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THE YELLOWSTONE RIVER INSTREAM RESERVATION

EIGHTH ANNUAL REPORT

DECEMBER 16, 1985 - DECEMBER 15, 1986

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INTRODUCTION

The Order of the Board of Natural Resources and Conservation establishing water reservations for the Yellowstone basin was signed on December 15, 1978. As a result of that Order, the Department of Fish, Wildlife and Parks (MDFWP) was granted an instream reservation for the Yellowstone River at Sidney of approximately 5.5 million acre-feet of water, with differing amounts granted in upstream reaches and tributaries.

The MDFWP applied for instream reservations on many streams and tributaries where little, if any, flow data were available. When granting instream reservations for those waters, the Board frequently granted a percentile flow rather than a specific amount of water in cfs or acre-feet. In such cases, the MDFWP was directed by the Board, through condition 116, to develop and submit to the Board within 5 years of December 15, 1978, a plan to convert the minimum flow instream reservation quantities into cubic feet of water per second and acre-feet of water per month.

Condition 117 states that the reservant shall submit an annual progress report to the Board setting forth accomplishments toward completion of such work as outlined in condition 116, a schedule of anticipated progress, and other information as may be prescribed by the Board. This eighth annual progress report is designed to fulfill those requirements.

INSTREAM FLOW QUANTIFICATIONS

The first annual progress report outlined a tentative plan for accomplishing the objectives in condition 116. The tentative plan was then reviewed, commented on and revised. In the second annual report, a final plan to convert the minimum-flow instream reservations into cubic feet of water per second and acre-feet per month, using hydrologic modeling techniques, was submitted to the Board. This was done pursuant to the Board's order, specifically condition 116(b). The Department of Natural Resources and Conservation (DNRC) concurred in the plan as presented and additionally suggested a provision for verifying the chosen methodology (Riggs' Method) using existing long-term gaging stations in the area. The testing and verification of the Riggs' Method were performed by Systems Technology, Inc. and presented verbally to the Board. A summary of the verification procedure was presented in the third annual report. The findings in general were very good, and the report states that better results than those obtained during verification can be achieved

through a careful study of basin characteristics for all gaged streams in the Upper Yellowstone Basin, and the omission of hydrologically different streams.

The final plan for quantifying the percentile flows was approved by the Board on June 5, 1981. Streams in need of quantification at the time of the Board's approval are shown in Table 1.

Completed Quantifications

The quantification of the granted percentile flows is being completed by the Helena office of the USGS through a cost-share cooperative agreement with the MDFWP. During the first year of the agreement (phase 1), the needed flow data were collected for 22 stream sites within the Yellowstone River drainage upstream from the Shields River. The preliminary instream flow quantifications that were derived by the USGS for these sites were presented in the fifth annual report. During the second year of the agreement (phase 2), the needed flow data were collected for 19 stream sites in the Shields River drainage itself and the Yellowstone drainage downstream from the Shields River. The preliminary flow quantifications for these sites were presented in the sixth annual report. The draft of a formal report that finalized the quantifications for phase 1 and 2 streams was completed by the USGS in September, 1985 and reviewed by this Department. The final report was released in 1986, and is attached to this eighth annual report as Appendix A.

The USGS decided during the second year of the agreement (phase 2) to extend streamflow records at all gages used in the regression analyses (Riggs' Method) to a common 1934-82 base period. The purpose of the record extension was to eliminate any bias that might result from using a short-record gage that might not be truly representative of long-term hydrologic conditions. All final quantifications (except Hanging Woman, Otter, and Pumpkin creeks) are based on this common period.

For Hanging Woman, Otter, and Pumpkin creeks, the Board granted the "historic minimum monthly flows," rather than percentile flows, as the instream reservation. There were limited gage records available on these streams at the time of the Board's order. A reliable method for synthesizing flows on these prairie streams was not available prior to establishment of gages on each stream. Therefore, the historic record was limited to the period the gages were operated. More than 10 years' record is currently available on each stream and these records were used to quantify the historic minimum monthly flows. These records include the drought years of 1977 and 1984.

The six flow quantifications listed on pages 3 and 4 of the fifth annual report were recalculated by the USGS to encompass the

1934-82 base flow period, and were presented in Table 1 of the seventh annual report. These six sites are:

1. Bluewater Creek (Mouth-Headwaters) #6-2078
2. Brackett Creek (Mouth-Sheep Creek) #6-1940
3. Rock Creek (Mouth-Custer National Forest) #6-2095
4. Sweet Grass Creek (Mouth-Forest Service boundary) #6-2005
5. Clarks Fork Yellowstone River #6-2075 (near Belfry)
6. Clarks Fork Yellowstone River #6-2085 (at Edgar)

The final results of all flow quantifications completed to date (including all Phase 1 and phase 2 streams) are presented in Table 2. The streams are presented in the same order that flows were requested in the original application, i.e., Upper Yellowstone, Middle Yellowstone, and Lower Yellowstone River basins.

Most of the data are found in Tables 7 and 8 on page 17 of the USGS final report (Appendix A). The following USGS site numbers in the heading for each stream correspond to those in Tables 7 and 8. This allows locations where flows were quantified to be identified with the stream reach where flows were requested. Monthly and total volumes in acre-feet were calculated from the quantified percentile flows (cfs). Table 7 lists flows quantified for streams in Phase 1, and Table 8 lists flows quantified for streams in Phase 2 of the MDFWP/USGS agreement.

Flows for streams not shown in Tables 7 or 8 were determined from existing information independently of the Phase 1 and 2 agreements.

Remaining Quantifications

The quantification of the granted percentile flows is being completed by the Helena office of the USGS through an extension of a cost-share, cooperative agreement with the MDFWP. The agreement specifies that the necessary field measurements will be completed by the USGS in two years and all data analyses and quantifications completed by the end of the third year.

The quantification of the granted instream flows was originally scheduled to be completed for all Yellowstone tributaries in 1985. However, unforseen budget constraints of the MDFWP prevented the USGS from completing all scheduled tasks during the allotted contract period. The MDFWP renegotiated its contract with the USGS and rescheduled the remaining tasks.

Instantaneous flow measurements that were collected by the USGS and the MDFWP in conjunction with other studies are sufficient for use in the Riggs' Method for defining the granted percentile

flows for many of the stream reaches having an instream reservation. Short-term USGS gage records for many sites are also suitable for use in the Riggs' Method.

The application of the Riggs' Method requires that monthly flow measurements be taken for one year on the streams to be analyzed. During the first year of the agreement (phase 1), the needed field data were collected for 21 stream sites within the Yellowstone River drainage upstream from Livingston, Montana. The preliminary instream flow quantifications that were derived by the USGS for these sites were completed and presented in the fifth annual report.

During the second year of the agreement (phase 2), the needed flow data were collected for 19 stream sites in the Shields River drainage and the Yellowstone drainage downstream from Livingston. The preliminary flow quantifications for these sites were completed and presented in the sixth annual report.

The quantification of the granted percentile flows for the Yellowstone spring creeks and tributaries to the Stillwater and Clarks Fork rivers will be completed by the USGS during phase 3 of the agreement. Collection of the needed flow data for phase 3 streams began in May, 1985 and continued through April, 1986. Field measurements were made at 14 sites. For another 10 sites, existing flow data collected by the USGS and MDFWP were sufficient for use in quantifying the granted flows. As of this report period, all data have been collected. The final task is to analyze this data and quantify the granted percentile flows. These quantifications will be included in a phase 3 report which is scheduled for completion by USGS in early 1987 (see Appendix A).

Streams remaining to have their granted percentile flows quantified are shown in Table 3.

Table 1. Summary of streams where flow quantifications were required on June 5, 1981.

Basin/Sub-basin	Stream
LOWER YELLOWSTONE RIVER (Bighorn River to North Dakota State line)	Hanging Woman Creek
	Otter Creek
	Pumpkin Creek
Tongue River	
	Rosebud Creek
MIDDLE YELLOWSTONE RIVER (Boulder River to Bighorn River)	
Clarks Fork River	Clarks Fork River
	Butcher Creek
	Willow Creek
	Red Lodge Creek
	Clear Creek
	Dry Creek
	Rock Creek
	Sage Creek
	Bluewater Creek
Stillwater River	Castle Creek
	Picket Pin Creek
	W.F. Stillwater River
	Little Rocky Creek
	W. Fishtail Creek
	E. Fishtail Creek
	Fishtail Creek
	E. Rosebud Creek
	W. Rosebud Creek
UPPER YELLOWSTONE RIVER (Gardiner to Boulder River)	
Below Shields River	Bridger Creek
	Lower Deer Creek
	Upper Deer Creek
	Sweet Grass Creek
	Mission Creek
	Little Mission Creek
Shields River	Smith Creek
	Flathead Creek
	Rock Creek
	Brackett Creek
	Shields River @ mouth
	Cottonwood Creek
	N.F. Brackett Creek
	M.F. Brackett Creek
	S.F. Brackett Creek

Table 1 (continued).

Basin/Sub-basin	Stream
Above Shields River	Bear Creek
	Cinnabar Creek
	Mol Heron Creek
	Cedar Creek
	Tom Miner Creek
	Rock Creek
	Big Creek
	Six Mile Creek
	Fridley Creek
	Eight Mile Creek
	Mill Creek
	Trail Creek
	Suce Creek
	Coke (Miner) Creek
	Billman Creek
	Fleshman Creek
	Armstrong Spring Creek
	Nelson Spring Creek
	McDonald Spring Creek
	Emigrant Spring Creek

total - 57

✓ = 32 = complete

✓ = 21 = need completing

✓✓ = 4 = Some reaches need completed, Some are already done.

25

Table 2

Final Instream Flow Quantifictions

UPPER YELLOWSTONE BASIN

(Gardiner to Mouth of Boulder River)

Table 2. Quantification of granted percentile flows in cubic feet of water per second and acre-feet per month. Flow quantifications are adjusted to a common 1934-82 base period.

BEAR CREEK
Mouth to North Fork (USGS Site No. 2)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	10.1	621.02
Feb.	9.58	532.04
Mar.	10.8	664.06
Apr.	32.2	1,916.03
May	90.8	5,583.07
Jun.	322.0	19,160.32
Jul.	135.0	8,300.82
Aug.	46.7	2,871.47
Sep.	38.8	2,308.76
Oct.	18.1	1,112.92
Nov.	16.5	981.82
Dec.	12.4	762.44
		44,814.77 AF/year

BEAR CREEK
North Fork to Fish Lake (USGS Site No. 1)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	5.68	349.25
Feb.	5.35	297.12
Mar.	6.15	378.15
Apr.	19.9	1,184.13
May	56.2	3,455.60
Jun.	186.0	11,067.76
Jul.	71.9	4,420.96
Aug.	24.3	1,494.15
Sep.	21.1	1,255.54
Oct.	10.3	633.32
Nov.	9.48	564.10
Dec.	7.11	437.18
		25,537.26 AF/year

~~25,537.26 AF/year~~

Table 2 (continued).

BILLMAN CREEK
Mouth to Coke (Miner) Creek (USGS Site No. 20)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	9.66	593.97
Feb.	9.18	509.83
Mar.	10.4	639.47
Apr.	31.0	1,844.63
May	87.7	5,392.46
Jun.	27.8	1,654.21
Jul.	8.11	498.66
Aug.	2.53	155.56
Sep.	2.58	153.52
Oct.	17.4	1,069.88
Nov.	15.8	940.16
Dec.	11.9	731.70
		14,184.05 AF/year

BILLMAN CREEK
Coke (Miner) Creek to Fork South of NE Corner Sec. 20
(USGS Site No. 18)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	5.25	322.81
Feb.	4.94	274.35
Mar.	5.70	350.48
Apr.	18.6	1,106.78
May	52.6	3,234.25
Jun.	21.6	1,285.29
Jul.	6.10	375.07
Aug.	1.88	115.60
Sep.	1.96	116.63
Oct.	9.50	584.13
Nov.	8.78	522.44
Dec.	6.59	405.20
		8,693.03 AF/year

Table 2 (continued).

BRACKETT CREEK (Gage No. 06194000)
Mouth to Sheep Creek (~~USGS Site No. 33~~)

50th Percentile Jan.-Dec.[1]

	Cfs	AF
Jan.	7.0	430.41
Feb.	7.0	388.76
Mar.	9.0	533.39
Apr.	42.0	2,499.17
May	93.0	5,718.34
Jun.	79.0	4,700.82
Jul.	27.0	1,660.16
Aug.	10.0	614.88
Sep.	11.0	654.54
Oct.	11.0	676.36
Nov.	9.0	535.54
Dec.	7.0	430.41
		18,842.78 AF/year

Do you want to use this or report?

[1]Derived from the actual gage records of the Brackett Creek gage (#06194000). These cfs figures differ from those in Table 8 of the USGS report, which are estimates ~~from regression analysis~~ based on the ~~Brackett Creek gage records~~. Riggs' Method.

Table 2 (continued).

BRACKETT CREEK
Sheep Creek to Skunk Creek (USGS Site No. 32)

50th Percentile Jan.-Dec.[1]

	Cfs	AF
Jan.	5.77	354.78
Feb.	5.77	320.45
Mar.	7.55	464.23
Apr.	40.4	2,403.96
May	89.6	5,509.29
Jun.	75.6	4,498.51
Jul.	29.6	1,820.03
Aug.	11.1	682.51
Sep.	11.9	708.10
Oct.	9.08	558.31
Nov.	7.31	434.97
Dec.	5.79	356.01
		18,111.15 AF/year

[1]Derived from the actual gage records of the Brackett Creek gage (#06194000). These cfs figures differ from those in Table 8 of the USGS report, which are estimates from regression analysis based on the Brackett Creek gage records.

Table 2 (continued).

BRACKETT CREEK
Skunk Creek to ~~South Fork~~[1] Confluence of North, Middle and South Forks
(USGS Site No. 31)

50th Percentile Jan.-Dec.[2]

	Cfs	AF
Jan.	3.20	196.76
Feb.	3.20	177.72
Mar.	4.26	261.94
Apr.	29.2	1,737.52
May	63.2	3,886.01
Jun.	49.0	2,915.70
Jul.	21.3	1,309.68
Aug.	7.98	490.67
Sep.	8.79	523.04
Oct.	5.01	308.05
Nov.	4.00	238.02
Dec.	3.17	194.92
		12,240.03 AF/year

[1]Shown in reservation application (page 32), and Order of the Board as "Brackett Creek-Skunk Creek to one mile up North, Middle, and South Forks."

[2]Derived from the actual gage records of the Brackett Creek gage (#06194000). These cfs figures differ from those shown in Table 8 of the USGS report, which are estimates from regression analysis based on the Brackett Creek gage records.

Table 2 (continued).

NORTH FORK BRACKETT CREEK
Mouth to One Mile Upstream[1] (USGS Site No. 28)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	2.08	127.89
Feb.	2.08	115.52
Mar.	2.66	163.56
Apr.	11.9	708.10
May	40.4	2,484.10
Jun.	29.9	1,779.17
Jul.	11.3	694.81
Aug.	4.26	261.94
Sep.	3.92	233.26
Oct.	3.32	204.14
Nov.	2.77	164.83
Dec.	2.38	146.34
		7,083.66 AF/year

[1]Shown in reservation application (page 32), and Order of the Board as "Brackett Creek-Skunk Creek to one mile up North, Middle, and South forks."

Table 2 (continued).

MIDDLE FORK BRACKETT CREEK
Mouth to One Mile Upstream[1] (USGS Site No. 29)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	1.28	78.70
Feb.	1.28	71.09
Mar.	1.66	102.07
Apr.	10.5	624.79
May	35.3	2,170.51
Jun.	25.3	1,505.45
Jul.	4.61	283.46
Aug.	1.74	106.99
Sep.	1.69	100.56
Oct.	2.04	125.43
Nov.	1.68	99.97
Dec.	1.45	89.16
		5,358.18 AF/year

[1]Shown in reservation application (page 32), and Order of the Board as "Brackett Creek-Skunk Creek to one mile up North, Middle, and South forks."

Table 2 (continued).

SOUTH FORK BRACKETT CREEK
Mouth to One Mile Upstream[1] (USGS Site No. 30)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	0.97	59.64
Feb.	0.97	53.87
Mar.	1.27	78.09
Apr.	8.29	493.29
May	27.4	1,684.76
Jun.	18.5	1,100.82
Ju.	5.68	349.25
Aug.	2.15	132.20
Sep.	2.05	121.98
Oct.	1.54	94.69
Nov.	1.26	74.98
Dec.	1.09	67.02
		4,310.59 AF/year

[1]Shown in reservation application (page 32), and Order of the Board as "Brackett Creek-Skunk Creek to one mile up North, Middle, and South forks."

Table 2 (continued).

CEDAR CREEK
Mouth to Second Fork (USGS Site No. 7)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	3.02	185.69
Feb.	2.81	156.06
Mar.	3.30	202.91
Apr.	11.7	696.20
May	33.0	2,029.09
Jun.	28.7	1,707.77
Jul.	8.43	518.34
Aug.	2.63	161.71
Sep.	2.68	159.47
Oct.	5.48	336.95
Nov.	5.15	306.45
Dec.	3.84	236.11

6,696.75 AF/year

CINNABAR CREEK
Mouth to Cottonwood Creek (USGS Site No. 5)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	4.29	263.78
Feb.	4.21	233.81
Mar.	4.88	300.06
Apr.	16.3	969.92
May	46.1	2,834.58
Jun.	38.8	2,308.76
Jul.	11.9	731.70
Aug.	3.76	231.19
Sep.	3.73	221.95
Oct.	8.13	499.89
Nov.	7.54	448.66
Dec.	5.65	347.40

9,391.70 AF/year

Table 2 (continued).

CINNABAR CREEK
Cottonwood Creek to FS Boundary in T8S, R7E and Sec. 32
(USGS Site No. 4)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	3.35	205.98
Feb.	3.13	173.83
Mar.	3.67	225.66
Apr.	12.8	761.65
May	36.1	2,219.70
Jun.	35.7	2,124.30
Jul.	10.8	664.06
Aug.	3.41	209.67
Sep.	3.41	202.91
Oct.	6.09	374.46
Nov.	5.70	339.17
Dec.	4.26	261.94
		7,763.33 AF/year

COKE (MINER) CREEK
Mouth to Miner (Eldridge) Creek (USGS Site No. 19)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	4.02	247.18
Feb.	3.77	209.38
Mar.	4.38	269.32
Apr.	14.9	886.61
May	42.0	2,582.48
Jun.	13.2	785.45
Jul.	3.46	212.75
Aug.	1.05	64.56
Sep.	1.14	67.83
Oct.	7.30	448.86
Nov.	6.79	404.03
Dec.	5.08	312.36
		6,490.81 AF/year

Table 2 (continued).

COTTONWOOD CREEK
Mouth to Little Cottonwood Creek (USGS Site No. 27)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	7.98	490.67
Feb.	7.98	443.19
Mar.	8.34	512.81
Apr.	20.9	1,243.64
May	79.8	4,906.71
Jun.	105.0	6,247.93
Jul.	33.3	2,047.54
Aug.	11.0	676.36
Sep.	10.1	600.99
Oct.	13.8	848.53
Nov.	11.9	708.10
Dec.	9.43	579.83
		19,306.30 AF/year

COTTONWOOD CREEK
Little Cottonwood Creek to Trespass Creek (USGS Site No. 26)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	5.44	334.49
Feb.	5.44	302.12
Mar.	5.69	349.86
Apr.	15.1	898.51
May	74.8	4,599.27
Jun.	105.0	6,247.93
Jul.	41.4	2,545.58
Aug.	13.7	842.38
Sep.	12.4	737.85
Oct.	9.40	577.98
Nov.	8.18	486.74
Dec.	6.43	395.36
		18,318.07 AF/year

Table 2 (continued).

EIGHTMILE CREEK
Mouth to Big Draw (USGS Site No. 14)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	10.5	645.62
Feb.	9.99	554.82
Mar.	11.2	688.66
Apr.	33.3	1,981.49
May	93.9	5,773.68
Jun.	63.2	3,760.66
Jul.	20.8	1,278.94
Aug.	6.72	413.20
Sep.	6.40	380.83
Oct.	18.9	1,162.12
Nov.	17.1	1,017.52
Dec.	12.9	793.19
		18,450.73 AF/year

FLATHEAD CREEK
Mouth to Muddy Creek (USGS Site No. 25)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	18.8	1,155.97
Feb.	18.8	1,044.10
Mar.	22.4	1,377.32
Apr.	33.6	1,999.34
May	123.0	7,562.97
Jun.	119.0	7,080.99
Jul.	25.7	1,580.23
Aug.	9.71	597.04
Sep.	8.51	506.38
Oct.	30.6	1,881.52
Nov.	26.7	1,588.76
Dec.	22.4	1,377.32
		27,751.94 AF/year

Table 2 (continued).

FLATHEAD CREEK
Muddy Creek to Cache Creek (USGS Site No. 24)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	13.4	823.93
Feb.	13.4	744.20
Mar.	16.1	989.95
Apr.	31.1	1,850.58
May	112.0	6,886.61
Jun.	107.0	6,366.94
Jul.	35.2	2,164.36
Aug.	13.3	817.78
Sep.	11.4	678.35
Oct.	21.7	1,334.28
Nov.	18.8	1,118.68
Dec.	15.8	971.50
		24,747.16 AF/year

FLATHEAD CREEK
Cache Creek to S.F. Flathead Creek (USGS Site No. 23)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	4.20	258.25
Feb.	4.20	233.26
Mar.	5.24	322.19
Apr.	12.9	767.60
May	43.8	2,693.16
Jun.	33.1	1,969.58
Jul.	13.4	823.93
Aug.	5.07	311.74
Sep.	4.61	274.31
Oct.	6.74	414.43
Nov.	5.69	338.58
Dec.	4.86	298.83
		8,705.86 AF/year

Table 2 (continued).

FLESHMAN CREEK
Mouth to Perkins Creek (USGS Site No. 21)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	2.72	167.25
Feb.	2.53	140.51
Mar.	2.99	183.85
Apr.	10.7	636.69
May	30.3	1,863.07
Jun.	6.57	390.94
Jul.	1.55	95.30
Aug.	0.46	28.28
Sep.	0.52	30.94
Oct.	4.95	304.36
Nov.	4.66	277.29
Dec.	3.48	213.98
		4,332.46 AF/year

FRIDLEY CREEK
Mouth to Miller Creek (USGS Site No. 13)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	1.58	97.15
Feb.	1.46	81.08
Mar.	1.76	108.22
Apr.	6.81	405.22
May	19.2	1,180.56
Jun.	29.7	1,767.27
Jul.	8.76	538.63
Aug.	2.74	168.48
Sep.	2.78	165.42
Oct.	2.90	178.31
Nov.	2.77	164.83
Dec.	2.05	126.05
		4,981.22 AF/year

Table 2 (continued).

FRIDLEY CREEK
Miller Creek to Needle Creek (USGS Site No. 12)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	6.12	376.30
Feb.	5.77	320.45
Mar.	6.62	407.05
Apr.	21.2	1,261.49
May	59.8	3,676.96
Jun.	69.6	4,141.48
Jul.	23.3	1,432.66
Aug.	7.55	464.23
Sep.	7.13	424.26
Oct.	11.1	682.51
Nov.	10.2	606.94
Dec.	7.64	469.76
		14,264.09 AF/year

LITTLE MISSION CREEK
Mouth to Little Mission Forks (USGS Site No. 36)

90th Percentile May-Sep.
50th Percentile Oct.-Apr.

	Cfs	AF
Jan.	2.00	122.98
Feb.	2.00	111.07
Mar.	2.55	156.79
Apr.	9.66	574.81
May	38.1	2,342.68
Jun.	31.9	1,898.18
Jul.	5.60	344.33
Aug.	1.72	105.76
Sep.	1.65	98.18
Oct.	3.19	196.14
Nov.	2.65	157.68
Dec.	2.28	140.19
		6,248.79 AF/year

Table 2 (continued).

MISSION CREEK
Mouth to ~~Spring Creek~~ Little Bear Draw (USGS Site No. 37)
90th Percentile May-Sep.
50th Percentile Oct.-Apr.

	Cfs	AF
Jan.	6.79	417.50
Feb.	6.79	377.10
Mar.	8.36	514.04
Apr.	24.6	1,463.80
May	122.0	7,501.48
Jun.	94.6	5,629.09
Jul.	27.4	1,684.76
Aug.	9.68	595.20
Sep.	8.05	479.01
Oct.	11.0	676.36
Nov.	9.35	556.36
Dec.	7.93	487.60
		20,382.30 AF/year

MISSION CREEK
Spring Creek to Little Bear Draw (USGS Site No. 35)

90th Percentile May-Sep.
50th Percentile Oct.-Apr.

	Cfs	AF
Jan.	4.80	295.14
Feb.	4.80	266.58
Mar.	5.97	367.08
Apr.	17.3	1,029.42
May	78.6	4,832.92
Jun.	62.7	3,730.91
Jul.	21.8	1,340.43
Aug.	7.54	463.62
Sep.	6.40	380.83
Oct.	7.71	474.07
Nov.	6.54	389.16
Dec.	5.56	341.87
		13,912.03 AF/year

Table 2 (continued).

MOL HERON CREEK
Mouth to Cinnabar Creek (USGS Site No. 6)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	9.93	610.57
Feb.	9.45	524.83
Mar.	10.6	651.77
Apr.	31.8	1,892.23
May	89.7	5,515.44
Jun.	125.0	7,438.01
Jul.	45.6	2,803.83
Aug.	15.1	928.46
Sep.	13.6	809.26
Oct.	17.9	1,100.63
Nov.	16.2	963.97
Dec.	12.3	756.30
		23,995.30 AF/year

MOL HERON CREEK
Cinnabar Creek to Yellowstone Park Boundary (USGS Site No. 3)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	6.91	424.88
Feb.	6.53	362.66
Mar.	7.46	458.70
Apr.	23.4	1,392.40
May	66.2	4,070.48
Jun.	92.7	5,516.03
Jul.	32.4	1,992.20
Aug.	10.6	651.77
Sep.	9.78	581.95
Oct.	12.5	768.59
Nov.	11.4	678.35
Dec.	8.60	528.79
		17,426.80 AF/year

Table 2 (continued).

ROCK CREEK (SHIELDS DRAINAGE)
Mouth to Forest Service West Boundary Sec. 8 (USGS Site No. 34)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	5.77	354.78
Feb.	5.77	320.45
Mar.	6.03	370.77
Apr.	15.9	946.12
May	68.0	4,181.15
Jun.	132.0	7,854.54
Jul.	48.6	2,988.30
Aug.	16.2	996.10
Sep.	14.5	862.81
Oct.	9.96	612.42
Nov.	8.66	515.30
Dec.	6.81	418.73
		20,421.47 AF/year

ROCK CREEK (YELLOWSTONE DRAINAGE)
Mouth to Steele Creek (USGS Site No. 10)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	4.36	268.08
Feb.	4.09	227.15
Mar.	4.74	291.45
Apr.	15.9	946.12
May	45.0	2,766.94
Jun.	109.0	6,485.95
Jul.	39.1	2,404.16
Aug.	12.9	793.19
Sep.	11.8	702.15
Oct.	7.90	485.75
Nov.	7.34	436.76
Dec.	5.50	338.18
		16,145.88 AF/year

Table 2 (continued).

SIXMILE CREEK
Mouth to North Fork (USGS Site No. 11)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	6.60	405.82
Feb.	6.23	346.00
Mar.	7.13	438.41
Apr.	22.6	1,344.79
May	63.7	3,916.76
Jun.	157.0	9,342.14
Jul.	59.1	3,633.92
Aug.	19.8	1,217.45
Sep.	17.5	1,041.32
Oct.	11.9	731.70
Nov.	10.9	648.59
Dec.	8.23	506.04
		23,572.94 AF/year

SMITH CREEK
Mouth to Bitter Creek (USGS Site No. 22)

50th Percentile Jan.-Dec.

	Cfs	AF
Jan.	2.61	160.48
Feb.	2.61	144.95
Mar.	3.31	203.52
Apr.	23.9	1,422.15
May	85.1	5,232.59
Jun.	75.5	4,492.56
Jul.	13.6	836.23
Aug.	5.14	316.05
Sep.	4.67	277.88
Oct.	4.17	256.40
Nov.	3.49	207.67
Dec.	2.99	183.85
		13,734.33 AF/year

Table 2 (continued).

SUCE CREEK
Mouth to Lost Creek (USGS Site No. 17)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	0.83	51.03
Feb.	0.76	42.21
Mar.	0.93	57.18
Apr.	3.96	235.64
May	11.2	688.66
Jun.	34.5	2,052.89
Jul.	10.4	639.47
Aug.	3.27	201.06
Sep.	3.28	195.17
Oct.	1.53	94.08
Nov.	1.48	88.07
Dec.	1.09	67.02
		4,412.48 AF/year

TOM MINER CREEK
Mouth to Canyon Creek (USGS Site No. 9)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	20.7	1,272.79
Feb.	19.9	1,105.19
Mar.	21.9	1,346.58
Apr.	58.8	3,498.84
May	166.0	10,206.94
Jun.	188.0	11,186.77
Jul.	72.7	4,470.15
Aug.	24.6	1,512.59
Sep.	21.3	1,267.44
Oct.	37.0	2,275.04
Nov.	33.0	1,963.64
Dec.	25.0	1,537.19
		41,643.16 AF/year

Table 2 (continued).

TOM MINER CREEK
Canyon Creek to Trail Creek (USGS Site No. 8)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	22.0	1,352.73
Feb.	21.3	1,182.94
Mar.	23.3	1,432.66
Apr.	62.0	3,689.25
May	175.0	10,760.32
Jun.	211.8	12,555.36
Jul.	83.2	5,115.76
Aug.	28.3	1,740.10
Sep.	24.3	1,445.95
Oct.	39.4	2,422.61
Nov.	35.0	2,082.64
Dec.	26.6	1,635.57
		45,415.83 AF/year

TRAIL CREEK
West Pine Creek to South Boundary Sec. 35
(USGS Site No. 16)

50th Percentile May-Sep.
20th Percentile Oct.-Apr.

	Cfs	AF
Jan.	7.93	487.60
Feb.	7.52	417.64
Mar.	8.54	525.10
Apr.	26.3	1,564.96
May	74.3	4,568.53
Jun.	59.0	3,510.74
Jul.	19.3	1,186.71
Aug.	6.20	381.22
Sep.	5.93	352.86
Oct.	14.3	879.27
Nov.	13.1	779.50
Dec.	9.84	605.04
		15,259.17 AF/year

Table 2 (continued).

Final Instream Flow Quantification

MIDDLE YELLOWSTONE BASIN

(Boulder River to Big Horn River)

Table 2 (continued).

BLUE WATER CREEK
Mouth to Headwaters (Gage No. 06207800)

85th Percentile Jan.-Dec.

	Cfs	AF
Jan.	26.5	1,629
Feb.	27.5	1,527
Mar.	27.0	1,660
Apr.	28.0	1,666
May	27.0	~~1,666~~ 1,660
Jun.	25.5	1,517
Jul.	24.0	1,475
Aug.	25.0	1,537
Sep.	26.0	1,547
Oct.	27.0	1,660
Nov.	27.0	1,606
Dec.	27.0	~~1,606~~ 1,660
		19,144 AF/year

BRIDGER CREEK
Headwaters to Krone Ditch Headgate (USGS Site No. 40)

90th Percentile Jan.-Dec.

	Cfs	AF
Jan.	1.48	91.00
Feb.	1.48	82.19
Mar.	1.52	93.46
Apr.	4.77	283.83
May	25.3	1,555.64
Jun.	43.7	2,600.33
Jul.	3.44	211.52
Aug.	1.01	62.10
Sep.	1.01	60.10
Oct.	1.98	121.74
Nov.	2.46	146.38
Dec.	1.75	107.60
		5,415.89 AF/year

Table 2 (continued).

CLARKS FORK YELLOWSTONE RIVER[1]
~~Bluewater Creek to Mouth~~[1]

90th Percentile Oct.-May
70th Percentile June-Sep.

	Cfs	AF
Jan.	300.0	18,442
Feb.	299.0	16,602
Mar.	308.0	18,934
Apr.	357.0	21,238
May	1,051.0	64,608
Jun.	3,569.0	212,320
Jul.	1,537.0	94,484
Aug.	399.0	24,528
Sep.	393.0	23,380
Oct.	332.0	20,409
Nov.	401.0	23,855
Dec.	330.0	20,286
		559,086 AF/year

No. 06208500

[1]Measured at USGS gage "Clarks Fork River at Edgar."

CLARKS FORK YELLOWSTONE RIVER[1]
~~Montana-Wyoming Line to Bluewater Creek~~[1]

90th Percentile Oct.-May
70th Percentile June-Sep.

	Cfs	AF
Jan.	186.0	11,434
Feb.	194.0	10,772
Mar.	189.0	11,618
Apr.	250.0	14,873
May	1,062.0	65,284
Jun.	3,477.0	206,847
Jul.	1,640.0	100,816
Aug.	423.0	26,003
Sep.	240.0	14,278
Oct.	117.0	7,192
Nov.	200.0	11,898
Dec.	229.0	14,077
		495,092 AF/year

No. 06207500

[1]Measured at USGS gage "Clarks Fork River near Belfry."

Table 2 (continued).

LOWER DEER CREEK
Headwaters to I-90 (USGS Site No. 39)

90th Percentile Jan.-Dec.

	Cfs	AF
Jan.	3.09	190.00
Feb.	3.09	171.61
Mar.	3.12	191.84
Apr.	10.4	618.84
May	51.9	3,191.20
Jun.	101.0	6,009.91
Jul.	13.7	842.38
Aug.	4.55	279.77
Sep.	4.03	239.80
Oct.	4.28	263.17
Nov.	4.90	291.57
Dec.	3.61	221.97
		12,512.06 AF/year

ROCK CREEK (CLARKS FORK DRAINAGE)
Mouth to Custer National Forest (Gage No. 06209500)

85th Percentile Jan.-Dec.

	Cfs	AF
Jan.	29.0	1,783
Feb.	27.0	1,499
Mar.	25.5	1,568
Apr.	30.0	1,785
May	113.0	6,946
Jun.	418.5	24,897
Jul.	326.5	20,071
Aug.	205.5	12,633
Sep.	108.5	6,455
Oct.	66.0	4,057
Nov.	45.0	2,677
Dec.	34.5	2,121
		86,492 AF/year

Table 2 (continued).

ROSEBUD CREEK
Cottonwood Creek to Yellowstone River (Gage No. 06296003)

80th Percentile Jan.-Dec.[1]

	Cfs	AF
Jan.	7.0	430
Feb.	18.0	999
Mar.	22.0	1,352
Apr.	36.0	2,142
May	28.0	1,721
Jun.	37.0	2,201
Jul.	9.0	553
Aug.	7.0	430
Sep.	2.0	119
Oct.	9.0	553
Nov.	10.0	595
Dec.	12.0	738
		11,833 AF/year

[1]Adjusted to 1934-82 base period.

UPPER DEER CREEK
Headwaters to a Point Upstream from I-90 Bridge (USGS Site No. 38)

90th Percentile Jan.-Dec.

	Cfs	AF
Jan.	3.06	188.15
Feb.	3.06	169.94
Mar.	3.08	189.38
Apr.	13.3	791.40
May	64.6	3,972.10
Jun.	130.0	7,735.53
Jul.	7.17	440.86
Aug.	2.25	138.35
Sep.	2.11	125.55
Oct.	4.23	260.09
Nov.	4.85	288.59
Dec.	3.57	219.51
		14,519.45 AF/year

Table 2 (continued).

Final Instream Flow Quantifications

LOWER YELLOWSTONE BASIN

(Big Horn River to North Dakota State Line)

Table 2 (continued).

HANGING WOMAN CREEK
East Fork to Tongue River (Gage No. 06307600)

Historic Minimum Monthly Flows[1]

	Cfs	AF
Jan.	0.30	18.4
Feb.	0.60	33.3
Mar.	0.66	40.6
Apr.	0.61	36.3
May	0.52	32.0
Jun.	0.34	20.2
Jul.	0.01	0.6
Aug.	0.00	0.0
Sep.	0.00	0.0
Oct.	0.04	2.5
Nov.	0.18	10.7
Dec.	0.06	3.7
		198.3 AF/year

[1]Period of record September 1973 through September 1984. The 1934-82 common base period was not used on this stream.

Table 2 (continued).

OTTER CREEK
Bear Creek to Tongue River (Gage No. 06307740)

Historic Minimum Monthly Flows[1]

	Cfs	AF
Jan.	1.67	102.7
Feb.	1.87	103.8
Mar.	2.65	162.9
Apr.	1.59	94.6
May	2.61	160.4
Jun.	2.14	127.3
Jul.	0.28	17.2
Aug.	0.08	4.9
Sep.	0.13	7.7
Oct.	0.40	24.6
Nov.	1.63	97.0
Dec.	2.05	126.0
		1,029.1 AF/year

[1]Period of record October 1972 through September 1984. The 1934-82 common base period was not used on this stream.

PUMPKIN CREEK
Deer Creek to Tongue River (Gage No. 06308400)

Historic Minimum Monthly Flows[1]

	Cfs	AF
Jan.	0.00	0.0
Feb.	0.00	0.0
Mar.	0.01	0.6
Apr.	0.00	0.0
May	0.00	0.0
Jun.	0.00	0.0
Jul.	0.00	0.0
Aug.	0.00	0.0
ep.	0.00	0.0
Oct.	0.00	0.0
Nov.	0.00	0.0
Dec.	0.00	0.0
		0.6 AF/year

[1]Period of record October 1972 through September 1984. The 1934-82 common base period was not used on this stream.

Table 3. Remaining quantifications.

Upper Yellowstone Basin

1. Armstrong Spring Creek
   Mouth to origin

2. Nelson Spring Creek
   Mouth to origin

3. McDonald Spring Creek
   Mouth to northern boundary Sec. 32

4. Emigrant Spring Creek
   Mouth to origin

5. Big Creek
   ~~Mouth to Millfork Creek~~
   Millfork Creek to Bark Cabin Creek

6. Cedar Creek
   Second Fork to North Fork

7. Eightmile Creek
   Big Draw to North Fork

~~8. Mill Creek~~
   ~~Mouth to East fork~~
   ~~East Fork to Passage Creek~~
   ~~Passage Creek to Lambert Creek~~

~~8~~ 9. Rock Creek (Shields drainage)
   Forest Service west boundary Sec. 8 to Smeller Creek

10. Trail Creek
   ~~West Pine Creek to south boundary Sec. 35~~
   Mouth to West Pine Creek

9. Shields River
   Shields River at its mouth

Table 3 (continued).

Middle Yellowstone Basin

1. Butcher Creek
   Headwaters to West Butcher Creek

2. Castle Creek
   Mouth to ~~Lodgepole Creek~~ West Butcher Creek to mouth
   ~~Lodgepole Creek to Pickett~~ 1500 feet above Picket Pin Creek Pin Creek
   ~~Picket Pin Creek upstream 1500 feet~~

3. Clear Creek
   Headwaters to mouth

4. Dry Creek
   Headwaters to mouth

5. East Fishtail Creek
   ~~From~~ its East Fork ~~to~~ to West Fishtail Creek

6. East Rosebud Creek
   Custer National Forest to West Rosebud Creek

7. Fishtail Creek
   Confluence of East and West Fishtail creeks to mouth

8. Little Rocky Creek
   Mouth to crossing of Forest Service Road No. 1414

9. Picket Pin Creek
   Mouth to Swamp Creek

10. Red Lodge Creek
    Custer National Forest to ~~East and West Red Lodge creeks~~ Cooney Reservoir

11. Sage Creek
    Headwaters to Crow Indian Reservation

~~12. Sweet Grass Creek~~
   ~~Forest Service boundary to Lake Adam Diversion~~
   ~~Lake Adam diversion to mouth~~

12
13. West Fishtail Creek
   ~~From junction with~~ East Fishtail Creek to Richman-Kennedy Ditch ~~headgate~~ and

Table 3 (continued).

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14. West Fork Stillwater River
    Mouth to Castle Creek
    Castle Creek to ~~Stillwater-Sweet Grass~~ County line
    ~~Stillwater-Sweet Grass~~ County line to Tumble Creek

15. West Rosebud Creek
    ~~Mystic Lake to Fiddler Creek~~
    Fiddler Creek to mouth

16. Willow Creek
    Forest boundary to ~~Spring Creek~~
    ~~Spring Creek to Cooney Reservoir~~

Table 3 (continued).

Lower Yellowstone Basin
All streamflows have been quantified.