

THIRTIETH ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1981

YELLOWSTONE RIVER COMPACT COMMISSION

821 East Interstate Avenue  
Bismarck, North Dakota

Honorable Ed Herschler  
Governor of the State of Wyoming  
Cheyenne, Wyoming

Honorable Ted Schwinden  
Governor of the State of Montana  
Helena, Montana

Honorable Allen I. Olson  
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 thirtieth annual report of activities for the period ending September 30, 1981.

The Commission held the annual meeting at Cheyenne, Wyoming, on December 21, 1981. The original meeting, scheduled for November 24, 1981, in Sheridan, Wyoming, was cancelled due to the shut down of the Federal Government and the inability of the Chairman to attend. Mr. George L. Christopulos, Wyoming State Engineer, Mr. Gary Fritz, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, the designated representatives of their respective States, and Mr. L. Grady Moore, the designated Federal representative and chairman, were all present.

Others present were:

Rich Moy, Department of Natural Resources and Conservation,  
Helena, Montana,  
Steve Holnbeck, Department of Natural Resources and Conservation,  
Helena, Montana,  
Paul Kawulok, State Engineer's Office, Story, Wyoming,  
Craig Cooper, State Engineer's Office, Riverton, Wyoming,  
Paul Schwieger, State Engineer's Office, Cheyenne, Wyoming,  
Bob Lane, Department of Natural Resources and Conservation,  
Helena, Montana,  
Tom Acevedo, Attorney for Crow Indian Tribe, Boulder,  
Colorado,  
Jack Palma, Attorney for Sheridan-Little Horn Water Group,  
Cheyenne, Wyoming,  
Larry Wolfe, Wyoming Attorney General's Office, Cheyenne,  
Wyoming,

Dave Palmerlee, Attorney for Sheridan-Little Horn Water Group, Buffalo, Wyoming,  
Larry Baccari, President, Sheridan-Little Horn Water Group, Sheridan, Wyoming,  
David B. Fuller, Managing Partner-Fuller Ranch Co., Parkman, Wyoming,  
Louis E. Allen, State Engineer's Office, Cheyenne, Wyoming,  
John Buyok, State Engineer's Office, Cheyenne, Wyoming

No incidents during the year required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission believes that a program of intensive water-use regulations is not necessary. However, the attention of the Commission is continuing to focus on the need to define the detailed procedures for implementing Compact provisions to the time when development of water within the Yellowstone River Basin requires that these provisions be enforced.

The interest in Yellowstone River water for coal development and peripheral needs has continued to increase. It is evident that, at some yet undetermined time, division of the waters of the Yellowstone River System, as allocated by Article V of the Compact, will be necessary.

The documentation of pre-1950 water rights has been completed in Wyoming. The 1973 Montana Water Use Act is assisting that State in its documentation, although it is still incomplete.

A problem that continues to be of major long-range concern to the Commission is the lack of proper quantification of all existing water rights. Of particular concern are the water rights of the Indian tribes and the implied Federal reserved rights. The Commission believes that studies and action necessary to quantify these rights should be expedited.

The Commission believes that due to the potential for large-scale use of water associated with coal development, joint allocation and development studies should be conducted in the near future. The proposal submitted to the Old West Regional Commission for the support of these studies was approved by the Commission's Agriculture and Resources Committee. The proposal, however, was not funded before the Old West Regional Commission was abolished. The Wyoming State Engineer's Office and the Montana Department of Natural Resources and Conservation, however, have each assigned one individual on their staffs to address these studies. The operation of the Tongue River Reservoir this year has raised the question of administering the Compact if in the future the flow is insufficient to fill the reservoir. Therefore, the Tongue River Basin will be the initial basin for study.

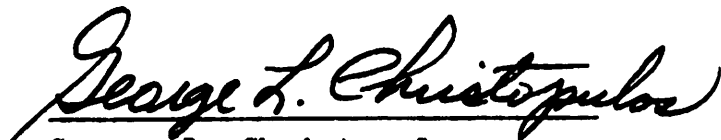
There is an immediate need for development and relocation studies on the Little Bighorn River. ARTICLE V of the Compact does not allocate the water of Little Bighorn River between Wyoming and Montana. A work group was established to develop options available to address the problem.

Another problem being addressed by the Commission is the diversion of water in Wyoming for use in Montana.

The following legal issues pertinent to the Yellowstone River Compact Commission were also discussed:

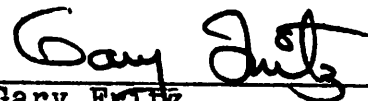
Utah International vs. Intake Water Co.  
Intake Water Co. vs. Yellowstone River Compact Commission  
Jan Paul application  
Montana Senate Bill 243, which delegates authority to the Montana Department of Natural Resources and Conservation to authorize diversions from the Yellowstone River Basin.

The budgets for fiscal years 1982 through 1983 are discussed in the following general report. The amount of funds required for future Commission activities will depend largely on the outcome of water-development plans, inflation, and the degree of water administration required.



George L. Christopoulos  
Commissioner for Wyoming

Respectfully submitted,



Gary Fritz  
Commissioner for Montana



L. Grady Moore  
Federal Representative

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## 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 Fiscal Year 1981 was \$24,280, in accordance with the budget adopted for the year.

The budgets for Fiscal Years 1982 and 1983 were tentatively adopted subject to the availability of appropriations.

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

October 1, 1980, to September 30, 1981 (Fiscal Year 1981):

Continuation of existing stream-gaging programs \$24,280

October 1, 1981, to September 30, 1982 (Fiscal Year 1982):

Continuation of existing stream-gaging program \$30,800

October 1, 1982, to September 30, 1983 (Fiscal Year 1983):

Estimate for continuation of existing stream-gaging program \$28,720

### Gaging Stations:

Gaging stations at the measuring sites specified in the Compact were continued in operation and satisfactory discharge records collected at each. Locations of gaging and reservoir stations are shown on a map of the Yellowstone River Basin at the end of the report.

During the water year ending September 30, 1981, annual streamflow was below average in all four tributaries of the Yellowstone River as given in the following table:

<u>Measurement Point</u>	<u>Percent of Average</u>
Clarks Fork Yellowstone River near Silesia, MT	92
Bighorn River at Bighorn minus Little Bighorn River near Hardin, MT Adjusted for change in contents in Bighorn Lake	78
Tongue River at Miles City, MT	71
Powder River near Locate, MT	59

Details of streamflow for Water Year 1981 and bar graphs showing comparisons with average flows during selected base periods and with the preceding year are given in appendix C.

#### Diversions:

No incidents during the year required administration of the water in accordance with the provisions of the Compact. At the present level of water-resources development, the Commission believes that a program of intensive water-use regulations is not necessary.

#### 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 1,061,000 acre-feet at the beginning of the year and 1,036,000 acre-feet at the close. It fluctuated from a minimum of 822,200 acre-feet on April 26, 1981, to a maximum of 1,111,000 acre-feet on June 30, 1981. Boysen Reservoir, located on the Wind River and operated by the U.S. Bureau of Reclamation, began the year with 607,700 acre-feet in storage and ended with 653,000 acre-feet. Details regarding these reservoirs are given in appendix D. 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 E 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 appropriate rights existing in the States of Wyoming and Montana on January 1, 1950, are supplied, and after appropriate 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 streamflow 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 NW1/4 SE1/4 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 NE1/4 NE1/4 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 SW1/4 NW1/4 sec. 20, 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 SE1/4 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 SE1/4 sec. 23, 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 are 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 at the office of the Chairman of the Commission.
- 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. The Geological Survey shall 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

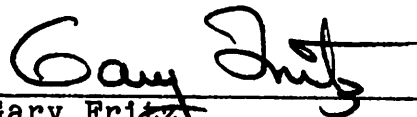
An annual meeting of the Commission shall be held each November at some mutually agreeable point in the

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.

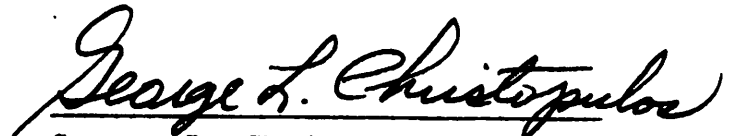
No action of the Commission shall be effective until approval by the Commissioners for the States of Wyoming and Montana.

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.



Gary Fritz  
Gary Fritz  
Commissioner for Montana



George L. Christopulos  
George L. Christopulos  
Commissioner for Wyoming

ATTESTED:



L. Grady Moore  
L. Grady Moore  
Federal Representative

Adopted November 17, 1953  
Amended April 9, 1980

## METRIC CONVERSION TABLE

The following factors may be used to convert the inch-pound units published herein to the International System (SI) of metric units. Subsequent reports will contain both the inch-pound and SI unit equivalents in the station manuscript descriptions until such time that all data will be published in SI units.

<u>Multiply inch-pound units</u>	<u>By</u>	<u>To obtain SI units</u>
Length		
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
Area		
acres	4047	square meters (m <sup>2</sup> )
	.4047	*hectares (ha)
	.4047	square hectometer (hm <sup>2</sup> )
	.004047	square kilometers (km <sup>2</sup> )
square miles (mi <sup>2</sup> )	2.590	square kilometers (km <sup>2</sup> )
Volume		
cfs-day (ft <sup>3</sup> /s-day)	2447	cubic meters (m <sup>3</sup> )
	.002447	cubic hectometers (hm <sup>3</sup> )
acre-feet (acre-ft)	1233	cubic meters (m <sup>3</sup> )
	.001233	cubic hectometers (hm <sup>3</sup> )
	.000001233	cubic kilometers (km <sup>3</sup> )
Flow		
cubic feet per second (ft <sup>3</sup> /s)	28.32	liters per second (L/s)
	28.32	cubic decimeters per second (dm <sup>3</sup> /s)
	.02832	cubic meters per second (m <sup>3</sup> /s)

\*The unit hectare is approved for use with the International System (SI) for a limited time. See NBS Special Bulletin 330, p. 15, 1972 edition.

## MONTHLY SUMMARY OF DISCHARGE FOR COMPACT STREAM-GAGING STATIONS

06208800 CLARKS FORK YELLOWSTONE RIVER NEAR SILESIA, MT

LOCATION.--Lat 45°30'48", long 108°49'42", in NW1/4 SE1/4 sec. 1, T. 4 S., R. 23 E., Carbon County, Hydrologic Unit 10070006, on left bank 0.5 mi (0.8 km) downstream from Whitehorse Canal intake, 1 mi (2 km) upstream from Rock Creek, 3 mi (5 km) south of Silesia, and at mile 16.3 (26.2 km), revised.

DRAINAGE AREA.--2,093 mi<sup>2</sup> (5,421 km<sup>2</sup>).

PERIOD OF RECORD.--October 1969 to current year. Records for July 1921 to September 1969 (published as Clarks Fork Yellowstone River at Edgar) at site 5.8 mi (9.3 km) upstream not equivalent owing to diversion in Whitehorse Canal during irrigation season. Records since January 1950 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Datum of gage is 3,405.79 ft (1,038.085 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers).

REMARKS.--Records good. Diversion for irrigation of about 42,600 acres (172 km<sup>2</sup>) of which 1,100 acres (4.45 km<sup>2</sup>) lies below station. In addition, about 9,000 acres (36.4 km<sup>2</sup>) of land above station are irrigated by diversions from the adjoining Rock Creek basin.

AVERAGE DISCHARGE.--12 years, 1,191 ft<sup>3</sup>/s (33.73 m<sup>3</sup>/s), 862,900 acre-ft/yr (1.06 km<sup>3</sup>/yr).

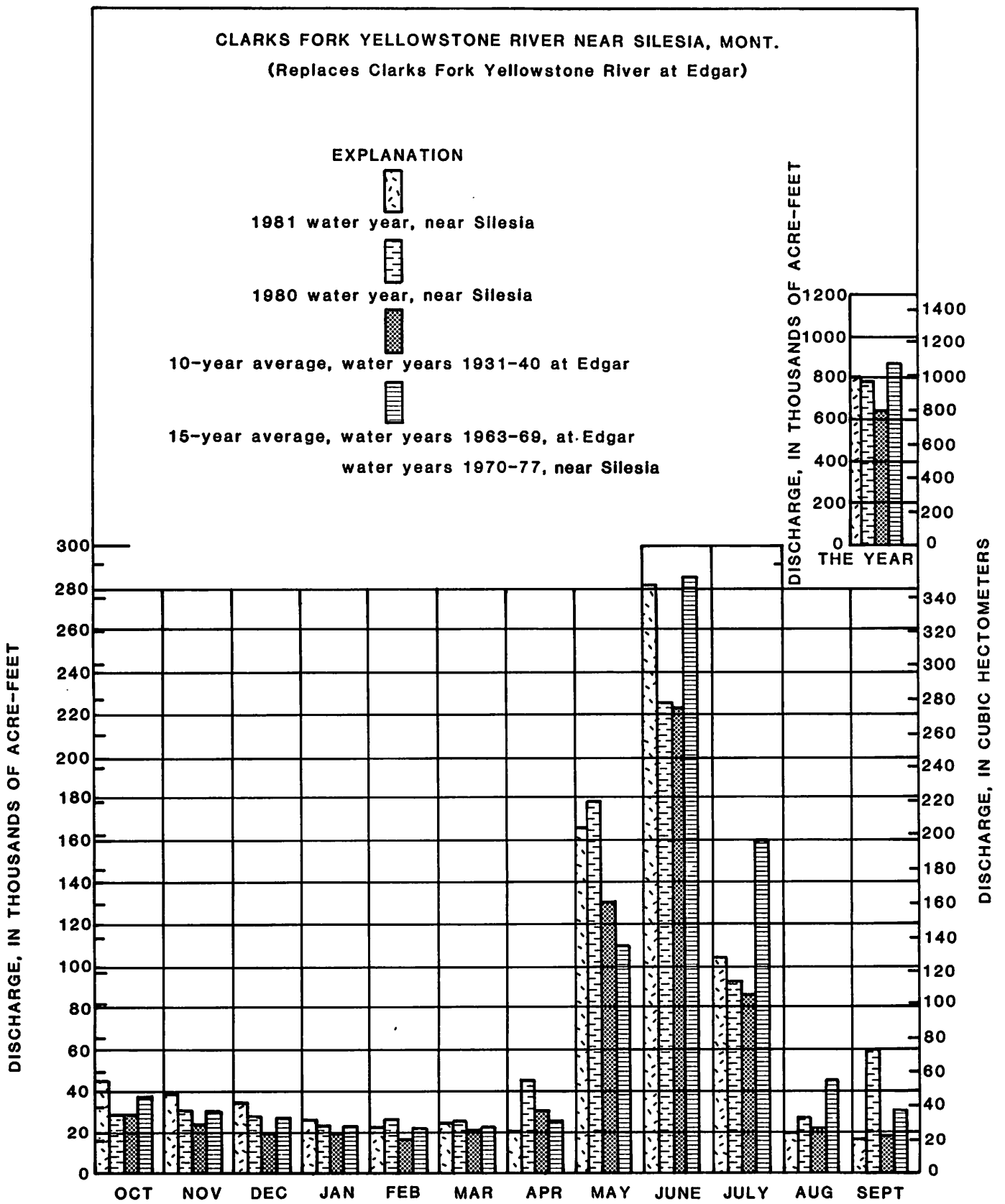
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,500 ft<sup>3</sup>/s (382 m<sup>3</sup>/s) June 10, 1981, gage height, 8.36 ft (2.548 m); minimum, 56 ft<sup>3</sup>/s (1.59 m<sup>3</sup>/s) Apr. 25, 1981, gage height, 0.53 ft (0.162 m).

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 5,300 ft<sup>3</sup>/s (150 m<sup>3</sup>/s) and maximums (\*):

Date	Time	Discharge		Gage height	
		(ft <sup>3</sup> /s)	(m <sup>3</sup> /s)	(ft)	(m)
June 1	1400	7,010	199	6.07	1.850
June 10	0300	*13,500	382	*8.36	2.548
June 24	1300	5,460	155	5.10	1.554

Minimum discharge, 56 ft<sup>3</sup>/s (1.59 m<sup>3</sup>/s) Apr. 25, gage height, 0.53 ft (0.162 m).

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1980	22,262	718	883	555	44,160
November	19,744	658	850	580	39,160
December	18,631	601	960	390	36,950
January 1981	13,635	440	537	387	27,050
February	10,618	379	520	130	21,060
March	11,683	377	435	344	23,170
April	10,115	337	600	66	20,060
May	83,217	2,684	6,330	648	165,100
June	142,140	4,738	10,500	2,050	281,900
July	52,654	1,699	3,590	648	104,400
August	10,328	333	648	183	20,490
September 1981	7,898	263	387	197	15,670
1981 water year	402,925	1,104	10,500	66	799,200



Comparison of discharge during 1981 water year with 1980 water year near Silesia and with average discharge for water years 1931-40 at Edgar and for water years 1963-69 at Edgar and 1970-77 near Silesia.

## 06294000 LITTLE BIGHORN RIVER NEAR HARDIN, MT

LOCATION.--Lat 45°44'09", long 107°33'24", revised, in SE1/4 NE1/4 NE1/4 sec. 19, T. 1 S., R. 34 E., Big Horn County, Hydrologic Unit 10080016, on left bank 50 ft (15 m) downstream from bridge on Sarpy Road, 0.2 mi (0.3 km) upstream from terminal wasteway of Agency Canal, 0.6 mi (1.0 km) upstream from mouth, and 2.3 mi (3.7 km) east of Hardin.

DRAINAGE AREA.--1,294 mi<sup>2</sup> (3,351 km<sup>2</sup>).

PERIOD OF RECORD.--June 1953 to current year. Records since June 1953 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Datum of gage is 2,882.29 ft (878.522 m), National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to Oct. 7, 1953, nonrecording gage at site 0.4 mi (0.6 km) downstream. Oct. 7, 1953, to May 6, 1963, water-stage recorder at site 0.3 mi (0.5 km) downstream. May 6, 1963, to Nov. 6, 1963, nonrecording gage at site 0.4 mi (0.6 km) downstream. All at different datums. Nov. 7, 1963, to Aug. 15, 1976, water-stage recorder at site 35 ft (11 m) downstream at present datum. Aug. 15, 1976, to Sept. 30, 1979, water-stage recorders located on each bank downstream of Sarpy Road bridge and were used depending on control conditions

REMARKS.--Records fair except those for winter period, which are poor. Flow partly regulated by Willow Creek Reservoir (capacity 23,000 acre-ft, 28.4 hm<sup>3</sup>). Diversions for irrigation of about 17,000 acres (68.8 km<sup>2</sup>) above station. Figures of discharge given herein include flow of terminal wasteway of Agency Canal.

AVERAGE DISCHARGE.--28 years 318 ft<sup>3</sup>/s (9.006 m<sup>3</sup>/s), 230,400 acre-ft/yr (284 hm<sup>3</sup>/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,600 ft<sup>3</sup>/s (640 m<sup>3</sup>/s), May 19, 1978, gage height, 11.20 ft (3.414 m), used gage height as obtained at bridge on Sarpy Road; maximum gage height, 11.78 ft (3.591 m) Mar. 20, 1960, site and datum then in use (backwater from ice); minimum discharge observed, 0.20 ft<sup>3</sup>/s (0.006 m<sup>3</sup>/s) Aug. 7, 1961, result of discharge measurement.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,980 ft<sup>3</sup>/s (56.1 m<sup>3</sup>/s) May 25, gage height, 4.68 ft (1.426 m), only peak above base of 1,000 ft<sup>3</sup>/s (28.3 m<sup>3</sup>/s); minimum, 46 ft<sup>3</sup>/s (1.30 m<sup>3</sup>/s) Sept. 1.

<u>Month</u>	<u>Second-foot days</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Runoff in acre-feet</u>
October 1980	3,484	112	147	72	6,910
November	3,940	131	150	110	7,810
December	4,715	152	250	65	9,350
January 1981	4,245	137	170	110	8,420
February	4,511	161	273	60	8,950
March	4,346	140	172	128	8,620
April	4,288	143	184	126	8,510
May	19,351	624	1,900	146	38,380
June	20,234	674	1,050	338	40,130
July	5,309	171	311	108	10,530
August	3,013	97.2	155	48	5,980
September 1981	2,625	87.5	122	48	5,210
1981 water year	80,061	219	1,900	48	158,800

## 06294700 BIGHORN RIVER AT BIGHORN, MT

LOCATION.--Lat 46°08'50", long 107°28'00", in NE1/4 NE1/4 sec. 33, T. 5 N., R. 34 E., Treasure County, Hydrologic Unit 10080015, on right bank just downstream from bridge on old U.S. Highway 10, 0.3 mi (0.5 km) downstream from bridge on Interstate Highway 94, 0.7 mi (1.1 km) upstream from mouth, 1.3 mi (2.1 km) southwest of Bighorn, and 4.4 mi (7.1 km) east of Custer.

DRAINAGE AREA.--22,885 mi<sup>2</sup> (59,272 km<sup>2</sup>). Area at site used prior to Oct. 7, 1955, 22,410 mi<sup>2</sup> (59,042 km<sup>2</sup>).

PERIOD OF RECORD.--May 1945 to current year. Published as "near Custer," 1945-55. Records since January 1950 available in annual reports of the Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,690 ft (820 m), by barometer. May 11 to Dec. 6, 1945, nonrecording gage, and Dec. 7, 1945, to Oct. 6, 1955, water-stage recorder, at site 4 mi (6 km) upstream at different datum.

REMARKS.--Records fair except those for periods of backwater Apr. 30 to July 19, which are poor. Flow regulated by Bighorn Lake beginning November 1965 (usable capacity, 1,356,000 acre-ft, 1.67 km<sup>3</sup>). 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 (1.73 km<sup>3</sup>), see appendixes D and E. Diversions for irrigation of about 465,000 acres (1,880 km<sup>2</sup>) above station.

AVERAGE DISCHARGE.--36 years, 3,921 ft<sup>3</sup>/s (111.0 m<sup>3</sup>/s) 2,841,000 acre-ft/yr (3.50 km<sup>3</sup>/yr), unadjusted.

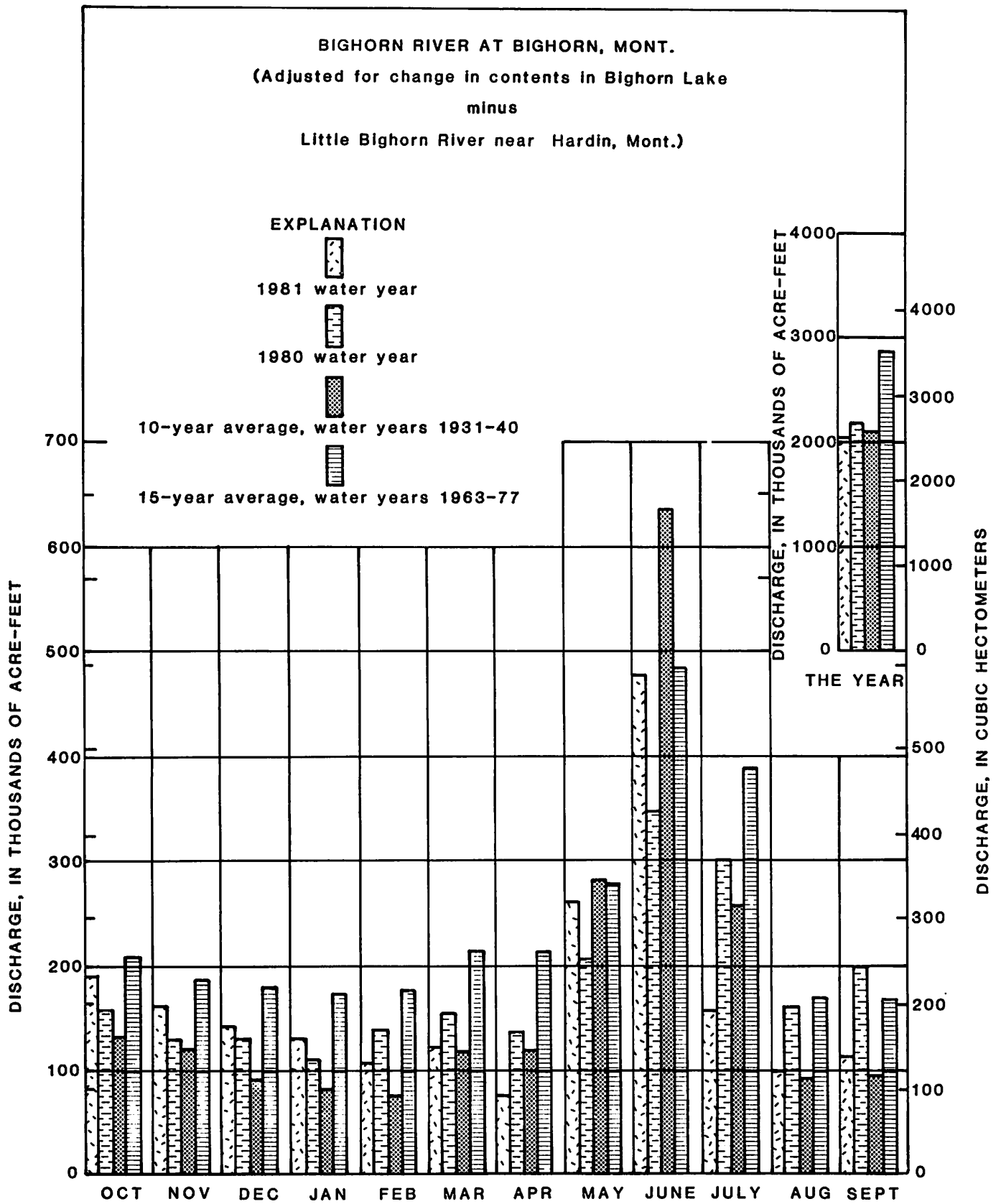
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 59,200 ft<sup>3</sup>/s (1,680 m<sup>3</sup>/s) May 20, 1978, gage height, 14.15 ft (4.313 m), revised; maximum gage height recorded, 14.21 ft (4.331 m) Apr. 2, 1965 (ice jam); minimum discharge, about 275 ft<sup>3</sup>/s (7.79 m<sup>3</sup>/s) Nov. 15, 1959, result of freezeup; minimum daily, 400 ft<sup>3</sup>/s (11.3 m<sup>3</sup>/s) Apr. 4, 1967.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 9,950 ft<sup>3</sup>/s (282 m<sup>3</sup>/s) June 11, gage height, 7.53 ft (2.295 m); minimum daily, 1,090 ft<sup>3</sup>/s (30.9 m<sup>3</sup>/s) Apr. 25.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet	Adjusted runoff, in acre-feet*
Oct. 1980	127,430	4,111	4,750	1,930	252,800	194,800
Nov.	88,170	2,939	3,200	2,520	174,900	168,700
Dec.	99,590	3,213	3,660	2,300	197,500	151,200
Jan. 1981	102,130	3,295	3,430	3,200	202,600	140,600
Feb.	86,590	3,093	3,640	2,200	171,800	117,100
Mar.	69,270	2,235	2,880	1,850	137,400	132,000
Apr.	45,370	1,512	1,990	1,090	90,000	85,700
May	80,030	2,582	5,270	1,120	158,700	301,200
June	188,280	6,276	9,070	3,020	373,500	517,900
July	118,580	3,825	6,060	2,420	235,200	167,200
Aug.	56,920	1,836	2,350	1,480	112,900	103,900
Sept. 1981	58,810	1,960	2,140	1,750	116,600	118,600
1981 water year	1,121,170	3,072	9,070	1,090	2,224,000	2,199,000

\*Adjusted for change in contents in Bighorn Lake.





Comparison of discharge for 1981 water year with 1980 water year and with average discharge for water years 1931-40 and 1963-77.

## 06308500 TONGUE RIVER AT MILES CITY, MT

LOCATION (REVISED).--Lat 46°20'44", long 105°48'10", in NE1/4 NE1/4 SE1/4 sec. 23, T. 7 N., R. 47 E., Custer County, Hydrologic Unit 10090102, on right bank 4 mi (6 km) south of Miles City and at mile 8.1 (13.0 km).

DRAINAGE AREA.--5,379 mi<sup>2</sup> (13,932 km<sup>2</sup>).

PERIOD OF RECORD.--April 1938 to April 1942, April 1946 to current year. 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 discharges 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. Datum of gage is 2,375.76 ft (724.132 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). April 1938 to April 1942, nonrecording gage at site 8 mi (13 km) upstream at different datum. April 1946 to Sept. 30, 1963, at datum 1.00 ft (0.305 m) higher.

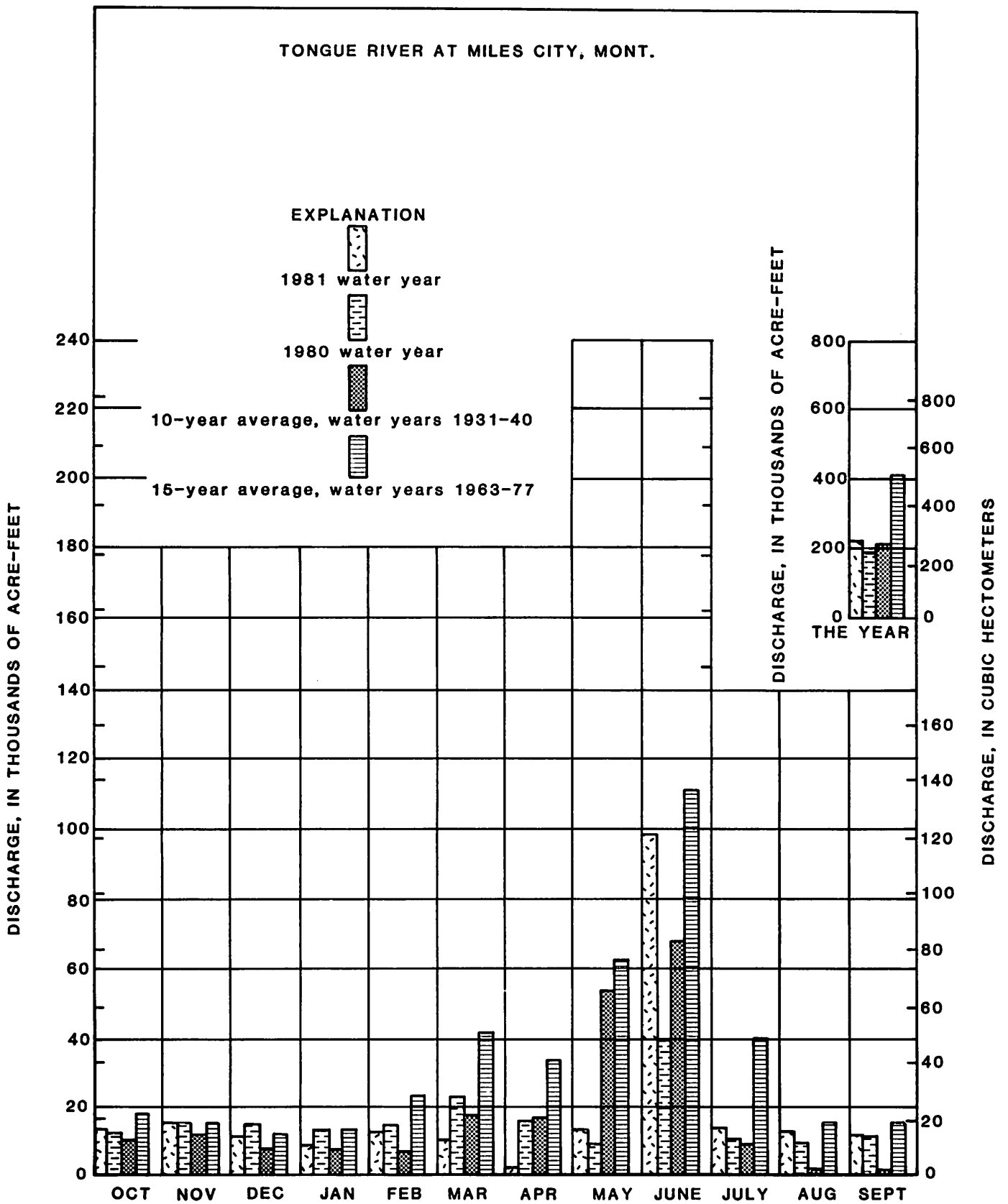
REMARKS.--Water-discharge records fair except those for winter period, which are poor. Flow regulation by Tongue River Reservoir (appendix E) and many small reservoirs in Wyoming (combined capacity, about 15,000 acre-ft, 18.5 hm<sup>3</sup>). Diversions for irrigation of about 90,000 acres (364 km<sup>2</sup>) above station.

AVERAGE DISCHARGE.--38 years (1938-41, 1946-81), 444 ft<sup>3</sup>/s (12.57 m<sup>3</sup>/s), 321,700 acre-ft/yr (397 hm<sup>3</sup>/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,300 ft<sup>3</sup>/s (337 m<sup>3</sup>/s) June 15, 1962, gage height, 12.33 ft (3.758 m), present datum, from rating curve extended above 8,220 ft<sup>3</sup>/s (233 m<sup>3</sup>/s) on basis of float measurement; maximum gage height, 13.27 ft (4.045 m), Mar. 19, 1960, Feb. 15, 1971 (ice jam), present datum; no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 2,250 ft<sup>3</sup>/s (63.7 m<sup>3</sup>/s) June 14, gage height, unknown, from observer gage height and extension of rating curve developed at nonrecording gage site 11.0 mi (17.7 km) upstream at different datum; minimum daily discharge, 2.2 ft<sup>3</sup>/s (0.062 m<sup>3</sup>/s) May 5, as result of diversions for irrigation.

<u>Month</u>	<u>Second-foot days</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Runoff, in acre-feet</u>
October 1980	7,079	228	359	134	14,040
November	8,196	273	331	170	16,260
December	6,150	198	450	80	12,200
January 1981	4,680	151	170	130	9,280
February	6,710	240	470	90	13,310
March	5,291	171	237	128	10,490
April	1,206	40.2	130	12	2,390
May	6,981.4	225	1,900	2.2	13,850
June	49,485	1,650	2,200	776	98,150
July	7,476	241	673	60	14,830
August	6,621	214	250	187	13,130
September 1981	6,186	206	252	180	12,270
1981 water year	116,061.4	318	2,200	2.2	230,200



Comparison of discharge for 1981 water year with 1980 water year and with average discharge for water years 1931-40 and 1963-77.

## 06326500 POWDER RIVER NEAR LOCATE, MT

LOCATION.--Lat 46°25'48", long 105°18'34", in SW1/4 SW1/4 SE1/4 sec. 23, T. 8 N., R. 51 E., Custer County, Hydrologic Unit 10090209, on right bank at downstream side of bridge on Highway 12, 0.12 mi (0.19 km) west of Locate, 25 mi (40 km) east of Miles City, and at mile 29.4 (47.3 km).

DRAINAGE AREA.--13,189 mi<sup>2</sup> (34,160 km<sup>2</sup>). Drainage area at site used Oct. 1, 1965, to Mar. 21, 1978, 13,194 mi<sup>2</sup> (34,172 km<sup>2</sup>).

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

REVISED RECORDS.--WSP 926: 1939. WSP 1309: 1938-39 (M). WSP 1729: Drainage area.

GAGE.--Water-stage recorder. Datum of gage is 2,384.79 ft (726.884 m) National Geodetic Vertical Datum of 1929 (levels by U.S. Army Corps of Engineers). Prior to July 11, 1947, non-recording gage at bridge 50 ft (15 m) upstream, and July 11, 1947, to Sept. 30, 1965, water-stage recorder at present site and datum. Oct. 1, 1965, to Oct. 4, 1966, nonrecording gage, and Oct. 5, 1966, to Mar. 21, 1978, water-stage recorder 1.5 mi (2.4 km) downstream at different datum. Mar. 22, 1978, to Apr. 23, 1981, water-stage recorder at present site and datum, Apr. 24 to Aug. 20, 1981, water-stage recorder 1.5 mi (2.4 km) downstream at different datum, and Aug. 21, 1981 to Sept. 30, 1981, at present site and datum.

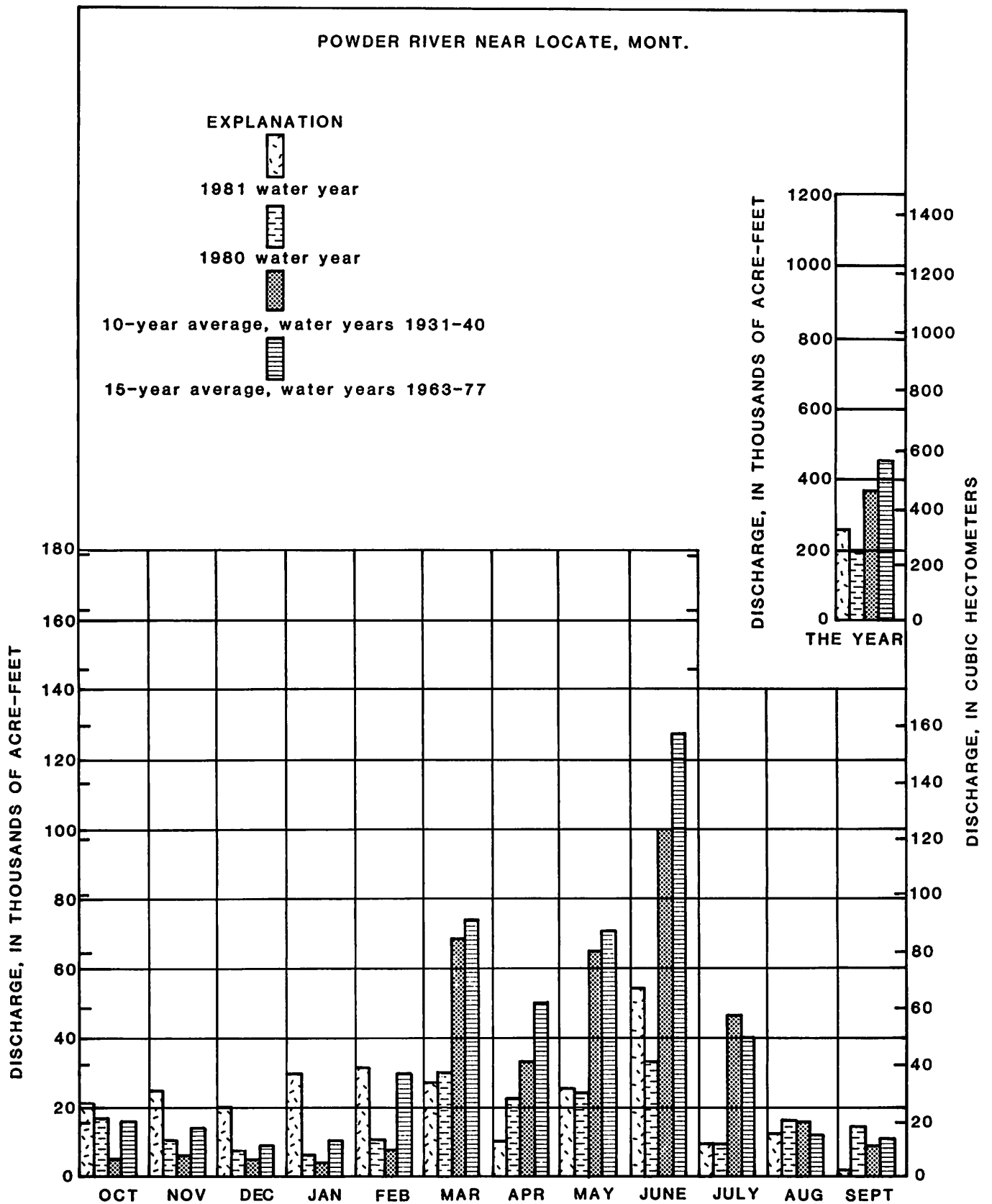
REMARKS.--Records poor. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft (45.5 hm<sup>3</sup>). Diversions for irrigation of about 74,500 acres (302 km<sup>2</sup>) above station.

AVERAGE DISCHARGE.--43 years, 618 ft<sup>3</sup>/s (17.50 m<sup>3</sup>/s), 447,700 acre-ft/yr (552 hm<sup>3</sup>/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge observed, 31,000 ft<sup>3</sup>/s (878 m<sup>3</sup>/s) Feb. 19, 1943, maximum gage height, 12.27 ft (3.740 m) Mar. 16, 1978 (backwater from ice); no flow Jan. 16 to Feb. 12, Feb. 22-24, 1950, July 27, Sept. 21-27, Oct. 1, 1960, Sept. 4-8, 1961.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 1,610 ft<sup>3</sup>/s (45.6 m<sup>3</sup>/s) June 1, gage height, 3.55 ft (1.082 m), no peaks above base of 5,000 ft<sup>3</sup>/s (142 m<sup>3</sup>/s); minimum, 4.0 ft<sup>3</sup>/s (0.11 m<sup>3</sup>/s) July 20, 23, gage height, 0.86 ft (0.262 m), at downstream site and datum.

<u>Month</u>	<u>Second-foot days</u>	<u>Mean</u>	<u>Maximum</u>	<u>Minimum</u>	<u>Runoff, in acre-feet</u>
October 1980	10,633	343	624	165	21,090
November	12,450	415	498	195	24,690
December	10,170	328	700	110	20,170
January 1981	14,750	476	800	270	29,260
February	16,015	572	900	130	31,770
March	13,645	440	850	277	27,060
April	5,224	174	290	80	10,360
May	12,942	417	1,480	82	25,670
June	27,694	923	1,560	251	54,930
July	4,783.6	154	808	4.0	9,490
August	6,107	197	913	40	12,110
September 1981	725	24.2	37	16	1,440
1981 water year	135,138.6	370	1,560	4.0	268,000



Comparison of discharge for 1981 water year with 1980 water year and with average discharge for water years 1931-40 and 1963-77.

## MONTHLY SUMMARY OF CONTENTS FOR COMPACT RESERVOIRS COMPLETED AFTER JANUARY 1, 1950

## 06258900 BOYSEN RESERVOIR, WY

LOCATION.--Lat 43°25'00", long 108°10'37", in NW1/4 NW1/4 sec. 16, T. 5 N., R. 6 E., Fremont County, at dam on Wind River, 13 mi (21 km) north of Shoshoni, Wyoming.

DRAINAGE AREA.--7,700 mi<sup>2</sup> (19,943 km<sup>2</sup>).

PERIOD OF RECORD.--October 1951 to current year (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is referenced to National Geodetic Vertical Datum of 1929 (levels by U.S. Bureau of Reclamation).

REMARKS.--Reservoir is formed by rock-fill dam completed in October 1951. Storage began Oct. 11, 1951. Usable capacity, 742,100 acre-ft (915 hm<sup>3</sup>) between elevation 4,657.00 ft (1,419.454 m), invert of penstock pipe, and 4,725.00 ft (1,440.180 m), top of spillway gate. Dead storage, 59,880 acre-ft (73.8 hm<sup>3</sup>) below elevation 4,657.00 ft (1,419.454 m). Prior to Jan. 1, 1966, usable capacity was 757,800 acre-ft (934 hm<sup>3</sup>) and dead storage was 62,000 acre-ft (76.4 hm<sup>3</sup>), at same elevations. Crest of dam is at elevation 4,758 ft (1,450 m). Figures given herein represent usable contents. Water used for irrigation, flood control, and power development.

COOPERATION.--Records furnished by U.S. Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 862,500 acre-ft (1,060 hm<sup>3</sup>) July 6, 7, 1967, elevation, 4,730.83 ft (1,441.957 m); minimum daily since normal use of water started, 189,800 acre-ft (234 hm<sup>3</sup>) Mar. 18, 19, 1956, elevation, 4,684.18 ft (1,427.738 m), capacity table then in use.

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 687,200 acre-ft (847 hm<sup>3</sup>) July 6, elevation, 4,722.10 ft (1,439.296 m); minimum daily, 501,400 acre-ft (618 hm<sup>3</sup>) Apr. 26, elevation, 4,711.10 ft (1,435.943 m).

<u>Month</u>	<u>Water-surface elevation, in feet</u>	<u>Contents*, in acre-feet</u>	<u>Change in contents, in acre-feet</u>
September 30, 1980. . . . .	4,717.68	607,700	
October 31. . . . .	4,717.23	600,000	-7,700
November 30 . . . . .	4,716.20	582,500	-17,500
December 31 . . . . .	4,715.08	564,000	-18,500
January 31, 1981. . . . .	4,713.89	544,800	-19,200
February 28 . . . . .	4,713.01	530,800	-14,000
March 31. . . . .	4,711.96	514,500	-16,300
April 30. . . . .	4,711.20	502,900	-11,600
May 31. . . . .	4,714.76	558,800	+ 55,900
June 30 . . . . .	4,721.89	682,900	+124,100
July 31 . . . . .	4,721.87	682,500	-400
August 31 . . . . .	4,720.98	666,200	-16,300
September 30, 1981. . . . .	4,720.25	653,000	-13,200
1981 water year			+45,300

\* Does not include dead storage of 59,880 acre-ft (73.8 hm<sup>3</sup>).

## 06260300 ANCHOR RESERVOIR, WY

LOCATION.--Lat 43°39'50", long 108°49'27", in sec. 26, T. 43 N., R. 100 W., Hot Springs County, at dam on South Fork Owl Creek, 2 mi (3 km) downstream from Middle Fork, 3 mi (5 km) southeast of Anchor, and 32 mi (51 km) west of Thermopolis.

DRAINAGE AREA.--125 mi<sup>2</sup> (324 km<sup>2</sup>), approximately.

PERIOD OF RECORD.--November 1960 to current year (monthend contents only).

GAGE.--Water-stage recorder. Datum of gage is referenced to National Geodetic Vertical Datum of 1929 (U.S. Bureau of Reclamation benchmark).

REMARKS.--Reservoir is formed by concrete arch dam completed in 1960. Usable capacity, 17,170 acre-ft (21.2 hm<sup>3</sup>) between elevation 6,343.75 ft (1,933.575 m), invert of river outlet, and 6,441.00 ft (1,963.217 m), spillway crest, not including 68 acre-ft (83,800 m<sup>3</sup>) below elevation 6,343.75 ft (1,933.575 m). Prior to Oct. 1, 1971, usable capacity was 17,280 acre-ft (21.3 hm<sup>3</sup>) not including 149 acre-ft (184,000 m<sup>3</sup>) below the invert. Figures given herein represent usable contents. Water is used for irrigation of land in Owl Creek basin.

COOPERATION.--Records furnished by U.S. Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 9,250 acre-ft (11.4 hm<sup>3</sup>) July 4, 1967 (elevation, 6,418.52 ft or 1,956.365 m); no storage on many days each year.

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 5,880 acre-ft (7.25 hm<sup>3</sup>) June 13, elevation, 6,407.55 ft (1,953.021 m); no storage on many days.

<u>Month</u>	<u>Water-surface elevation, in feet</u>	<u>Contents*, in acre-feet</u>	<u>Change in contents, in acre-feet</u>
September 30, 1980. . . . .	* 6,304.30	0	0
October 31. . . . .	* 6,304.30	0	0
November 30 . . . . .	* 6,304.30	0	0
December 31 . . . . .	* 6,304.30	0	0
January 31, 1981. . . . .	* 6,304.30	0	0
February 28 . . . . .	* 6,304.30	0	0
March 31. . . . .	* 6,304.30	0	0
April 30. . . . .	6,345.00	9	+9
May 31. . . . .	6,389.45	2,740	+2,731
June 30 . . . . .	6,399.68	4,340	+1,600
July 31 . . . . .	* 6,304.30	0	-4,340
August 31 . . . . .	* 6,304.30	0	0
September 30, 1981. . . . .	* 6,304.30	0	0
1981 water year			0

\*Does not include dead storage of 68 acre-ft (83,800 m<sup>3</sup>).

## 06286400 BIGHORN LAKE NEAR ST. XAVIER, MT

LOCATION.--Lat 45°18'27", long 107°57'26", in SW1/4 SE1/4 sec 18, T. 6 S., R. 31 E., Big Horn County, Hydrologic Unit 10080010, in block 13 of Yellowtail Dam on Bighorn River, 1.3 mi (2.1 km) upstream from Grapevine Creek, 15.5 mi (24.9 km) southeast of St. Xavier, and at mile 86.6 (139.3 km), revised.

DRAINAGE AREA.--19,626 mi<sup>2</sup> (50,831 km<sup>2</sup>).

PERIOD OF RECORD.--November 1965 to current year (monthend contents only). Prior to October 1969, published as "Yellowtail Reservoir."

GAGE.--Water-stage recorder in powerhouse control room. Datum of gage is referenced to National Geodetic Vertical Datum of 1929 (levels by U.S. Bureau of Reclamation).

REMARKS.--Reservoir is formed by thin concrete-arch dam; construction began in 1961; completed in 1967. Storage began Nov. 3, 1965. Usable capacity, 1,356,000 acre-ft (1.67 km<sup>3</sup>) between elevation 3,296.50 ft (1,004.773 m), river outlet invert, and 3,657.00 ft (1,114.654 m), top of flood control. Elevation of spillway crest, 3,593.00 ft (1,095.146 m). Normal maximum operating level, 1,097,000 acre-ft (1.35 km<sup>3</sup>), elevation, 3,640.00 ft (1,109.472 m). Minimum operating level, 483,400 acre-ft (596 hm<sup>3</sup>), elevation 3,547.00 ft (1,081.126 m). Dead storage, 18,970 acre-ft (23.4 hm<sup>3</sup>) below elevation 3,296.50 ft (1,004.773 m). Figures given herein represent usable contents. Water is used for power production, flood control, irrigation, and recreation.

COOPERATION.--Elevations and capacity table furnished by U.S. Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 1,346,000 acre-ft (1.66 km<sup>3</sup>) July 6, 1967, elevation, 3,656.43 ft (1,114.480 m); minimum since first filling, 660,700 acre-ft (815 hm<sup>3</sup>) Mar. 11, 1970, elevation, 3,584.45 ft (1,092.540 m).

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 1,111,000 acre-ft (1.37 km<sup>3</sup>) June 30, elevation, 3,641.07 ft (1,109.798 m); minimum daily, 822,200 acre-ft (1.01 km<sup>3</sup>) Apr. 26, elevation, 3,610.33 ft (1,100.429 m).

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1980 . . . . .	3,637.06	1,061,000	
October 31 . . . . .	3,631.78	1,003,000	-58,000
November 30. . . . .	3,631.20	996,800	-6,200
December 31. . . . .	3,626.38	950,500	-46,300
January 31, 1981 . . . . .	3,618.98	888,500	-62,000
February 28. . . . .	3,612.26	833,800	-54,700
March 31 . . . . .	3,611.42	828,400	-5,400
April 30 . . . . .	3,610.69	824,100	-4,300
May 31 . . . . .	3,628.12	966,600	+142,500
June 30. . . . .	3,641.07	1,111,000	+144,400
July 31. . . . .	3,635.46	1,043,000	-68,000
August 31. . . . .	3,634.71	1,034,000	-9,000
September 30, 1981 . . . . .	3,634.92	1,036,000	+2,000
1981 water year			-25,000

\* Does not include dead storage of 18,970 acre-ft (23.4 hm<sup>3</sup>).



## MONTHLY SUMMARY OF CONTENTS FOR COMPACT 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	06224500	b/Pilot	06281500	06307000
	a/Bull Lake	Butte Reservoir	c/Buffalo Bill Reservoir	d/Tongue River Reservoir
September 30, 1980. . .	66,270	13,290	313,600	9,060
October 31. . . . .	66,370	12,710	309,000	9,560
November 30 . . . . .	67,100	12,710	315,200	11,900
December 31 . . . . .	67,930	12,550	317,700	10,150
January 31, 1981. . . .	68,120	12,520	319,600	13,000
February 28 . . . . .	68,500	12,450	323,000	14,670
March 31. . . . .	69,070	27,490	328,500	18,890
April 30. . . . .	70,220	29,930	319,600	24,100
May 31. . . . .	89,620	30,470	432,000	66,960
June 30 . . . . .	148,600	24,460	442,000	62,340
July 31 . . . . .	126,000	19,400	392,000	49,980
August 31 . . . . .	85,220	13,040	310,300	35,000
September 30, 1981. . .	46,780	5,500	249,500	21,340
Change in contents during water year. . .	-19,490	-7,790	-64,100	+12,280

a/ Usable contents, from revised capacity table effective October 1, 1965. Dead storage is 722 acre-ft (890,000 m<sup>3</sup>).

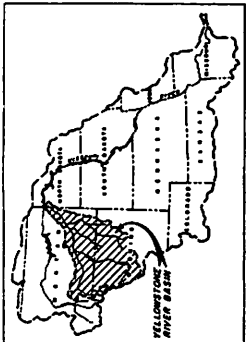
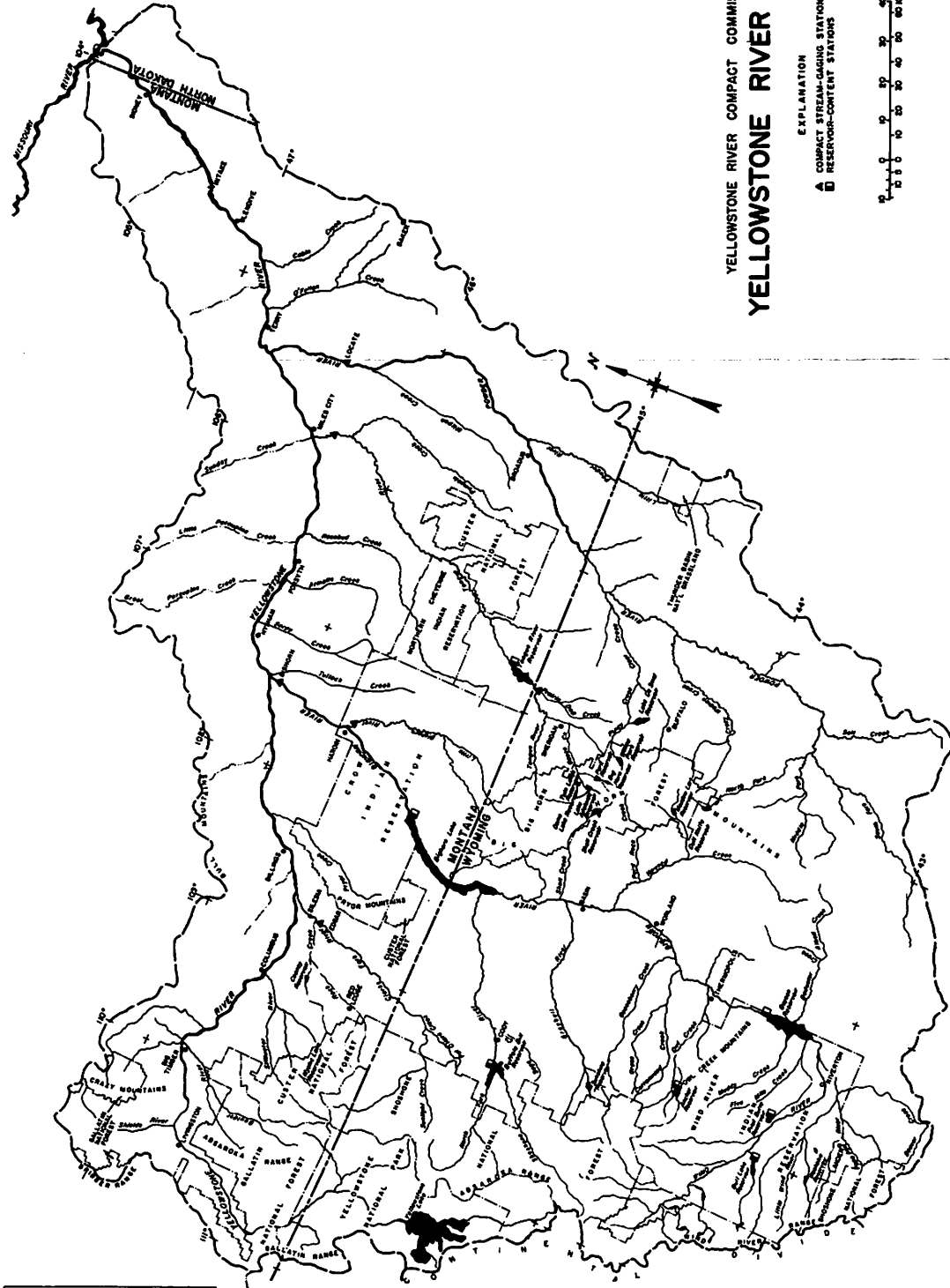
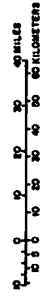
b/ Usable contents. Dead storage is 5,360 acre-ft (6.61 hm<sup>3</sup>).

c/ Usable contents, from revised capacity table based on survey of 1959. Contents prior to October 1960 based on survey of 1941. Dead storage is negligible.

d/ Usable contents. Dead storage is 1,400 acre-ft (1.73 hm<sup>3</sup>). Contents based upon sedimentation surveys of October 1948.

# YELLOWSTONE RIVER COMPACT COMMISSION YELLOWSTONE RIVER BASIN

EXPLANATION  
▲ COMPACT STREAM-GAGING STATIONS  
■ RESERVOIR-CONTENT STATIONS



MAP SHOWING LOCATIONS OF COMPACT STREAM-GAGING AND RESERVOIR-CONTENT STATIONS