TWENTY-SEVENTH ANNUAL REPORT

YELLOWSTONE RIVER

COMPACT COMMISSION

1978

YELLOWSTONE RIVER COMPACT COMMISSION

428 Federal Building
Helena, Montana

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

Honorable Thomas L. Judge
Governor of the State of Montana
Helena, Montana

Honorable Arthur A. Link
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-seventh annual report of activities for the period ending September 30, 1978.

The Compact Administration Subcommittee met at Billings, Montana on February 7, 1978. Those present were:

Walter R. Scott, Chairman, Federal Representative and Chairman, Yellowstone River Compact Commission, Bismarck, North Dakota,
Gary Fritz, Montana Department of Natural Resources and Conservation, Helena, Montana,
Rick Bondy, Montana Department of Natural Resources and Conservation, Helena, Montana,
Clem Lord, State Engineer's Office, Cheyenne, Wyoming,
Frank J. Trelease, State Engineer's Office, Cheyenne, Wyoming,
David A. Sprynczynatyk, North Dakota State Water Commission, Bismarck, North Dakota

The Commission held a special meeting at Billings, Montana, on May 17, 1978. Mr. George L. Christopulos, Wyoming State Engineer; Mr. Orrin A. Ferris, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation; the designated representatives of their respective States; and Mr. Walter R. Scott, the designated representative and Chairman, were all present.

Others present were:

Ted J. Doney, Deputy Director/Chief Legal Counsel, Department of Natural Resources and Conservation, Helena, Montana,
Donald D. MacIntyre, Department of Natural Resources and Conservation, Helena, Montana,
Phillip Lehr, Wyoming Water Planning Program, Cheyenne, Wyoming,
Clem Lord, Interstate Streams Engineer, State Engineer's Office, Cheyenne, Wyoming,
Jack D. Palma, Attorney General, State of Wyoming, Cheyenne, Wyoming,
William Long, Deputy Wyoming State Engineer, Cheyenne, Wyoming,
George M. Pike, U.S. Geological Survey, Helena, Montana,
Paul Kawulok, Wyoming Board of Control, Sheridan, Wyoming,
David A. Sprynczynatyk, North Dakota State Water Commission, Bismarck, North Dakota,
Phil Gibbs, Consultant to Intake Water Company, Houston, Texas,
Jack L. Adams, Manager, Intake Water Company, Houston, Texas,
Al Bielefeld, Field Solicitor, Department of Interior, Billings, Montana,
Andy Patten, Northern Plains Resource Council,
Kathy Cox, U.S. Geological Survey, Bismarck, North Dakota

This special meeting was called to continue discussions of water-right procedures in Montana and Wyoming, definition of terms in the Compact, and to respond to Intake Water Company's petition to the Commission requesting permission to divert water out of the Yellowstone River Basin.

Legal opinions from each State on what action is necessary to obtain consent of that signatory State as discussed in Article X have been furnished as follows:

Montana - A request to divert water out of the basin must be acted upon by the State Legislature.

North Dakota - The North Dakota State Water Commission has the requisite authority to act upon the petition.

Wyoming - A request to divert water out of the basin must be acted upon by the State Legislature.

The Commissioners from Montana and Wyoming agreed to confer with their respective Governors to see if they would agree to seek legislative authority for them to act on requests for out-of-basin diversions.

In view of the foregoing action Intake Water Company agreed to not pursue the lawsuit until at least the next regular Commission meeting.

The motion was passed to defer action on Intake's petition at this time.

The Compact Administration Subcommittee met at Helena, Montana on July 19-20, 1978. Those present were:

Walter R. Scott, Chairman, Federal Representative and Chairman, Yellowstone River Compact Commission, Bismarck, North Dakota,
Gary Fritz, Montana Department of Natural Resources and Conservation, Helena, Montana,
Rick Bondy, Montana Department of Natural Resources and Conservation, Helena, Montana,
William Long, Wyoming State Engineer's Office, Cheyenne, Wyoming,
Clem Lord, Wyoming State Engineer's Office, Cheyenne, Wyoming,
Phillip Lehr, Wyoming State Engineer's Office, Cheyenne, Wyoming

The Commission annual meeting was scheduled to be held in Billings, Montana, on November 9, 1978. A severe winter storm prevented the designated representatives from Montana and Wyoming from reaching Billings. The meeting was therefore conducted by telephone conference with the following in the conference:

George L. Christopulos, Wyoming State Engineer, and designated Wyoming representative, Cheyenne, Wyoming,
Orrin Ferris, Administrator, Water Resources Division, Montana Department of Natural Resources and Conservation, designated Montana representative, Helena, Montana,
Walter R. Scott, Chairman, designated Federal representative, Bismarck, North Dakota,
Clem Lord, Interstate Streams Engineer, State Engineer's Office, Cheyenne, Wyoming,
Jack D. Palma, Assistant Attorney General, State of Wyoming, Cheyenne, Wyoming,
Donald D. MacIntyre, Department of Natural Resources and Conservation, Helena, Montana

In response to questions previously asked of the Governors about seeking legislative authority for the Commissioners to act for the signatory States, the respective Commissioners have been told that the Governor of Montana "determined that he was not willing to sponsor such legislation," and the Governor of Wyoming "indicated that he would not oppose such legislation, but that it would be difficult to get passage of it." Because of this reaction Intake's petition was dismissed for lack of jurisdiction.

There were no incidents during the year that required administration of the 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, the attention of the Commission is continuing to focus on the need to define the detailed procedures for implementing Compact provisions previous 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 and it is evident that, at some yet undetermined time, it will be necessary to divide the waters of the Yellowstone River System as allocated by Article V of the Compact.

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 feels that due to the potential for large-scale use of water associated with coal development, joint allocation and development studies should be carried out in the near future. To this end, special meetings of the Commission and the Compact Administration Subcommittee, conducted as work sessions, will be scheduled to continue to document understandings and to develop procedures for implementation of Article V of the Compact.

The budgets for fiscal years 1978 through 1980 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.

Respectfully submitted,

George L. Christopulos
Commissioner for Wyoming

Orrin Ferris
Commissioner for Montana

Walter R. Scott
Federal Representative

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ILLUSTRATION

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 United States bears the remaining one-half. 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 1978 was $23,120, in accordance with the budget adopted for the year.

The budgets for Fiscal Years 1979 and 1980 were tentatively adopted subject to the availability of appropriations.

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

October 1, 1977 to September 30, 1978 (Fiscal Year 1978):	
Continuation of existing stream-gaging programs	$23,120
October 1, 1978 to September 30, 1979 (Fiscal Year 1979):	
Continuation of existing stream-gaging program	23,880
October 1, 1979 to September 30, 1980 (Fiscal Year 1980):	
Estimate for continuation of existing stream-gaging program	25,380

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. 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, 1978, annual streamflow at the designated points of measurement in Montana was well above average in all tributaries of the Yellowstone River as shown in the following table:

Measurement Point	Percent of Average
Clarks Fork Yellowstone River near Silesia, MT	103
Bighorn River at Bighorn minus Little Bighorn River near Hardin, MT Adjusted for change in contents in Bighorn Lake	126
Tongue River at Miles City, MT	231
Powder River at Locate, MT	241

Details of streamflow for Water Year 1978 and bar graphs showing comparisons with average flows during selected base periods and with the preceding year are given in Appendix C.

Diversions:

There were no incidents during the year that required administration of the 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.

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 931,100 acre-feet at the beginning of the year and 1,042,000 acre-feet at the close. It fluctuated from a minimum of 747,000 acre-feet on April 15, 1978, to a maximum of 1,219,000 acre-feet on July 13, 1978. Boysen Reservoir, located on the Wind River and operated by the U.S. Bureau of Reclamation, began the year with 413,100 acre-feet in storage and ended with 681,600 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 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 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 at 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, 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

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.

Multiply inch-pound units	By	To obtain SI units
	Length	
feet (ft)	.3048	meters (m)
miles (mi)	1.609	kilometers (km)
	Area	
acres	4047	square meters (m^2)
	.4047	*hectares (ha)
	.4047	square hectometer (hm^2)
	.004047	square kilometers (km^2)
square miles (mi^2)	2.590	square kilometers (km^2)
	Volume	
cfs-day (ft^3/s-day)	2447	cubic meters (m^3)
	.002447	cubic hectometers (hm^3)
acre-feet (acre-ft)	1233	cubic meters (m^3)
	.001233	cubic hectometers (hm^3)
	.000001233	cubic kilometers (km^3)
	Flow	
cubic feet per second (ft^3/s)	28.32	liters per second (L/s)
	28.32	cubic decimeters per second (dm^3/s)
	.02832	cubic meters per second (m^3/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 19 (31 km).

DRAINAGE AREA.--2,093 mi^2 (5,421 km^2).

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 mi (8 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. Altitude of gage is 3,410 ft (1,039 m), from topographic map.

REMARKS.--Records good except those for winter period, which are poor. Diversion for irrigation of about 42,600 acres (172 km^2) of which 1,100 acres (4.45 km^2) lie below station. In addition, about 9,000 acres (36.4 km^2) of land above station are irrigated by diversions from the adjoining Rock Creek basin.

AVERAGE DISCHARGE.--9 years, 1,229 ft^3/s (34.81 m^3/s), 890,400 acre-ft/yr (1.10 km^3/yr).

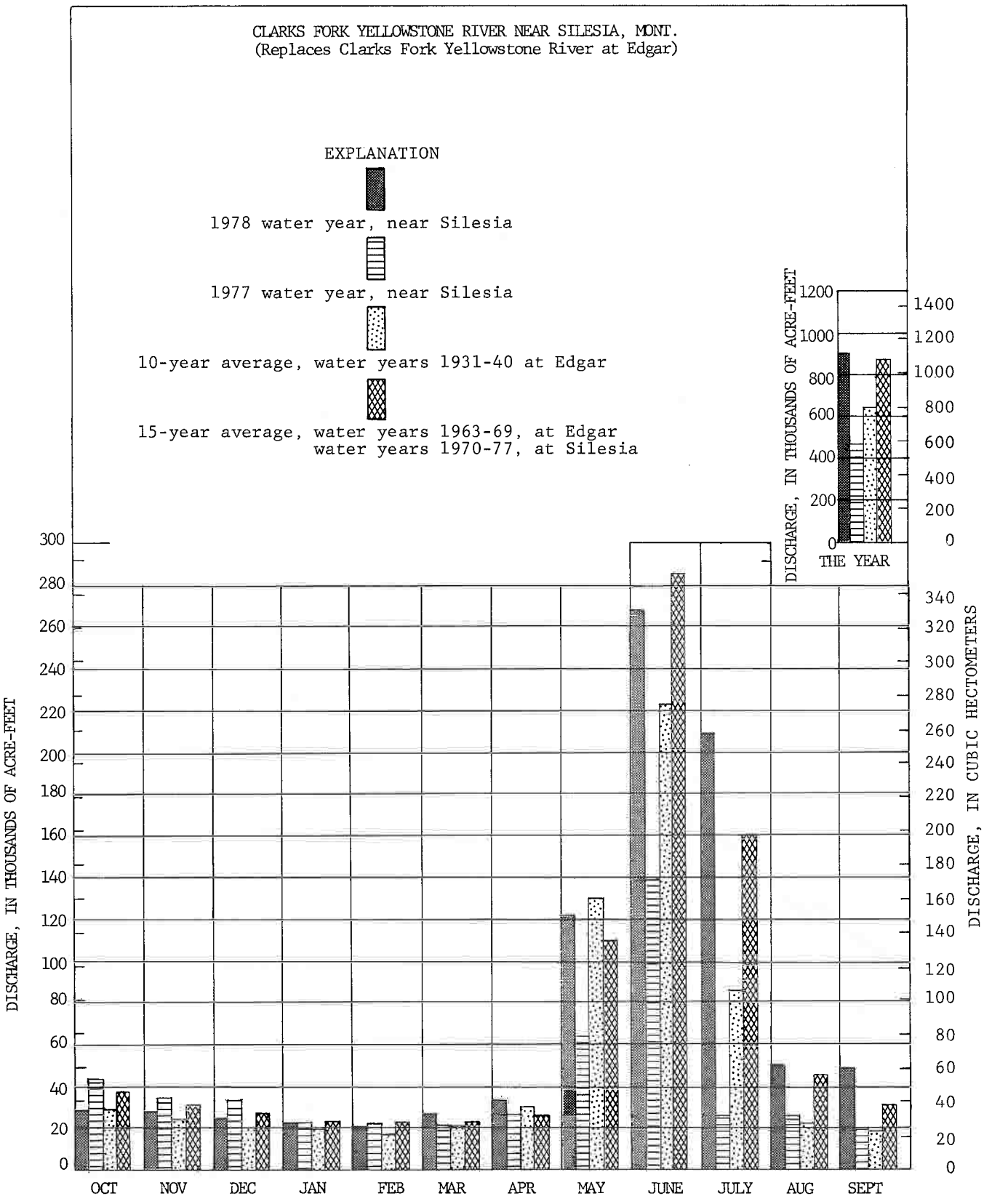
EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 11,800 ft^3/s (334 m^3/s) June 10, 1972, gage height, 7.51 ft (2.289 m); maximum gage height, 7.82 ft (2.384 m) July 6, 1975; minimum discharge, 88 ft^3/s (2.36 m^3/s) July 21, 1977, gage height, 0.72 ft (0.219 m).

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 5,300 ft^3/s (150 m^3/s) and maximum (*):

Date	Time	Discharge (ft^3/s)	Discharge (m^3/s)	Gage height (ft)	Gage height (m)
May 19	0500	*10,500	297	*7.41	2,259
June 10	1800	7,850	222	6.42	1.957
June 16	1400	6,560	186	5.87	1.789
June 24	1600	5,920	168	5.58	1.701
July 1	1400	5,940	168	5.59	1.704

Minimum daily discharge, 150 ft^3/s (4.25 m^3/s) Dec. 9.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1977	15,910	513	550	393	31,560
November	15,277	509	709	220	30,300
December	14,488	467	714	150	28,740
January 1978	11,460	370	700	230	22,730
February	10,260	366	540	200	20,350
March	14,993	484	788	230	29,740
April	17,744	591	902	435	35,200
May	63,347	2,043	7,180	724	125,600
June	134,700	4,490	6,920	1,980	267,200
July	104,920	3,385	5,640	1,870	208,100
August	26,771	864	1,860	398	53,100
September 1978	26,222	874	2,250	390	52,010
1978 water year	456,092	1,250	7,180	150	904,700



Comparison of discharge during 1978 water year with 1977 water year near Silesia and with average discharge for water years 1931-40 and 1963-69 at Edgar and for water years 1970-77 at Silesia.

06294000 LITTLE BIGHORN RIVER NEAR HARDIN, MT

LOCATION.--Lat 45°44'10", long 107°33'24", in NW1/4 SW1/4 NW1/4 sec.20, T.1 S., R.34 E., Big Horn County, Hydrologic Unit 10080016, 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^2 (3,351 km^2).

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. Altitude of gage is 2,890 ft (881 m) from topographic map. 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 current year, gages are located on both banks downstream from bridge on Sarpy Road and are used depending on control conditions.

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

AVERAGE DISCHARGE.--25 years, 325 ft^3/s (9.204 m^3/s), 235,500 acre-ft/yr (290 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 22,500 ft^3/s (637 m^3/s) May 19, 1978, gage height, 11.20 ft (3.414 m); 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^3/s (0.006 m^3/s) Aug. 7, 1961, result of discharge measurement.

EXTREMES FOR CURRENT YEAR.--Peak discharges above base of 1,000 ft^3/s (28.3 m^3/s) and maximum (*):

Date	Time	Discharge (ft^3/s)	Discharge (m^3/s)	Gage height (ft)	Gage height (m)
Mar. 29	0515	1200	34.0	3.77	1.149
Apr. 30	1330	2420	68.5	5.30	1.615
May 9	2330	2950	83.5	5.59	1.704
May 19	2245	*22500	637	*11.20	3.414
June 17	1500	2400	68.0	5.10	1.554

Minimum daily discharge, 100 ft^3/s (2.83 m^3/s) Nov. 21, Dec. 9, Jan. 2.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1977	5,109	165	190	152	10,130
November	4,608	154	180	100	9,140
December	4,470	144	170	100	8,870
January 1978	3,810	123	150	100	7,560
February	3,930	140	160	120	7,800
March	12,574	406	1,120	110	24,940
April	11,730	391	2,190	210	23,270
May	87,842	2,834	15,800	787	174,200
June	54,140	1,805	2,370	1,400	107,400
July	22,158	715	1,420	340	43,950
August	8,284	267	354	198	16,430
September 1978	8,000	267	502	154	15,870
1978 water year	226,655	621	15,800	100	449,600

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^2 (59,272 km^2). Area at site used prior to Oct. 7, 1955, 22,410 mi^2 (59,042 km^2).

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 good except those for winter period and periods of backwater from Yellowstone River, Nov. 21 to Sept. 30, which are poor. Flow regulated by Bighorn Lake beginning November 1965 (usable capacity, 1,356,000 acre-ft, 1.67 km^3). 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^3), see appendixes D and E. Diversions for irrigation of about 465,000 acres (1,880 km^2) above station.

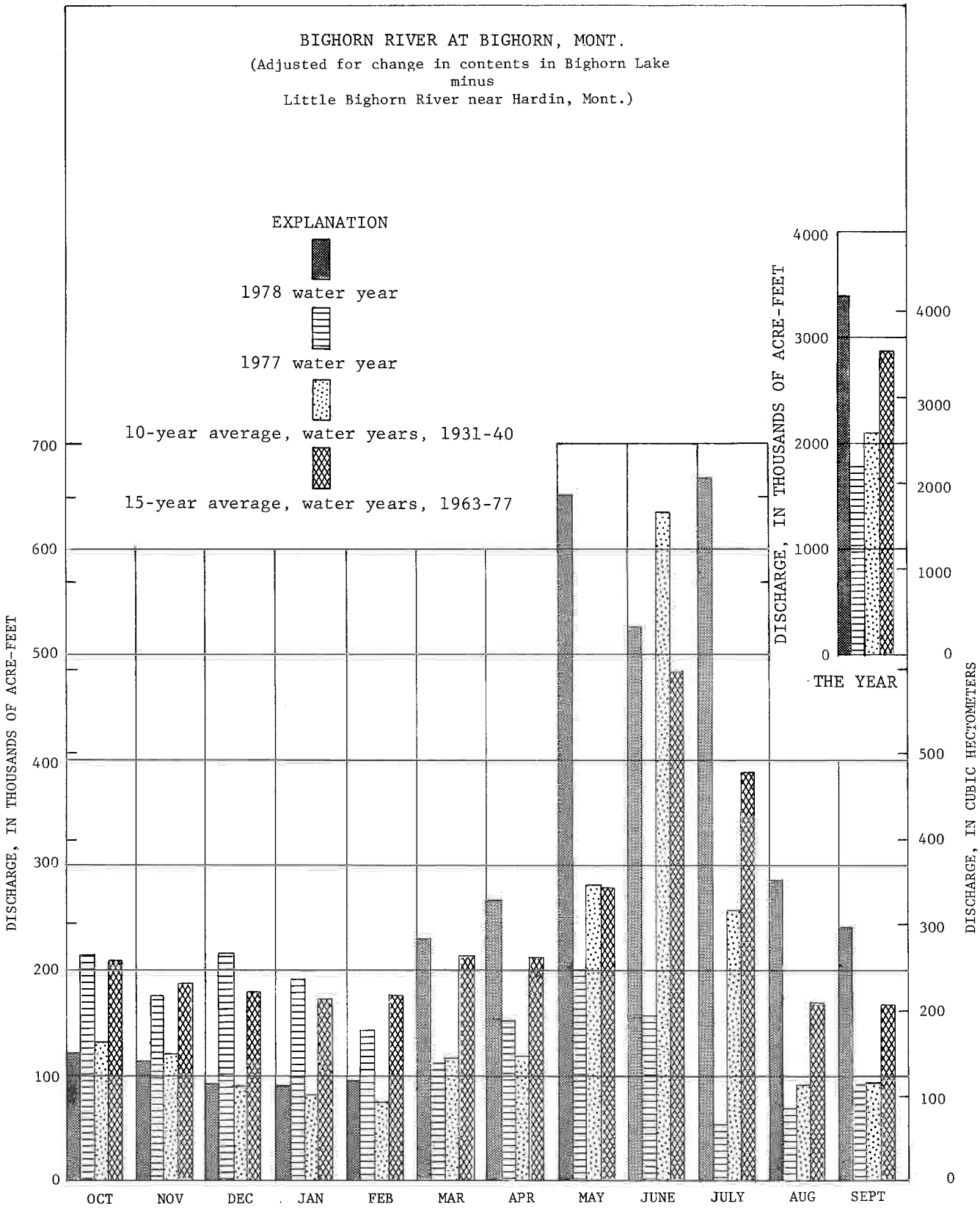
AVERAGE DISCHARGE.--33 years, 3,970 ft^3/s (112.4 m^3/s) 2,876,000 acre-ft/yr (355 km^3/yr), unadjusted.

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 57,000 ft^3/s (1,610 m^3/s) May 20, 1978, gage height, 14.00 ft (4.267 m); maximum gage height recorded, 14.21 ft (4.331 m) Apr. 2, 1965 (ice jam); minimum discharge, about 275 ft^3/s (7.79 m^3/s) Nov. 15, 1959, result of freezeup; minimum daily, 400 ft^3/s (11.3 m^3/s) Apr. 4, 1967.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 57,000 ft^3/s (1,610 m^3/s) May 20, gage height, 14.00 ft (4.267 m); minimum daily, 600 ft^3/s (17.0 m^3/s) Nov. 21, 22.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet	Adjusted runoff, in acre-feet*
Oct. 1977	46,487	1,500	1,800	917	92,210	132,100
Nov.	50,340	1,678	5,400	600	99,850	123,900
Dec.	66,700	2,152	2,300	1,700	132,300	99,200
Jan. 1978	80,200	2,587	3,000	2,400	159,100	96,600
Feb.	93,100	3,325	3,900	3,000	184,700	106,100
Mar.	152,520	4,920	7,990	3,200	302,500	254,300
Apr.	129,450	4,315	8,570	2,800	256,800	286,000
May	266,450	8,595	48,800	3,560	528,500	824,700
June	299,950	9,998	11,800	8,480	595,000	635,000
July	349,660	11,280	12,300	8,920	693,600	709,600
Aug.	217,620	7,020	8,920	4,560	431,600	297,600
Sept. 1978	119,140	3,971	5,590	3,080	236,300	258,300
1978 water year	1,871,617	5,128	48,800	600	3,712,000	3,822,900

* Adjusted for change in contents in Bighorn Lake.



Comparison of discharge for 1978 water year with 1977 water year and with average discharge for water years 1931-40 and 1963-77.

06306250 PRAIRIE DOG CREEK NEAR ACME, WY

LOCATION.--Lat 44°59'02", long 106°50'21", in NE1/4 SW1/4 SW1/4 sec.23, T.58 N., R.83 W., Sheridan County, Hydrologic Unit 10090101, on right bank, 600 ft (183 m) upstream from county bridge, 0.9 mi (1.5 km) upstream from mouth, 2.8 mi (4.5 km) downstream from Coutant Creek, and 7.6 mi (12.2 km) northeast of Acme.

DRAINAGE AREA.--358 mi^2 (927 km^2).

PERIOD OF RECORD.--October 1970 to current year. Records for May 1965 to September 1970 in files of Office of Wyoming State Engineer. Records since October 1970 available in annual reports of Yellowstone River Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 3,450 ft (1,052 m), from topographic map.

REMARKS.--Records good except those for winter period and period of road construction across control, Dec. 5 to Sept. 30, which are poor. Diversions above stations for irrigation of about 13,600 acres (55.0 km^2) of which about 60 acres (243,000 m^2) lies below station. Flow supplemented by three transbasin diversions from North Piney Creek and South Piney Creek via Prairie Dog ditch, Piney and Cruse ditches and Mead-Coffeen ditch.

AVERAGE DISCHARGE.--8 years, 46.6 ft^3/s (1.320 m^3/s), 33,760 acre-ft/yr (41.6 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 3,940 ft^3/s (112 m^3/s) May 19, 1978, gage height, 12.60 ft (3.840 m), from rating curve extended above 662 ft^3/s (18.7 m^3/s) on basis of slope-area measurement of peak flow; minimum daily, 6.3 ft^3/s (0.178 m^3/s) June 4, 5, 1976.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 3,940 ft^3/s (112 m^3/s) May 19, gage height, 12.60 ft (3.840 m), from rating curve extended above 662 ft^3/s (18.7 m^3/s) on basis of slope-area measurement of peak flow; minimum, 9.0 ft^3/s (0.255 m^3/s) Dec. 8.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1977	1,274	41.1	58	31	2,530
November	833	27.8	39	14	1,650
December	818.0	26.4	52	9.0	1,620
January 1978	545	17.6	25	10	1,080
February	514	18.4	25	12	1,020
March	4,104	132	380	12	8,140
April	1,263	42.1	187	24	2,510
May	11,023	356	2,500	67	21,860
June	2,621	87.4	221	39	5,200
July	948	30.6	49	18	1,880
August	1,265	40.8	59	25	2,510
September 1978	1,365	45.2	63	28	2,690
1978 water year	26,564	72.8	2,500	9.0	52,690

06308500 TONGUE RIVER AT MILES CITY, MT

LOCATION (REVISED).--Lat 46°20'44", long 105°48'10", in 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 8 mi (13 km) upstream from mouth.

DRAINAGE AREA.--5,379 mi^2 (13,932 km^2).

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 report of Yellowstone Compact Commission.

GAGE.--Water-stage recorder. Altitude of gage is 2,370 ft (722 m), by barometer. 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.

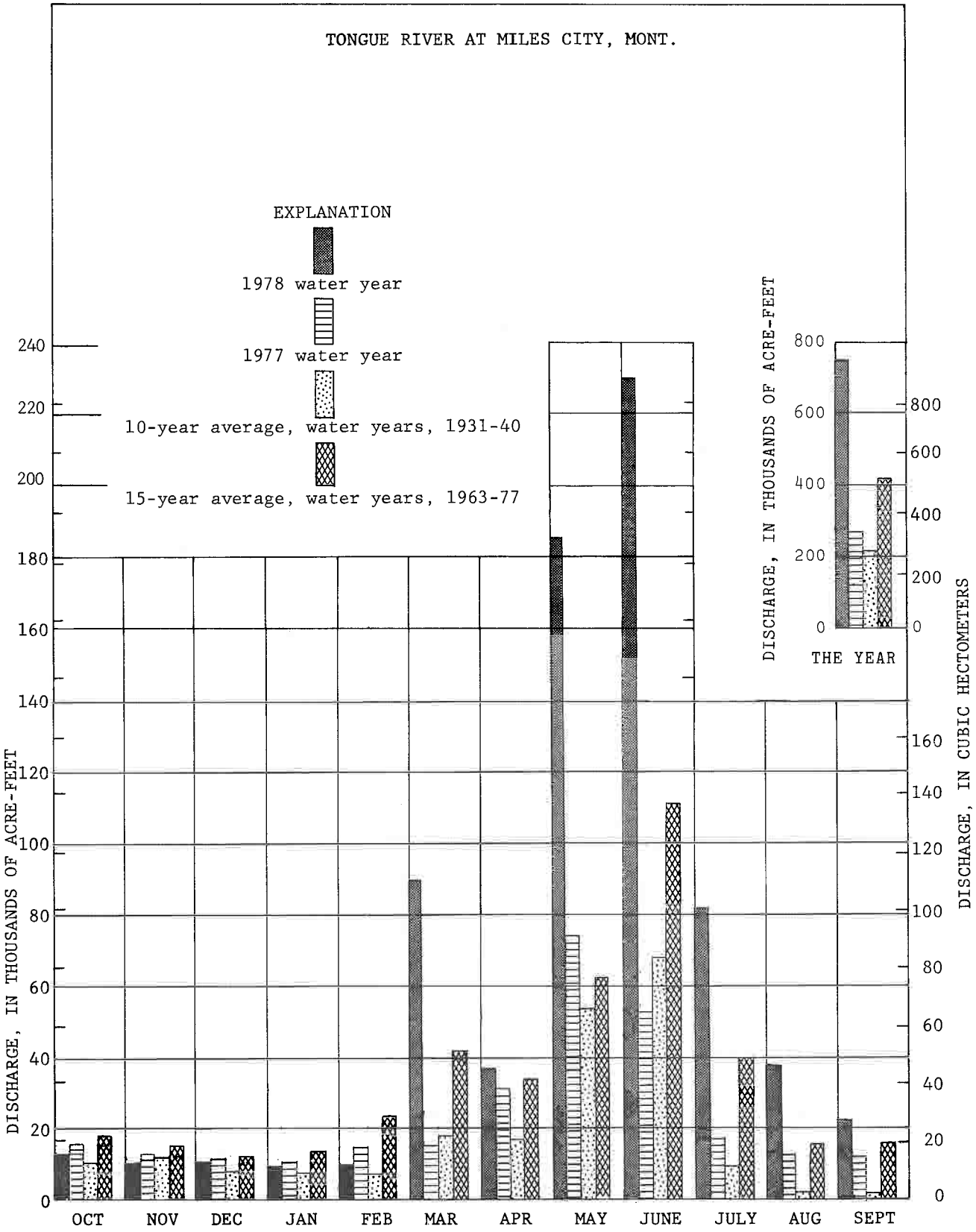
REMARKS.--Water-discharge records good except those for winter period, which are poor. Flow regulation by Tongue River Reservoir (appendix E) only, and many small reservoirs in Wyoming (combined capacity, about 15,000 acre-ft, 18.5 hm^3). Diversions for irrigation of about 90,000 acres (364 km^2) above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

AVERAGE DISCHARGE.--35 years (1938-41, 1946-78), 456 ft^3/s (12.91 m^3/s), 330,400 acre-ft/yr (407 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge, 13,300 ft^3/s (337 m^3/s) June 15, 1962, gage height, 12.33 ft (3.758 m), present datum, from rating curve extended above 5,200 ft^3/s (147 m^3/s) on basis of float measurement; maximum gage height, 13.27 ft (4.045 m), present datum, Mar. 19, 1960, Feb. 15, 1971 (ice jam); no flow July 9-19, Aug. 13, 14, Sept. 28, 1940.

EXTREMES FOR CURRENT YEAR.--Maximum discharge, 8,650 ft^3/s (245 m^3/s) May 23, gage height, 10.18 ft (3.103 m); minimum daily, 80 ft^3/s (2.27 m^3/s) Dec. 9.

Month	Second-foot days	Mean	Maximum	Minimum	Runoff, in acre-feet
October 1977	7,463	241	447	171	14,800
November	5,562	185	270	100	11,030
December	5,980	193	300	80	11,860
January 1978	4,980	161	170	150	9,880
February	5,010	179	300	130	9,940
March	44,464	1,434	5,030	140	88,190
April	19,437	648	684	600	38,550
May	92,252	2,976	7,700	552	183,000
June	114,100	3,803	4,940	3,170	226,300
July	41,464	1,338	2,780	866	82,240
August	19,377	625	919	374	38,430
September 1978	11,337	378	697	231	22,490
1978 water year	371,426	1,018	7,700	80	736,700



Comparison of discharge during 1978 water year with 1977 water year and with average discharge for water years 1931-40 and 1963-77.

06326500 POWDER RIVER AT LOCATE, MT

LOCATION (REVISED).--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, and 25 mi (40 km) east of Miles City.

DRAINAGE AREA.--13,189 mi^2 (34,160 km^2). Drainage area at site used Oct. 1, 1977, to Mar. 21, 1978, 13,194 mi^2 (34,172 km^2).

PERIOD OF RECORD.--March 1938 to current year. Oct. 5, 1966 to Mar. 21, 1978, published as "near Locate." 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. Altitude of gage is 2,400 ft (732 m), by barometer. 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.

REMARKS.--Records fair Oct. 1 to Nov. 19, poor during winter period and period of no gage-height record, Nov. 20 to Mar. 22, and good Mar. 23 to Sept. 30. Some regulation by three reservoirs in Wyoming with combined usable capacity of 36,800 acre-ft (45.4 hm^3). Diversions for irrigation of about 74,500 acres (302 km^2) above station.

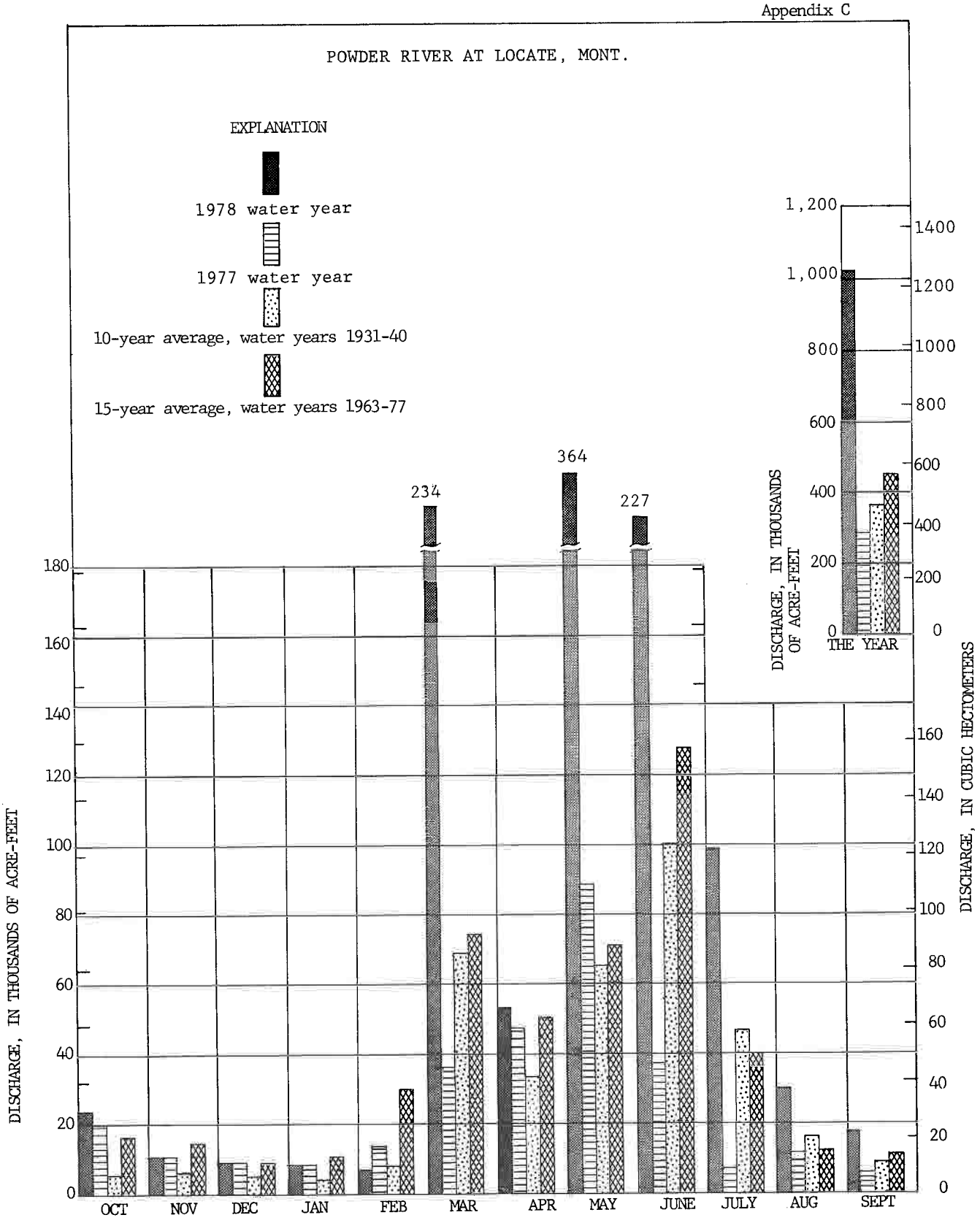
AVERAGE DISCHARGE.--40 years, 637 ft^3/s (18.04 m^3/s), 461,500 acre-ft/yr (569 hm^3/yr).

EXTREMES FOR PERIOD OF RECORD.--Maximum discharge observed, 31,000 ft^3/s (878 m^3/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.--Peak discharges above base of 5,000 ft^3/s (141 m^3/s) and maximum (*):

Date	Time	Discharge (ft^3/s)	Discharge (m^3/s)	Gage height (ft)	Gage height (m)
Mar. 16	----	ice jam		*12.27	3.740
Mar. 22	----	*30,300	858	11.59	3.533
May 13	1315	5,170	146	5.31	1.618
May 23	0100	27,400	776	11.27	3.435

Minimum daily discharge, 86 ft^3/s (2.44 m^3/s) Nov. 21.



Comparison of discharge during 1978 water year with 1977 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^2 (19,943 km^2).

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

GAGE.--Water-stage recorder. Datum of gage is mean sea level, datum of 1933 (levels by 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^3) 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^3) below elevation 4,657.00 ft (1,419.454 m). Prior to Jan. 1, 1966, usable capacity was 757,800 acre-ft (934 hm^3) and dead storage was 62,000 acre-ft (76.4 hm^3), 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 Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 862,500 acre-ft (1,060 hm^3) 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^3) 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, 765,300 acre-ft (944 hm^3) July 13, elevation, 4,726.17 ft (1,440.537 m); minimum daily, 367,400 acre-ft (453 hm^3) May 8, elevation, 4,701.51 ft (1,433.020 m).

Month	Water-surface elevation, in feet	Contents* in acre-feet	Change in contents, in acre-feet
September 30, 1977.	4704.98	413,100	
October 31.	4706.71	437,100	+24,000
November 30	4708.26	459,300	+22,200
December 31	4709.51	477,600	+18,300
January 31, 1978.	4710.21	488,000	+10,400
February 28	4710.40	490,900	+2,900
March 31.	4709.32	474,800	-16,100
April 30.	4702.20	376,200	-98,600
May 31.	4708.70	465,700	+89,500
June 30	4724.42	730,900	+265,200
July 31	4725.25	747,100	+16,200
August 31	4722.67	697,500	-49,600
September 30, 1978.	4721.82	681,600	-15,900
1978 water year			+268,500

* Does not include dead storage of 59,880 acre-feet (73.8 hm^3).

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^2 (324 km^2), approximately.

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

GAGE.--Water-stage recorder. Datum of gage is at mean sea level (Bureau of Reclamation datum).

REMARKS.--Reservoir is formed by concrete arch dam completed in 1960. Usable capacity, 17,170 acre-ft (21.2 hm^3) 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^3) 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^3) not including 149 acre-ft (184,000 m^3) below the invert. Figures given herein represent usable contents. Water is used for irrigation of lands in Owl Creek basin.

COOPERATION.--Records furnised by Bureau of Reclamation.

EXTREMES FOR PERIOD OF RECORD.--Maximum daily contents, 9,250 acre-ft (11.4 hm^3) 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, 7,620 acre-ft (9.40 hm^3) June 26, (elevation, 6,413.23 ft or 1,954.719 m); no storage on many days.

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1977	-	0	0
October 31	-	0	0
November 30	-	0	0
December 31	-	0	0
January 31, 1978	-	0	0
February 28	-	0	0
March 31	-	0	0
April 30	0	0	0
May 31	6,381.15	1,850	+1,850
June 30	6,411.92	7,280	+5,430
July 31	6,386.48	2,470	-4,810
August 31	-	0	-2,470
September 30, 1978	-	0	0
1978 water year			0

*Does not include dead storage of 68 acre-feet (83,800 m^3).

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 81.0 (130.3 km).

DRAINAGE AREA.--19,626 mi^2 (50,831 km^2).

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 mean sea level (levels by 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^3) 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^3), elevation, 3,640.00 ft (1,109.472 m). Minimum operating level, 483,400 acre-ft (596 hm^3), elevation 3,547.00 ft (1,081.126 m). Dead storage, 18,970 acre-ft (23.4 hm^3) 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 Bureau of Reclamation.

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

EXTREMES FOR CURRENT YEAR.--Maximum daily contents, 1,219,000 acre-ft (1.50 km^3) July 13, elevation, 3,648.60 ft (1,112.093 m); minimum daily 747,000 acre-ft (921 hm^3) Apr. 15, elevation, 3,599.15 (1,097.021 m).

Month	Water-surface elevation, in feet	Contents*, in acre-feet	Change in contents, in acre-feet
September 30, 1977	3624.20	931,100	
October 31	3628.58	971,000	+39,900
November 30	3631.01	994,900	+23,900
December 31	3627.62	961,900	-33,000
January 31, 1978	3620.43	899,400	-62,500
February 28	3610.09	820,800	-78,600
March 31	3603.07	772,600	-48,200
April 30	3607.34	801,800	+29,200
May 31	3640.11	1,098,000	+296,200
June 30	3643.11	1,138,000	+40,000
July 31	3644.27	1,154,000	+16,000
August 31	3633.38	1,020,000	-134,000
September 30, 1978	3635.41	1,042,000	+22,000
1978 water year			+110,900

* Does not include dead storage of 18,970 acre-feet (23.4 hm^3).

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

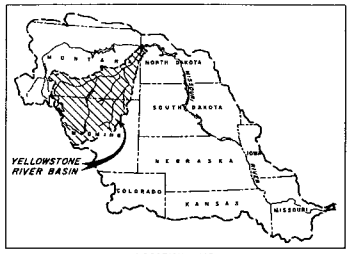
Month	06224500 [a]/Bull Lake	[b]/Pilot Butte Reservoir	06281500 [c]/Buffalo Bill Reservoir	06307000 [d]/Tongue River Reservoir
September 30, 1977. . .	71,760	6,550	185,200	20,080
October 31.	73,920	6,400	182,500	24,740
November 30	75,190	6,150	190,200	27,570
December 31	77,590	5,950	195,900	29,460
January 31, 1978. . . .	79,360	5,875	200,200	29,640
February 28	79,990	5,775	196,700	30,900
March 31.	80,010	13,360	199,600	43,400
April 30.	78,640	23,900	193,600	32,040
May 31.	95,300	30,200	267,000	68,040
June 30	146,200	24,780	441,600	53,720
July 31	145,500	24,380	434,100	46,160
August 31	133,200	20,230	391,400	22,600
September 30, 1978. . .	107,300	20,750	348,400	20,780
Change in contents during water year. .	+35,540	+14,200	+163,200	+700

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

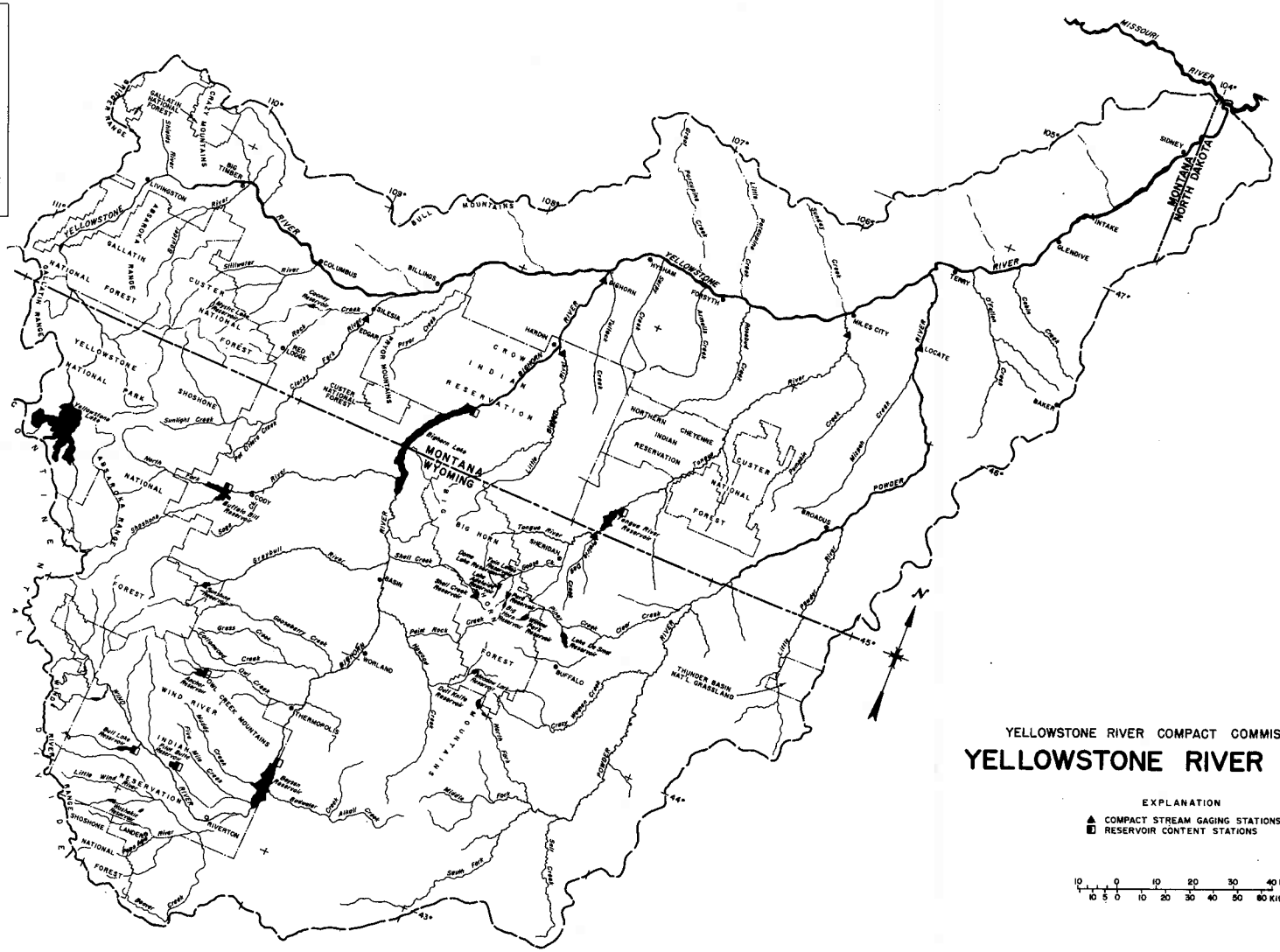
[b]/ Usable contents. Dead storage is 5,360 acre-ft (6.61 hm^3).

[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^3). Contents based upon sedimentation surveys of October 1948.



LOCATION MAP



YELLOWSTONE RIVER COMPACT COMMISSION

YELLOWSTONE RIVER BASIN

EXPLANATION

▲ COMPACT STREAM GAGING STATIONS
◧ RESERVOIR CONTENT STATIONS

10 0 10 20 30 40 MILES
10 5 0 10 20 30 40 50 60 KILOMETERS

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