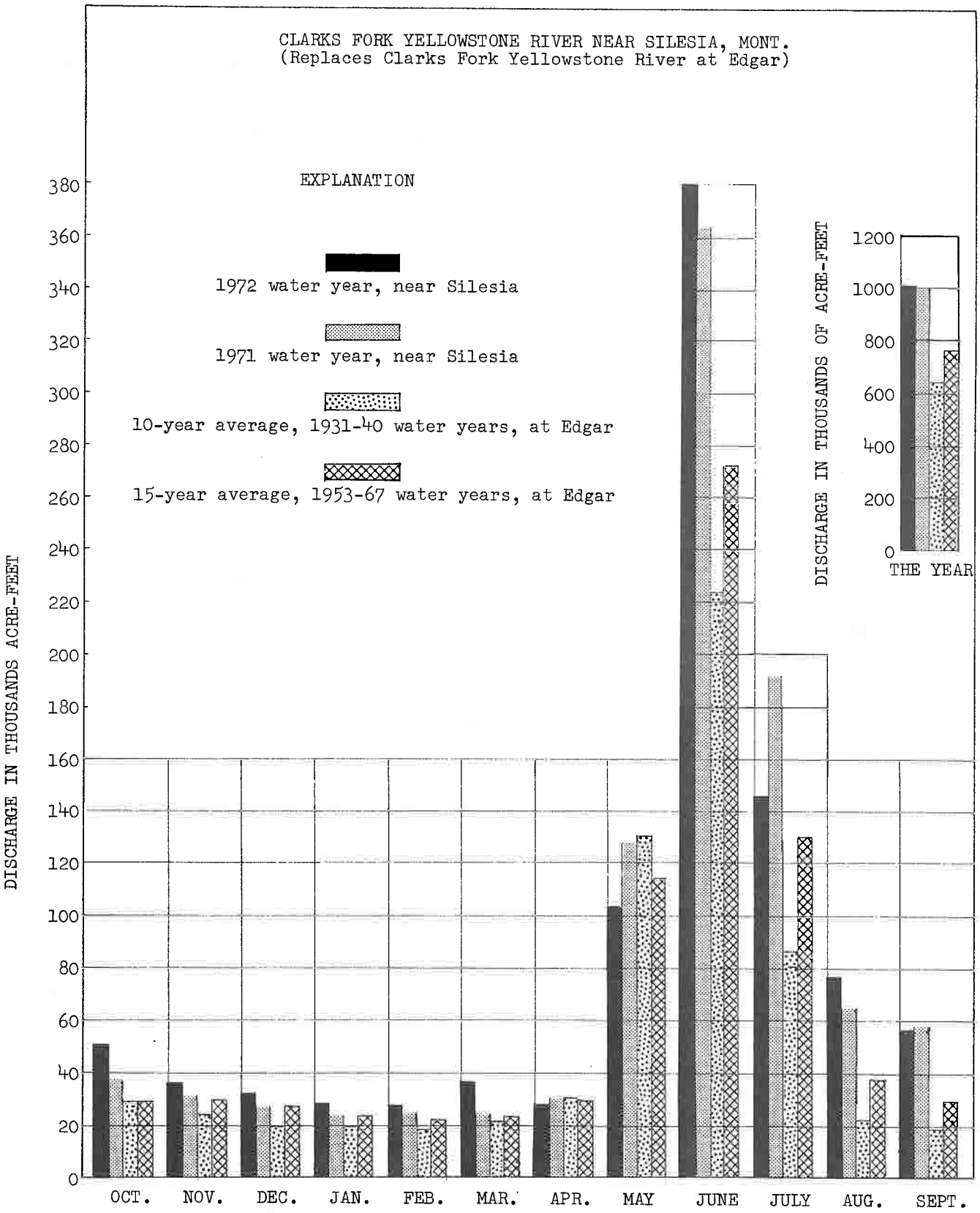
GAGE.--Water-stage recorder. Altitude of gage is 3,410 ft (from topographic map).

EXTREMES.--Current year: Maximum discharge, 11,800 cfs June 10 (gage height, 7.51 ft); minimum daily, 200 cfs Dec. 8.

Period of record: Maximum discharge, 11,800 cfs June 10, 1972 (gage height, 7.51 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.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1971	25,849	1,380	626	834	51,270
November	18,711	754	544	624	37,110
December	15,250	620	200	492	30,250
January 1972	14,500	580	320	468	28,760
February	14,305	800	360	493	28,370
March	18,468	793	455	596	36,630
April	14,292	766	433	476	28,350
May	57,318	4,850	515	1,849	113,700
June	192,210	10,600	2,760	6,407	381,200
July	73,570	4,400	1,380	2,373	145,900
August	38,830	1,820	970	1,253	77,020
September 1972	28,600	1,500	666	953	56,730
Water year 1971-72	511,903	10,600	200	1,399	1,015,000



Comparison of discharge during 1972 water year with 1971 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°44'08", long 107°33'27", in NE¼NE¼ 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 1972.

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.--19 years, 285 cfs (206,500 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, about 4,000 cfs Mar. 9 (gage height, 7.20 ft, backwater from ice); minimum daily, 50 cfs Dec. 10, 11.

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.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1971	7,400	333	191	239	14,680
November	6,546	269	191	218	12,980
December	3,476	187	50	112	6,890
January 1972	3,830	170	80	124	7,600
February	11,869	1,520	120	409	23,540
March	30,595	2,230	381	987	60,690
April	9,717	395	270	324	19,270
May	16,189	1,010	314	522	32,110
June	24,172	1,290	353	806	47,950
July	6,992	347	166	226	13,880
August	5,635	230	145	182	11,170
September 1972	5,129	198	152	171	10,170
Water year 1971-72	131,550	2,230	50	359	260,900

MONTHLY SUMMARY OF DISCHARGE
Bighorn River at Bighorn, Montana

LOCATION.--Lat 46°08'50", long 107°28'00", in NE¼NE¼ 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 miles 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 1972. 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.

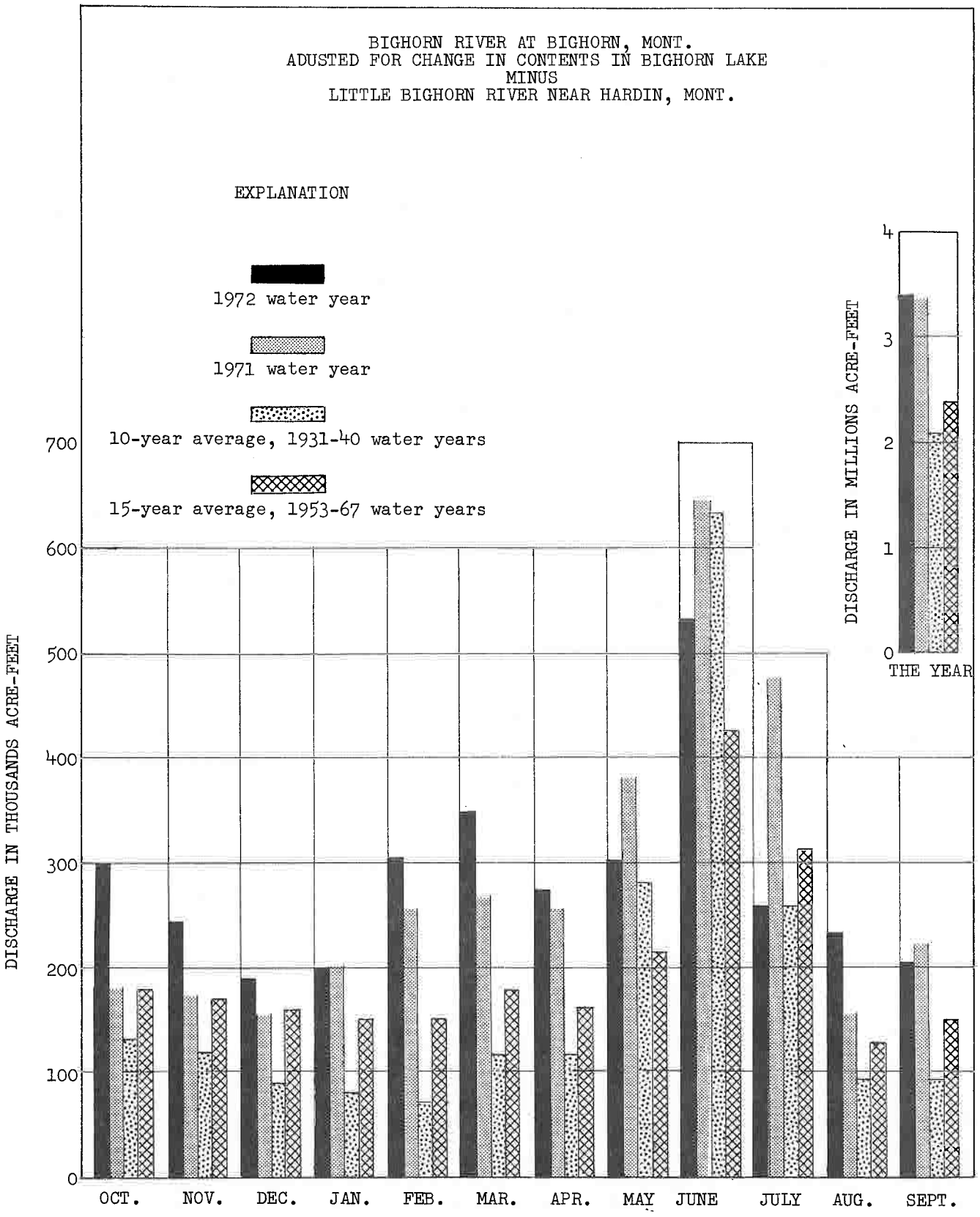
AVERAGE DISCHARGE.--27 years, 3,851 cfs (2,790,000 acre-ft per year), unadjusted.

EXTREMES.--Current year: Maximum discharge, 9,730 cfs Mar. 7 (gage height, 5.02 ft); minimum daily, 2,400 cfs May 28.
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.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet	Adjusted runoff in acre-feet*
Oct. 1971	171,930	7,300	2,990	5,546	341,000	316,000
Nov.	160,550	6,250	4,910	5,352	318,500	257,900
Dec.	137,740	5,780	3,580	4,443	273,200	197,300
Jan. 1972	124,540	4,300	3,300	4,017	247,000	209,400
Feb.	142,270	8,850	3,600	4,906	282,200	329,800
Mar.	203,970	9,110	3,970	6,580	404,600	409,100
Apr.	216,080	8,170	6,420	7,203	428,600	294,400
May	180,120	7,140	2,400	5,810	357,300	332,800
June	191,060	7,800	4,410	6,369	379,000	581,400
July	122,530	5,130	2,840	3,953	243,000	272,900
Aug.	99,220	3,500	2,910	3,201	196,800	246,200
Sept.1972	98,960	3,560	2,840	3,299	196,300	216,300
Water year 1971-72	1,848,970	9,110	2,400	5,052	3,667,000	3,663,000

* Adjusted for change in contents in Bighorn Lake.



Comparison of discharge during 1972 water year with 1971 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 NE¼SW¼SW¼ 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 1972. 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, 673 cfs May 22 (gage height, 5.59 ft), from rating curve extended above 190 cfs on basis of step-backwater computation; minimum, 11 cfs July 30, 31 (gage height, 0.73 ft).

Period of record: Maximum discharge, 673 cfs May 22 (gage height, 5.59 ft), from rating curve extended above 190 cfs on basis of step-water computation; maximum gage height, 5.62 ft Feb. 16, 1971 (backwater from ice); minimum daily discharge, 7.4 cfs Aug. 11, 12, 17, 1971.

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.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1971	1,473	83	37	47.5	2,920
November	1,026	47	28	34.2	2,040
December	762	33	18	24.6	1,510
January 1972	626	33	17	20.2	1,240
February	745	60	20	25.7	1,480
March	5,176	349	66	167	10,270
April	1,533	68	40	51.1	3,040
May	1,815	488	19	58.5	3,600
June	813	46	12	27.1	1,610
July	685	52	11	22.1	1,360
August	867	39	14	28.0	1,720
September 1972	1,214	58	28	40.5	2,410
Water year 1971-72	16,735	488	11	45.7	33,190

MONTHLY SUMMARY OF DISCHARGE
Tongue River at Miles City, Montana

LOCATION.--Lat 46°21'30", long 105°48'24", in SE¼ 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 1972. 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.

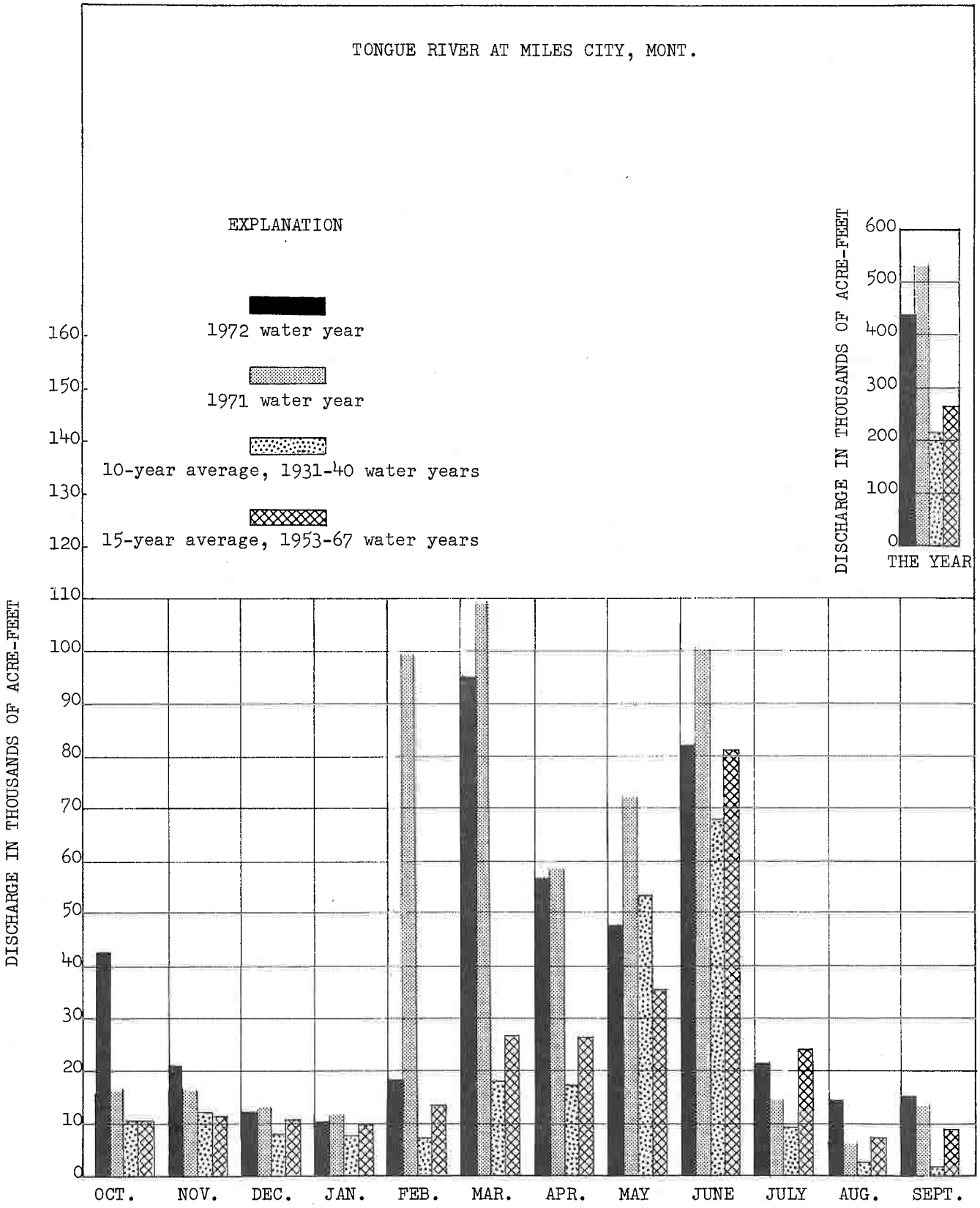
AVERAGE DISCHARGE.--29 years (1938-41, 1946-72), 423 cfs (306,500 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 6,430 cfs Oct. 3 (gage height, 8.66 ft); minimum daily, 100 cfs Dec. 8-13, Jan. 14.

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.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1971	21,523	4,560	195	694	42,690
November	10,766	474	240	359	21,350
December	6,240	372	100	201	12,380
January 1972	5,230	250	100	169	10,370
February	9,250	700	170	319	18,350
March	47,942	3,600	600	1,547	95,090
April	28,485	1,260	286	949	56,500
May	24,195	1,490	416	780	47,990
June	41,399	2,240	755	1,380	82,110
July	10,891	738	165	351	21,600
August	7,454	542	171	240	14,790
September 1972	7,720	324	212	257	15,310
Water year 1971-72	221,095	4,560	100	604	438,500



Comparison of discharge during 1972 water year with 1971 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°26'56", long 105°18'44", in NW¼SW¼ 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 1972. 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.

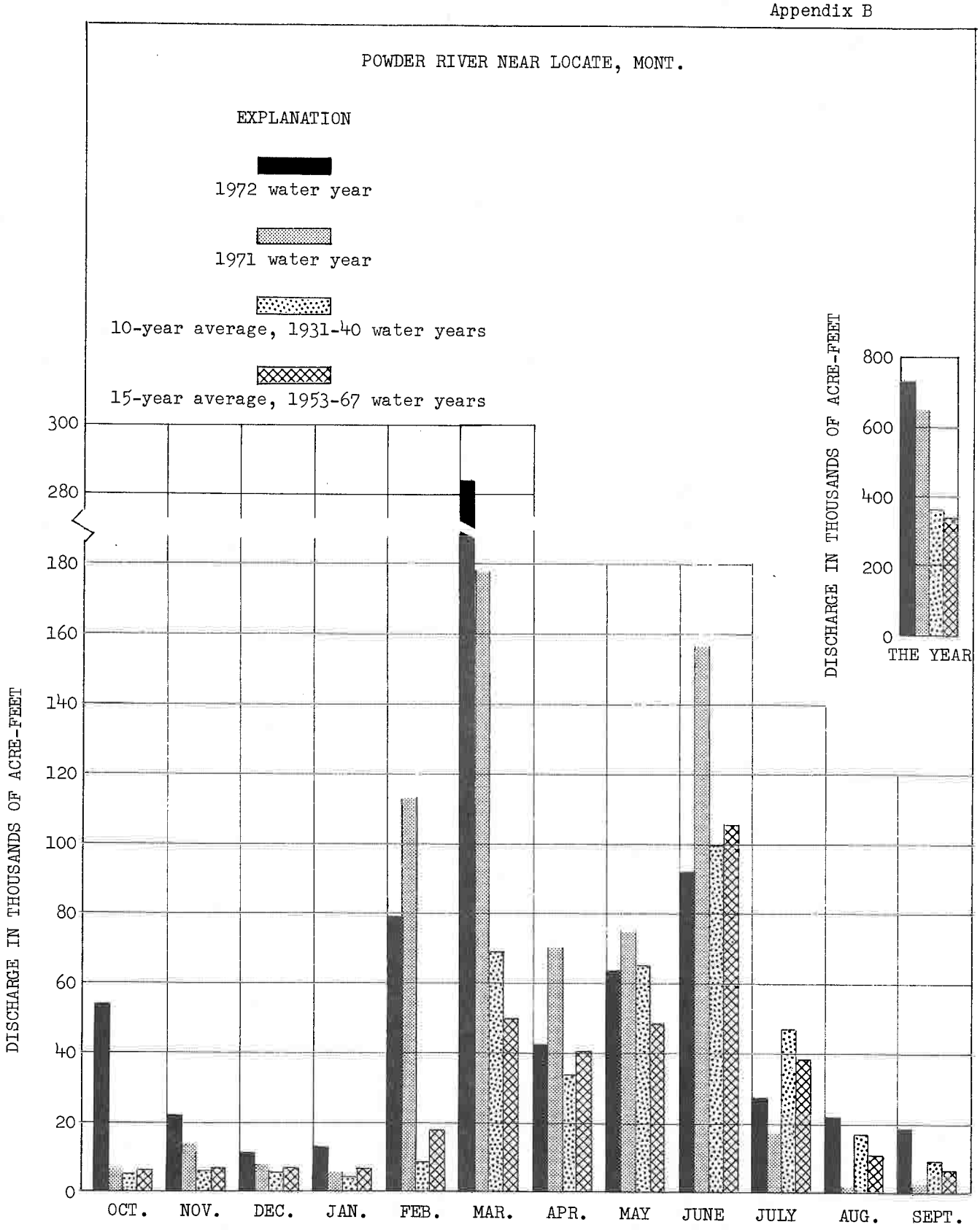
AVERAGE DISCHARGE.--34 years, 620 cfs (449,200 acre-ft per year).

EXTREMES.--Current year: Maximum discharge, 14,500 cfs Mar. 11 (gage height, 8.50 ft); minimum daily, 50 cfs Dec. 12.

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.

Month	Second-foot days	Maximum	Minimum	Mean	Runoff in acre-feet
October 1971	27,417	4,890	107	884	54,380
November	11,224	650	230	374	22,260
December	3,180	250	50	103	6,310
January 1972	4,025	170	80	130	7,980
February	39,840	7,000	130	1,374	79,020
March	143,422	14,100	942	4,627	284,500
April	21,422	894	599	714	42,490
May	32,145	1,650	620	1,037	63,760
June	46,285	4,550	767	1,543	91,810
July	13,869	739	180	447	27,510
August	11,190	1,040	130	361	22,200
September 1972	9,379	571	208	313	18,600
Water year 1971-72	363,398	14,100	50	993	720,800



Comparison of discharge for 1972 water year with 1971 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, 749,100 acre-ft June 26 (elevation, 4,725.35 ft); minimum, 441,200 acre-ft May 4-8 (elevation, 4,707.00 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).

Month	Water-surface elevation in feet	Contents in acre-feet*	Change in contents during month in acre-feet
September 30, 1971	4,721.77	680,700	--
October 31	4,721.98	684,600	+3,900
November 30	4,719.85	645,800	-38,800
December 31	4,719.25	635,100	-10,700
January 31, 1972	4,715.55	571,700	-63,400
February 29	4,713.70	541,800	-29,900
March 31	4,711.13	501,900	-39,900
April 30	4,707.19	443,900	-58,000
May 31	4,712.07	516,200	+72,300
June 30	4,724.81	738,400	+222,200
July 31	4,723.92	721,200	-17,200
August 31	4,721.68	679,000	-42,200
September 30, 1972	4,719.40	637,800	-41,200
Water year 1971-72			-42,900

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

RESERVOIR 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 concrete arch dam completed in 1960. Revised total capacity, 17,230 acre-ft between elevation 6,343.75 ft (invert of river outlet) and 6,441.00 ft (spillway crest), including 68 acre-ft below elevation 6,343.75 ft. Prior to Oct. 1, 1971, total capacity was 17,350 acre-ft with 149 acre-ft below the invert.

Records given in this report are total contents. Data furnished by U.S. Bureau of Reclamation.

Month	Water-surface elevation in feet	Contents in acre-feet*	Change in contents during month in acre-feet
September 30, 1971	6,344.00	†69	-
October 31	6,344.00	69	0
November 31	6,343.25	62	-7
December 31	Dry	0	-62
January 31, 1972	6,343.25	62	+62
February 29	6,344.75	76	+14
March 31	6,357.67	347	+271
April 30	6,351.00	175	-172
May 31	6,382.32	2,040	+1,865
June 30	6,383.15	2,140	+100
July 31	Dry	0	-2,140
August 31	6,348.75	134	+134
September 30, 1972	Dry	0	-134
Water year 1971-72			-69

* Includes dead storage.
† Contents from capacity table used beginning Oct. 1, 1971; contents from capacity table used prior to Oct. 1, 1971 was 153 acre-ft.

RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

BIGHORN LAKE

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. Prior to Oct. 1, 1969, published as Yellowtail Reservoir.

EXTREMES.--Current year: Maximum daily contents, 1,090,000 acre-ft Oct. 20 (elevation, 3,639.42 ft); minimum, 705,500 acre-ft May 18 (elevation, 3,592.38 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).

Month	Water-surface elevation in feet	Contents in acre-feet*	Change in contents during month in acre-feet
September 30, 1971	3,638.09	1,073,000	--
October 31	3,635.95	1,048,000	-25,000
November 30	3,630.27	987,400	-60,600
December 31	3,621.90	911,500	-75,900
January 31, 1972	3,617.03	873,900	-37,600
February 29	3,623.08	921,500	+47,600
March 31	3,623.61	926,000	+4,500
April 30	3,605.90	791,800	-134,200
May 31	3,602.26	767,300	-24,500
June 30	3,628.44	969,700	+202,400
July 31	3,631.47	999,600	+29,900
August 31	3,636.02	1,049,000	+49,400
September 30, 1972	3,637.76	1,069,000	+20,000
Water year 1971-72			-4,000

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

Appendix D

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 Water Resources Division of the Montana Department of Natural Resources and Conservation, which agency furnished operating data.

Contents in acre-feet

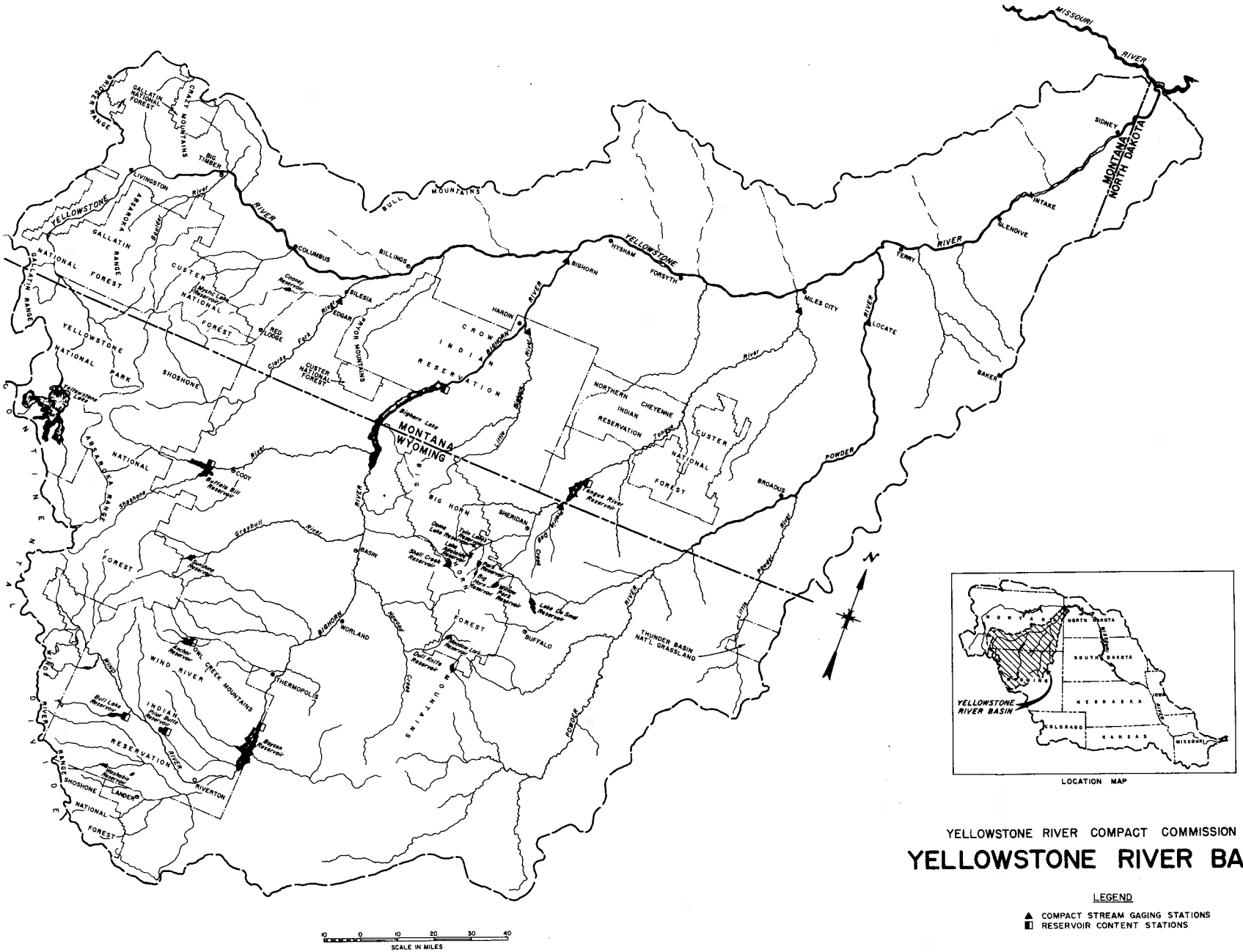
Month	a/Bull Lake	b/Pilot Butte Reservoir	c/Buffalo Bill Reservoir	d/Tongue River Reservoir
September 30, 1971	146,100	2,830	358,000	23,500
October 31	147,400	7,100	333,400	32,610
November 30	143,000	17,350	321,900	34,600
December 31	129,000	18,080	288,100	32,800
January 31, 1972	114,000	16,610	272,400	34,200
February 29	106,600	19,440	244,300	36,200
March 31	100,500	24,140	227,200	55,800
April 30	90,080	25,900	154,400	41,330
May 31	87,230	25,580	190,500	49,040
June 30	150,900	23,260	420,700	57,620
July 31	140,300	23,100	417,800	51,760
August 31	132,100	21,430	393,600	40,000
September 30, 1972	121,800	17,590	373,200	32,800
Change in Contents during water year	-24,300	+14,760	+15,200	+9,300

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.



YELLOWSTONE RIVER COMPACT COMMISSION

YELLOWSTONE RIVER BASIN

LEGEND

▲ COMPACT STREAM GAGING STATIONS
◧ RESERVOIR CONTENT STATIONS