Mailing Address:
Water Resources Data System
University of Wyoming, Dept 3943
1000 E University Avenue
Laramie, WY 82071

Physical Address:
Wyoming Hall, Room 249
University of Wyoming
Laramie, WY 82071

Phone: (307) 766-6651
Fax: (307) 766-3785

Funding for WRDS and the creation of this electronic document was provided by the Wyoming Water Development Commission (http://wwdc.state.wy.us)

51.1245 (South Fork Grand Encampment)

REPORT ON THE FEASIBILITY OF PROVIDING INSTREAM FLOW IN THE SOUTH FORK GRAND ENCAMPMENT RIVER FLOW SEGMENT NO. 1 TEMPORARY FILING NO. 26 5/399

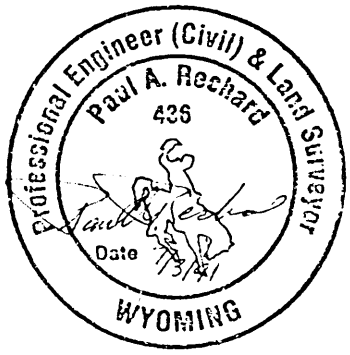
July 1991

Prepared For:

WYOMING WATER DEVELOPMENT COMMISSION
Herschler Building
Cheyenne, Wyoming 82002

Prepared By:

Western Water Consultants, Inc.
611 Skyline Road
Laramie, Wyoming 82070



701 Antler Dr. - Suite 233
Casper, Wyoming 82601

1949 Sugarland Dr. - Suite 134
Sheridan, Wyoming 82801

Western Water Consultants, Inc.

SOUTH FORK GRAND ENCAMPMENT RIVER
TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

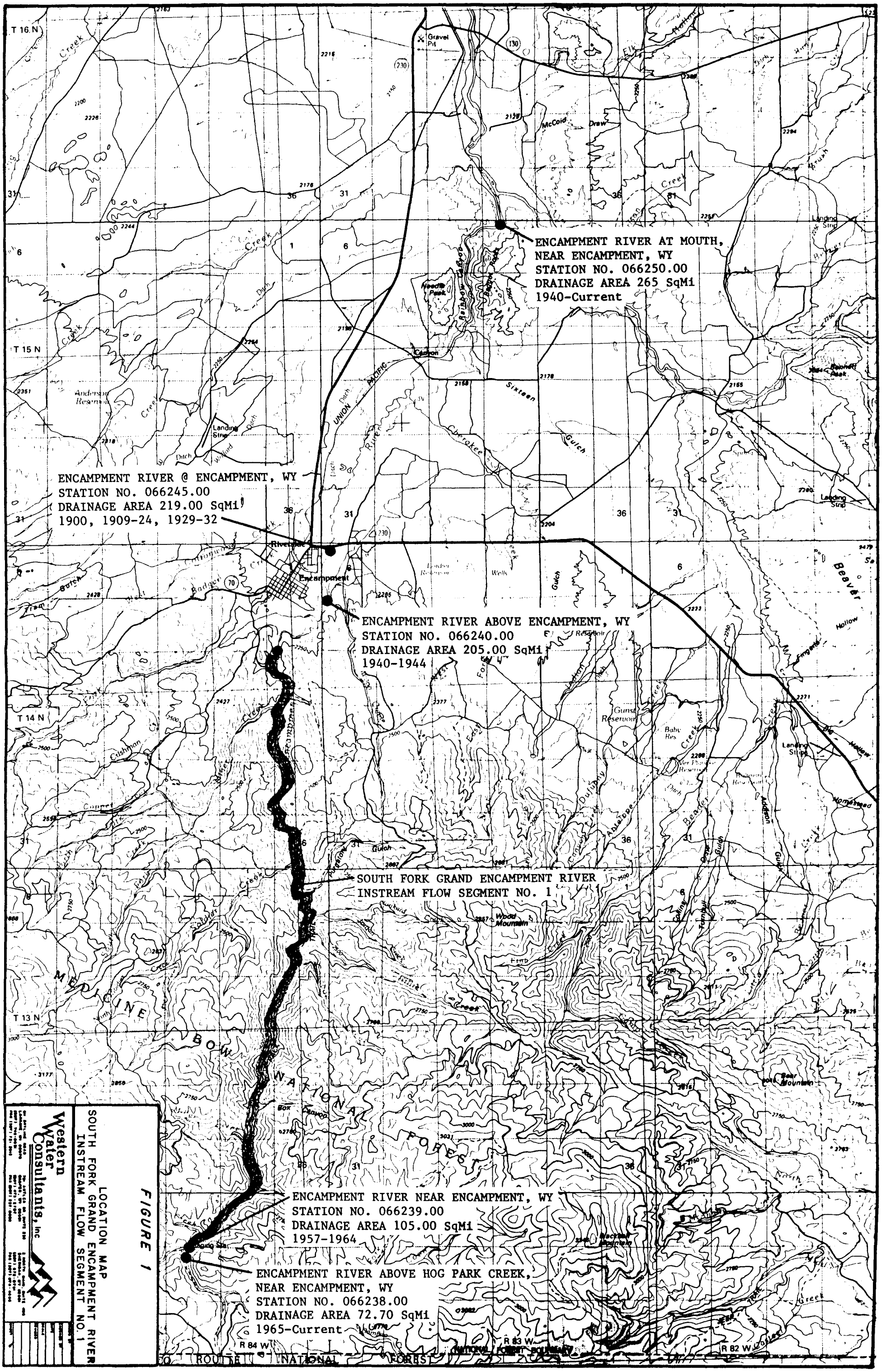
LIST OF APPENDICES

REPORT ON THE FEASIBILITY OF PROVIDING INSTREAM FLOW IN THE SOUTH FORK GRAND ENCAMPMENT RIVER INSTREAM FLOW SEGMENT NO. 1 TEMPORARY FILING NO. 26 5/399

Wyoming Water Development Commission
July 1991

I. SUMMARY

The Wyoming Water Development Commission (WWDC) is required by W.S. 41-3-1004(a) to complete a determination of the feasibility of providing various amounts of unappropriated direct flow of water for instream uses for stream segments requested by the Wyoming Game and Fish Department (WGFD). For the South Fork Grand Encampment River (Encampment River), WWDC contracted with Western Water Consultants, Inc. of Laramie, Wyoming to prepare the technical study. WGFD has requested by filing an application with the State Engineer (Temporary Filing No. 26 5/399) a direct flow water right of 54 cubic feet per second (cfs) for three different periods of the year which are: October 1 through March 31, April 1 through June 30, and July 1 through September 30. The purpose of the request is to provide instream flow for fisheries in a segment of the South Fork Grand Encampment River. The segment is called the South Fork Grand Encampment River - Instream Flow Segment No. 1 and is defined by an upstream point located at the confluence of Hog Park Creek and the South Fork Grand Encampment River in the NE¼ NW¼, Section 10, Township 12 North, Range 84 West and a downstream point located at the north boundary line of the NW¼ NW¼, Section 13, Township 14 North, Range 84 West, a stream length of approximately 13.6 miles, all in Carbon County, Wyoming. The location of the segment is shown on Figure 1.



Western Water Consultants, Inc

LOCATION MAP
SOUTH FORK GRAND ENCAMPMENT RIVER
INSTREAM FLOW SEGMENT NO. 1

FIGURE 1

Mean monthly flow, dry year flow, and daily flow exceedence analyses were conducted. The mean monthly flow analysis shows that on the average, the flow of 54 cfs is available except for the late fall and winter months of November through March at the downstream end of the proposed South Fork Grand Encampment River Instream Flow Segment No. 1. During an extremely dry year the requested flow is not available in its entirety during the late summer, fall, and winter months from August through March.

A daily flow-duration analysis was conducted for each of the three instream flow periods. The requested flow of 54 cfs during the period of October through March is available 18 percent of the time. This availability occurs mostly in October and the first part of November. The requested flow of 54 cfs for the period of April through June is available 80 percent of the time with almost 100% availability for the months of May and June. The requested flow of 54 cfs for the period of July through September is available 76 percent of the time. WGFD considers that if the requested flows are available during the period of July through September at least 50 percent of the time, their criteria are satisfied. The WGFD has not developed exceedence criteria for other times of the year but has stated that during these periods the flow should equal natural flows up to the requested amounts.

II. WATER RIGHTS

All water rights and permits for diversion at points located upstream of the downstream end of the instream flow segment have been tabulated. Table 1 lists all of the Wyoming water rights and Table 2 lists all of the Colorado water rights. Both direct flow

TABLE 1

LISTING OF WATER RIGHTS IN THE SOUTH FORK GRAND ENCAMPMENT RIVER BASIN
Upstream of the Downstream End of
Instream Flow Segment No. 1

Permit Number	Proof Number	Facility	Source	Priority Date Mo	Day	Yr	Amount* CFS	Use**	Adj./ Unadj.	Diversion Location Sec.	Twn.	Rng.
DIRECT FLOW												
458E	3833	Enl. Encampment	E.& W.Billy Ck.	7	5	1899	5.61	1	Adj.	20	13	83
458E	3832	Enl. Encampment	E. & W. Billy Ck.	7	5	1899	5.14 S.S.	1	Adj.	20	13	83
458E	24348	Enl. Encampment	W. Fork Billy Ck.	7	5	1899	2.86 S.S.	1	Adj.	20	13	83
5006	----	North American Pipeline	S. Fk. Grand Encampment River	8	11	1902	not stated	5	Unadj.	24	14	84
5057	9526	Bashore Ditch	Miner Creek	9	13	1902	0.5	1	Adj.	23	14	84
5510	10637	Soldier Creek Ditch	Soldier Creek	5	28	1903	1.90	1	Adj.	10	13	84
1243E	----	Enl. Soldier Creek Ditch	Soldier Creek	7	28	1904	2.14	1	Canc.	10	13	84
6031	10645	Ver Plancke Res. Ditch	Billy Creek	4	30	1904	2.14	1	Adj.	19	14	82
1923E	21974	Ext. Kurtz-Chatterton	N.Fk. Miner Crk.	7	23	1908	4.00 O.S,.57 S.S.	1	Adj.	31	14	84
2222E	13466	Enl. Soldier Creek Ditch	Soldier Creek	10	6	1909	2.06	1	Adj.	10	13	84
13910	----	Lordier No. 3 Ditch	Bull Creek	1	10	1916	0.69 S.S.	1	Unadj.	5	13	83
13911	----	Lordier No. 4 Ditch	North Dunkard Ck.	1	10	1916	0.69 S.S.	1	Unadj.	5	13	83
14591	----	Grand Encampment Canal	S. Fk. Grand Encampment River	1	16	1917	27.0 OS, 3.4 SS	1	Unadj.	13	14	84
15131	16727	Ernest Ditch	N. Fk. Miner Crk.	6	27	1918	2.14	1	Adj.	32	14	84
15132	16728	Ernest Ditch	Rock Creek	6	27	1918	2.14 S.S.	1	Adj.	32	14	84
15227	----	Ashley Ditch	Soldier Creek	6	27	1918	1.79	1	Unadj.	10	13	84
15210	----	Encampment Canal	S. Fk. Grand Encampment River	7	27	1918	3.29 S.S.	1	Unadj.	24	14	84
15623	----	Grand Encampment Canal	S. Fk. Grand Encampment River	2	24	1919	19.6 OS, 2.0 SS	1,2,3	Unadj.	13	14	84
17165	24409	Coon Creek No. One	Branch of Coon Ck.	8	7	1926	8.97 S.S.	1	Adj.	2	12	83
17166	43349	Coon Creek No. Two	Branch of Coon Ck.	8	7	1926	8.97 S.S.	1	Adj.	2	12	83
17188	----	Englehart No. 1 Ditch	Purgatory Gulch	3	28	1927	3.73 S.S	1	Unadj.	32	14	83
17189	----	Englehart No. 2 Ditch	Bull Creek	3	28	1927	3.73 S.S.	1	Unadj.	5	13	83
19035	23266	Blackhall Mtn Lkt Sta. P.L. #2	Blackhall Spring #2	12	2	1938	0.07	2	Adj.	2	12	83
5709E	25369	Enl. Encampment	West Sharp Creek	12	7	1953	7.93 S.S.	1,3,6	Adj.	31	14	82
5708E	25369	Enl. Encampment	East Sharp Creek	12	7	1953	7.93 S.S.	1,3,6	Adj.	31	14	82
5737E	26173	Enl. Soldier Creek Ditch	Soldier Creek	7	8	1954	2.37	1	Adj.	10	13	84
21454	----	Miner Creek Ditch	Miner Creek	7	8	1954	6.33 S.S.	1	Unadj.	10	13	84
21873	----	Lodge Ditch	Miner Creek	5	13	1957	0.15	1,2	Unadj.	24	14	84
22585	29721	Water Valley Supply Ditch	Soldier Creek	6	2	1964	3.92(68.25 A.F.)	6	Adj.	36	14	84
23538	30530	Water Valley No. 1 Supply D.	Soldier Creek	12	2	1970	174.60(3.76 A.F.)	6	Adj.	36	14	84
TF 26 5/399	----	Encamp R. - Ins.Flow Seg #1	S. Fk. Grand Encampment River	8	4	1989	54	11	Unadj.	13	14	84

TABLE 1 (continued)

LISTING OF WATER RIGHTS IN THE SOUTH FORK GRAND ENCAMPMENT RIVER BASIN Upstream of the Downstream End of Instream Flow Segment No. 1

Permit Number	Proof Number	Facility	Source	Priority Date Mo	Day	Yr	Amount* CFS	Use**	Adj./ Unadj.	Diversion Location Sec.	Twn.	Rng.
RESERVOIRS												
518R	10644	Ver Plancke Res.	Billy Creek	4	30	1904	241.2 A.F.	1	Adj.	30	14	82
1281E	17967	Enl. Ver Plancke Res.	Billy Creek	11	2	1904	2.06 S.S.	1	Adj.	19	14	82
6809R	29769	Water Valley Fish and Rec. Res.	Soldier Creek	6	2	1964	68.25 A.F.	10,11	Adj.	36	14	84
7235R	----	Hog Park Res.	Hog Park Creek	8	26	1964	2972.30 A.F.	1,8,9	Adj.	5	12	84
7361R	30576	Auxiliary No. 1 Res	Soldier Creek	6	16	1970	3.76 A.F.	11	Adj.	36	14	84
8168SR	----	Manning Draw Stk Res.	Manning Draw	12	8	1976	3 AF	3	Unadj.	3	13	84
8455R	34413	Enl. Hog Park Res.	Hog Park Creek	6	11	1979	19683.92 A.F.	1,8,9	Adj.	5	12	84
8658S.R.	33075	Ridgetop Stock Res.	S. Fork Purgatory Gulch	2	14	1980	0.22 A.F.	3	Adj.	6	13	83

** USE DESCRIPTION:
1=Irrigation
2=Domestic
3=Stock
4=Highway Department
5=Power
6=Reservoir Conveyance
7=BLM Water Use
8=Municipal Use
9=Mining/Industrial
10=Flood Control
11=Fisheries

* Amounts are given in CFS unless otherwise noted.
S.S. = Supplemental Supply
O.S. = Original Supply
A.F. = Acre-Feet

TABLE 2

COLORADO WATER RIGHTS
From the South Fork of the Grand Encampment river and Tributaries
Upstream of the Downstream End of
Instream Flow Segment No. 1

Permit Number	Proof Number	Facility	Source	Priority Date Mo	Day	Yr	Amount CFS*	Use**	Adj./ Unadj.	Diversion Location Sec.	Twn.	Rng.
DIRECT FLOW												
1126		S. Fork Hog Park Ck. MSF	S. Fork Hog Park Ck.	9	19	1978	8	11	Adj.	8	11	84
1124		W. Fork Encampment R.MSF	W. Fork Encampment R.	9	19	1978	15	11	Adj.	13	11	84
1123		Encampment River MSF	Encampment River	9	19	1978	45	11	Adj.	21	12	84
2073		DamFino Ck. MSF	DamFino Creek	12	3	1981	2.5	11	Adj.		12	83
RESERVOIRS												
4344		Gem Lake MLL	Encampment River	3	17	1976	105 AF	11	Adj.	33	11	83
4367		Seven Lakes MLL	Encampment River	3	17	1976	58 AF	11	Adj.	26	11	83

MSF=Minimum Stream Flow
MLL=Minimum Lake Level

** USE DESCRIPTION:
1=Irrigation
2=Domestic
3=Stock
4=Highway Department
5=Power
6=Reservoir Conveyance
7=BLM Water Use
8=Municipal Use
9=Mining
10=Flood Control
11=Fisheries

and storage rights are listed in each table. The listings of both Wyoming and Colorado water rights were obtained from the respective State Engineer's Office in January 1991.

III. STREAMFLOW RECORDS

There are five United States Geologic Survey (USGS) gaging stations on the Grand Encampment and South Fork Grand Encampment Rivers. These stations and their period of record are:

1. Encampment River above Hog Park Creek, near Encampment, Wyoming; Station Number 066238.00; 1965-Current.

2. Encampment River near Encampment, Wyoming; Station Number 066239.00; 1957-1964.

3. Encampment River above Encampment, Wyoming; Station Number 066240.00; 1940-1944.

4. Encampment River at Encampment, Wyoming; Station Number 066245.00; 1900, 1909-1924, 1929-1932.

5. Encampment River at Mouth, near Encampment, Wyoming; Station Number 066250.00; 1940-Current.

In addition there are operational records for Hog Park Reservoir which is part of a trans-basin diversion project operated by the City of Cheyenne. The records include daily diversions from the Little Snake River drainage basin, reservoir levels, and releases from Hog Park Reservoir. The releases from the reservoir are administratively controlled such that all natural flow into the reservoir must be passed through the reservoir. However, a minimum flow of 15 cfs must be provided from storage of Little Snake River drainage basin water when natural flows are not sufficient. Releases from the reservoir are limited to 200 cfs unless the natural flow exceeds that amount.

The locations of gaging stations are shown in relation to the proposed instream flow segment on Figure 1. The flow records for all of the stations are presented in Tables 3 through 7.

IV. HYDROLOGY

A hydrologic analysis was conducted to estimate the flows at the downstream end of the proposed instream flow segment. All five gaging stations on the Encampment River were evaluated for use in predicting streamflows in the instream flow segment. A summary of the conclusions reached about each gaging station follows:

1. Station Number 066238.00, above Hog Park Creek has a reasonably long period of record (25 years) and has almost no impact from upstream diversions. To use this station to estimate the flows at the downstream end of the proposed instream flow segment, it would be necessary to determine the water production from the downstream drainage area. Releases from Hog Park Reservoir can be added directly.

2. Station Number 066239.00, near Encampment has 8 years of record which is insufficient to determine the availability of flow for instream flow purposes. Hog Park Reservoir has been constructed since the station was discontinued, so records would need to be adjusted to take that into consideration.

3. Station Number 066240.00, above Encampment has a four-year period of record and is the gaging station closest to the downstream end of the instream flow segment. There is a good correlation between this station and Station No. 066250.00 at the mouth, so long term records could be developed by regression analysis. However, there have been considerable diversion rights adjudicated on both the Grand Encampment and North Fork Grand Encampment since 1944 making the relationship based on 1940-1944 records questionable for present conditions.

TABLE 3

ENCAMPMENT RIVER ABOVE HOG PARK CREEK
Station No.066238.00
Average monthly Flow (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1965	20.35	22.37	22.10	20.77	25.64	21.10	29.20	181.65	715.33	307.03	71.65	59.20	90218
1966	60.55	35.07	28.45	26.68	20.36	21.29	51.03	331.71	280.73	61.65	27.52	18.97	58387
1967	21.13	15.83	15.29	13.48	14.64	15.19	20.97	195.13	577.43	250.55	51.90	40.03	74342
1968	25.65	18.60	15.48	14.06	12.75	13.84	20.93	136.45	707.17	187.19	59.26	33.67	74957
1969	32.61	20.47	11.66	10.87	10.77	10.87	50.17	399.32	423.57	146.94	38.52	26.27	71584
1970	29.84	25.33	24.35	21.97	22.36	24.87	26.43	283.45	736.87	298.48	51.55	44.43	95976
1971	39.23	30.93	30.29	28.87	28.11	24.52	48.80	264.97	876.13	366.45	63.39	42.70	111259
1972	33.29	25.80	21.94	18.94	17.48	23.97	39.20	257.87	495.83	87.39	30.90	28.37	65228
1973	29.68	27.57	22.03	18.55	17.43	21.06	21.07	211.00	576.77	191.65	53.52	31.10	73696
1974	23.45	19.80	15.45	13.74	15.50	17.87	32.53	467.58	785.37	142.13	35.97	25.13	96330
1975	26.87	24.83	20.06	17.48	16.43	15.45	19.33	142.32	673.10	470.81	63.84	30.93	91970
1976	29.58	27.00	24.90	21.16	18.28	17.52	29.77	276.52	531.33	191.87	49.35	28.53	75306
1977	25.74	15.83	19.74	16.42	12.32	11.90	40.23	151.19	229.07	47.52	25.19	19.07	37091
1978	21.94	15.57	21.90	17.61	19.32	20.52	42.83	245.90	914.20	354.74	52.65	29.73	105925
1979	20.90	18.13	19.87	18.52	16.89	16.55	30.93	300.94	896.80	334.10	54.26	25.23	105769
1980	22.65	26.60	22.32	21.55	21.07	19.81	34.03	309.06	825.37	199.68	38.90	26.67	94500
1981	24.48	23.30	20.58	17.52	17.21	16.94	59.63	179.81	291.47	64.55	26.97	23.90	46229
1982	37.16	25.03	25.19	21.06	15.68	14.81	36.37	284.84	853.67	475.48	70.52	40.67	114867
1983	44.45	34.53	26.52	25.81	23.11	22.71	24.20	135.10	871.87	452.90	75.29	37.10	106996
1984	44.90	35.00	32.10	22.55	20.48	20.90	24.53	357.35	797.33	340.74	70.68	63.40	110614
1985	49.61	38.73	25.97	21.55	20.32	20.45	61.30	424.13	579.57	138.87	42.97	32.63	87999
1986	38.32	29.10	26.65	24.71	25.61	30.52	69.03	370.77	867.90	229.29	52.61	43.30	109004
1987	45.65	31.90	28.84	22.81	19.71	20.29	65.23	297.68	181.30	50.39	27.87	18.57	49113
1988	19.00	20.50	17.20	18.50	16.30	16.50	43.10	279.00	608.00	91.70	34.30	29.90	71960
1989	20.20	17.80	18.20	16.90	16.90	19.60	76.50	269.00	287.00	68.70	29.60	22.40	52180
#RECORDS	25	25	25	25	25	25	25	25	25	25	25	25	25
AVERAGE	31.49	25.02	22.28	19.68	18.59	19.16	39.89	270.11	623.33	222.03	47.97	32.88	82860
STD DEV	10.72	6.54	5.02	4.25	4.15	4.33	16.20	88.80	227.04	134.17	15.53	11.20	22383
MIN	19.00	15.57	11.66	10.87	10.77	10.87	19.33	135.10	181.30	47.52	25.19	18.57	37091
MAX	60.55	38.73	32.10	28.87	28.11	30.52	76.50	467.58	914.20	475.48	75.29	63.40	114867

TABLE 4

ENCAMPMENT RIVER NEAR ENCAMPMENT
Station No.066239.00
Average monthly Flow (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1957	22.61	25.00	23.00	22.00	25.00	28.00	43.27	306.03	1423.47	624.47	85.13	41.07	160937
1958	33.26	32.00	30.00	26.00	23.00	20.00	50.73	714.48	710.03	96.10	33.48	32.73	109015
1959	23.71	23.73	21.00	20.00	21.00	23.00	45.37	368.90	699.13	116.61	47.10	35.13	87112
1960	71.94	45.80	28.00	25.00	23.00	31.19	149.13	526.94	713.93	127.32	38.10	26.23	109136
1961	27.55	29.13	28.00	26.00	25.00	28.19	59.37	421.45	589.77	93.45	41.81	72.53	87043
1962	85.03	64.00	54.00	45.00	66.43	58.16	282.87	851.90	725.13	222.58	50.97	33.50	153564
1963	33.29	27.67	23.39	17.32	20.18	22.23	43.50	541.77	444.73	77.55	53.32	37.60	81332
1964	26.94	27.37	22.90	21.42	23.55	29.52	55.20	499.55	944.60	224.48	58.58	34.70	118857
#RECORDS	8	8	8	8	8	8	8	8	8	8	8	8	8
AVERAGE	40.54	34.34	28.79	25.34	28.40	30.04	91.18	528.88	781.35	197.82	51.06	39.19	113375
STD DEV	22.44	12.93	9.98	7.96	14.46	11.24	79.62	168.31	275.80	169.79	15.00	13.21	28183
MIN	22.61	23.73	21.00	17.32	20.18	20.00	43.27	306.03	444.73	77.55	33.48	26.23	81332
MAX	85.03	64.00	54.00	45.00	66.43	58.16	282.87	851.90	1423.47	624.47	85.13	72.53	160937

TABLE 5

ENCAMPMENT RIVER ABOVE ENCAMPMENT
Station No.066240.00
Average monthly Flow (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1940								966.39	644.90	89.65	30.71	30.07	
1941	47.19	40.83	35.35	33.97	34.64	44.23	69.23	1010.39	743.53	124.00	60.00	46.30	139795
1942	104.35	69.53	49.00	39.19	29.25	30.23	212.57	855.10	1431.43	217.32	49.55	37.00	188473
1943	42.10	51.93	39.81	40.06	40.75	50.16	331.90	906.29	1397.80	261.26	79.06	35.27	197611
1944	41.10	40.80	33.45	32.19	32.55	40.42	69.33	701.06	1319.83	246.87	42.68	27.87	158578
#RECORDS	4	4	4	4	4	4	4	5	5	5	5	5	4
AVERAGE	58.69	50.77	39.40	36.35	34.30	41.26	170.76	887.85	1107.50	187.82	52.40	35.30	171115
STD DEV	26.47	11.74	6.00	3.35	4.19	7.25	109.90	107.23	340.81	68.50	16.38	6.43	23138
MIN	41.10	40.80	33.45	32.19	29.25	30.23	69.23	701.06	644.90	89.65	30.71	27.87	139795
MAX	104.35	69.53	49.00	40.06	40.75	50.16	331.90	1010.39	1431.43	261.26	79.06	46.30	197611

TABLE 6

ENCAMPMENT RIVER AT ENCAMPMENT
Station No.066245.00
Average monthly Flow (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1911								1220.00	1420.00	209.00	96.00	131.00	
1912	140.00	70.00	55.00	50.00	45.00	45.00	125.00	1158.29	2128.67	407.26	115.61	125.10	269502
1913	89.61	60.00	50.00	45.00	40.00	45.00	333.50	1462.90	741.67	85.94	40.39	39.00	183925
1914	28.71	35.00	35.00	30.00	35.00	50.42	190.57	1602.26	1564.47	214.45	40.16	36.20	234264
1915	70.90	60.00	50.00	45.00	40.00	42.42	256.97	684.65	872.03	118.74	36.55	55.00	140699
1916	61.29	44.97	40.00	35.00	35.00	50.00	282.30	1301.94	1630.67	224.65	98.19	70.93	234097
1917	181.90	57.60	40.00	40.00	35.00	45.00	135.40	545.19	2619.83	1012.65	129.26	61.73	295599
1918	70.39	90.00	60.00	50.00	40.00	50.00	221.43	900.00	1719.83	210.48	25.61	47.40	209933
1919	96.45	75.13	50.00	40.00	35.00	40.00	254.00	1339.29	594.57	52.71	29.45	41.17	160683
1920	50.23	50.00	40.00	40.00	35.00	40.00	200.00	1232.52	1980.00	350.55	59.94	53.83	249402
1921	52.06	50.07	40.00	40.00	40.00	55.10	124.53	1501.10	2263.67	332.81	67.35	33.67	277724
1922	22.26	30.27	30.00	25.00	25.00	30.00	65.90	978.00	1570.17	242.65	32.94	25.57	185738
1923	27.87	25.83	25.00	25.00	25.00	30.00	111.40	940.90	1866.67	557.35	120.16	137.73	234970
1924	81.26	58.00	39.00	33.00	28.17	33.00	260.00	1040.00	902.87	99.42	17.48	15.00	157747
1929	34.00	60.00	54.00	54.00	54.00	75.00	921.00	1687.42	2330.67	491.03	64.48	108.37	357761
1930	100.68	65.00	45.00	38.00	42.00	50.00	338.27	703.13	744.60	57.74	73.58	46.27	139065
1931	92.61	39.47	40.00	45.00	35.00	40.00	120.70	507.71	472.00	30.45	19.26	26.83	88812
1932	51.68	41.80	36.00	34.00	40.00	45.00	155.80	1294.94	1790.00				
#RECORDS	17	17	17	17	17	17	17	18	18	17	17	17	16
AVERAGE	73.64	53.71	42.88	39.35	37.01	45.06	240.99	1116.68	1511.80	276.35	62.73	62.05	213745
STD DEV	40.61	16.17	8.98	8.15	6.92	10.24	187.06	343.89	633.46	237.66	36.01	37.95	66784
MIN	22.26	25.83	25.00	25.00	25.00	30.00	65.90	507.71	472.00	30.45	17.48	15.00	88812
MAX	181.90	90.00	60.00	54.00	54.00	75.00	921.00	1687.42	2619.83	1012.65	129.26	137.73	357761

TABLE 7

ENCAMPMENT RIVER AT MOUTH
Station No.066250.00
Average monthly Flow (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1940								881.03	543.23	47.51	10.52	34.17	
1941	64.00	59.37	51.84	44.97	53.82	55.35	86.77	980.48	650.83	90.39	55.68	56.87	136356
1942	130.13	83.97	60.00	50.00	40.00	52.19	224.47	852.71	1369.07	173.81	27.55	38.77	187133
1943	56.29	63.53	54.32	52.29	56.71	59.10	328.13	863.74	1439.20	225.03	47.00	30.83	197415
1944	55.32	66.17	53.65	47.13	46.31	53.94	71.27	664.06	1226.37	201.19	27.35	27.83	153271
1945	59.65	60.23	50.35	50.23	59.89	60.81	86.97	938.61	1498.33	611.68	175.23	83.87	225921
1946	76.58	74.00	66.00	60.84	53.82	73.35	348.77	702.32	860.67	102.52	40.26	45.97	151075
1947	81.61	70.67	56.68	53.55	61.04	72.52	118.43	1112.13	1101.30	332.84	54.45	59.93	192190
1948	74.19	68.13	56.71	44.77	48.45	74.71	142.03	1136.61	915.77	75.52	21.52	25.80	162569
1949	74.35	73.47	60.52	65.35	67.50	71.81	194.23	1102.77	1704.37	321.68	40.48	38.73	230202
1950	93.48	70.17	56.19	52.97	58.89	59.90	156.57	714.23	1632.67	313.35	38.19	68.10	199640
1951	71.13	70.90	71.42	60.52	54.29	62.68	107.03	916.61	1115.67	288.03	79.23	39.83	177642
1952	92.74	56.20	52.03	46.48	43.10	48.19	204.37	1257.58	1937.07	215.74	51.39	45.87	244451
1953	42.23	49.90	50.77	51.68	58.07	58.68	91.83	410.87	1189.87	93.03	55.13	26.63	130923
1954	36.77	66.37	70.45	74.65	57.07	54.61	188.33	602.52	316.37	38.39	23.29	14.20	93376
1955	41.77	43.43	56.71	40.97	35.75	48.45	91.57	604.19	584.77	71.32	41.94	27.83	102139
1956	42.68	67.60	63.68	49.48	51.83	69.81	171.83	1042.77	994.63	55.16	25.84	25.47	160901
1957	40.13	65.97	54.81	51.97	62.79	57.94	82.93	509.94	1942.67	871.29	80.45	52.10	233514
1958	62.61	72.43	75.61	66.32	66.18	55.61	96.37	990.42	854.73	48.90	22.26	29.60	147612
1959	48.61	57.90	53.52	50.90	54.96	52.42	85.10	434.35	831.90	109.16	26.26	38.77	111037
1960	112.10	83.50	61.29	50.68	47.10	64.06	227.73	645.00	919.80	98.94	27.94	29.20	142875
1961	41.65	61.30	59.84	55.16	51.00	54.65	81.40	519.84	649.50	61.26	33.10	110.50	107304
1962	136.19	107.77	85.03	73.23	114.86	89.48	352.30	1096.39	969.33	249.10	37.00	36.63	202227
1963	69.23	62.73	50.97	34.23	45.07	50.03	91.70	749.90	599.30	59.42	56.74	51.43	116237
1964	37.55	64.57	49.23	37.42	36.10	44.48	72.00	660.48	1111.40	225.48	41.52	43.40	146319
1965	51.00	58.57	60.06	56.42	55.14	55.68	102.67	644.71	1934.67	618.35	119.03	140.93	234867
1966	165.35	146.90	90.03	63.16	56.93	83.45	175.80	719.32	481.07	85.03	48.13	45.70	130844
1967	56.90	60.30	56.45	59.35	87.54	70.94	93.20	527.42	1346.67	419.10	82.74	93.00	177929
1968	82.84	64.37	58.00	54.19	60.97	77.06	82.37	410.55	1566.50	242.61	94.97	66.60	172145
1969	86.06	72.30	61.48	53.94	56.71	60.87	173.27	960.26	794.13	202.32	54.00	49.07	158872
1970	78.35	75.57	67.06	57.55	65.86	65.81	76.77	829.00	1738.67	483.23	70.61	78.83	222424
1971	98.61	90.27	88.87	75.23	68.07	73.23	177.07	751.81	2029.00	576.10	80.35	61.50	251328
1972	91.55	83.83	74.29	75.32	73.93	74.16	123.37	647.03	1210.80	110.77	38.10	45.83	159683
1973	77.94	92.00	74.52	63.71	48.93	56.45	111.03	768.68	1325.33	306.74	96.29	56.30	185819
1974	60.71	91.23	71.87	57.87	61.89	70.71	123.80	1174.61	1703.50	270.19	58.87	49.03	229031
1975	62.81	64.30	61.74	55.65	61.04	61.94	89.17	517.87	1536.30	871.68	101.84	50.03	213505
1976	56.26	73.50	75.32	63.26	54.17	56.42	109.40	748.97	1048.53	312.81	84.58	54.67	165580
1977	47.45	42.60	61.94	59.16	60.36	45.90	127.27	340.00	319.53	55.29	38.61	28.83	74055
1978	49.06	52.07	52.42	60.10	41.00	59.45	122.10	618.00	1935.33	575.58	84.68	51.60	223059
1979	65.45	75.67	70.48	40.23	46.29	71.61	141.70	847.16	1738.67	555.03	91.39	41.30	228492

TABLE 7 (continued)

ENCAMPMENT RIVER AT MOUTH
Station No.066250.00
Average monthly Flow (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1980	29.39	60.07	69.35	67.32	40.28	50.97	156.73	935.48	1535.90	335.06	48.16	43.00	203597
1981	40.65	67.40	75.77	74.26	66.11	57.00	117.50	383.65	547.03	90.06	47.45	33.70	96504
1982	93.71	81.00	73.13	47.61	53.71	70.65	116.10	796.97	1835.67	901.77	177.81	90.20	262223
1983	142.10	111.97	90.45	78.48	65.86	77.87	100.40	506.52	1977.67	805.23	145.90	62.23	251216
1984	115.06	105.57	85.10	75.65	66.83	67.03	120.93	1200.32	1771.33	582.77	130.58	117.60	268469
1985	116.10	99.40	92.84	83.42	78.21	79.29	199.23	1053.97	958.37	167.16	73.26	59.00	185092
1986	110.00	97.80	72.39	68.35	76.68	100.13	271.00	982.42	1871.57	385.71	56.58	72.47	251058
1987	138.77	114.90	85.26	72.13	72.79	72.10	206.70	597.23	192.70	62.00	47.29	40.00	103111
1988	51.00	73.30	74.50	67.80	66.20	75.60	161.00	763.00	1157.00	115.00	38.30	44.60	162100
1989	51.60	78.40	70.30	57.70	57.10	117.00	229.00	477.00	446.00	80.70	61.20	44.30	106900
# RECORD	49	49	49	49	49	49	49	50	50	50	50	50	49
AVERAGE	74.69	74.56	66.03	58.24	58.51	65.23	147.14	771.83	1199.22	283.82	62.22	52.05	176943
STD DEV	31.76	19.49	12.04	11.31	13.58	13.76	69.85	236.74	514.83	240.41	37.14	24.76	50834
MIN	29.39	42.60	49.23	34.23	35.75	44.48	71.27	340.00	192.70	38.39	10.52	14.20	74055
MAX	165.35	146.90	92.84	83.42	114.86	117.00	352.30	1257.58	2029.00	901.77	177.81	140.93	268469

4. Station 066245.00 at Encampment has about 20 years of records all before 1932. These records do not overlap with any other records so there is no way of correlating them to other station records.

5. Station 066250.00 at mouth has the longest period of record (1940-current) of any station. The records would have to be adjusted to the instream flow segment because between the station and the instream flow segment there are numerous diversions and a major tributary, North Fork Grand Encampment River. There are few records for the North Fork Grand Encampment River and diversion records are incomplete making it impractical to adjust the flow at the mouth to the instream flow segment.

From this analysis it was concluded that the best method to generate flows for the instream flow segment was to base the flows upon the gaging station above Hog Park Creek, No. 066238.00. To build streamflow records for the downstream end of the instream flow segment, the drainage basin above that point was broken into three portions: drainage basin above the gaging station above Hog Park Creek, Hog Park Creek drainage basin above and including Hog Park Reservoir, and the remaining portion of the drainage basin. Streamflow was developed for all three drainage areas for the period 1965-1989 and the flows were added together to determine the flow at the downstream end of the instream flow segment. Water rights are taken into consideration for each segment where appropriate. The procedure used for each sub-basin is described below.

Streamflow from the drainage area above the gaging station on the Encampment River above Hog Park Creek is essentially natural. The only water rights which might reduce the flow in the Encampment River are those on the tributaries to Coon Creek (Permit Nos. 17165 and 19166). These rights permit a diversion out of the basin, however, the diversion point is very high in the drainage and water supply is limited. The amount of the diversion is a small portion of the total basin flow reflected in the measurements taken

at the gaging station, therefore no adjustment is necessary. In Colorado all of the water rights are for minimum stream flow and minimum lake levels so there is no impact. There is a minimum flow right on the South Fork Grand Encampment River in Colorado of 45 cfs.

Flows from the Hog Park Reservoir drainage basin are controlled by Hog Park Reservoir and administratively regulated. The reservoir is operated by the City of Cheyenne and by agreement with the U.S. Forest Service, the City is required to release a minimum of 15 cfs or the natural flow from the Hog Park drainage, whichever is more. There is also a maximum release level of 200 cfs unless the natural flow is higher. According to the City of Cheyenne, the flows for the late spring and early summer are very near the 200 cfs limit. For this analysis it is assumed that the flow in May and June is 200 cfs. Any natural flows higher than 200 cfs would be of very short duration and should not significantly affect the monthly average. For the remainder of the year the 15 cfs minimum flow rate was used in order to be conservative. To determine if this assumption is reasonable, the natural flows in the basin were estimated using the yield per square mile above the Encampment River gaging station drainage area. With this, the Hog Park Reservoir drainage basin area would yield less than 15 cfs for all months except May through July. Therefore, the administrative release of 15 cfs would be in effect. The water production is most likely less per square mile in the Hog Park Reservoir due to it's lower mean basin elevation, so this method may over-predict natural flows. Therefore utilizing a flow rate of 200 cfs for May and June and 15 cfs for all other months is conservative but reasonable.

Flows for the balance of the drainage area above the downstream end of the instream flow segment (excluding the Encampment River above Hog Park Creek gaging station and

Hog Park Reservoir drainage basins) were estimated as follows: The portion of the remaining drainage which has a mean basin elevation equal to that of the basin above gaging station 066238 (9,540 feet) was assumed to yield the same amount per square mile as for the gage. That portion of the basin at lower elevations is conservatively assumed to yield no water. Basin areas and elevations are presented in Table 8.

Table 8
Drainage Basin Areas and Elevations
Grand Encampment River Basin

Drainage Basin	Drainage Area (Square Miles)	Mean Basin Elevation (Feet MSL)	Area With Mean Elevation 9540 Ft. MSL (Square Miles)
Gaging Station No. 066238.00	72.7	9,540	72.7
Hog Park Reservoir	12.1	9,040	4.0
Balance of Basin Above Downstream End of Instream Flow Segment	85.2	8,780	22.9

This assumption results in the balance of the drainage basin above the downstream end of the instream flow segment producing 31.5% (22.9/72.7) of the flow at the gaging station number 066238. This flow has to be adjusted for existing water rights. All of the adjudicated reservoirs, except for Hog Park are small. It is assumed that these will be filled during the spring and have no impact on low flows. The adjudicated diversion rights are divided into two groups, those utilized in basin and those utilized for out of basin diversions. The adjudicated diversions utilized in the basin total 12.74 cfs excluding supplemental supplies. These diversions are only from tributaries to the South Fork Grand Encampment River and irrigate lands along those tributaries. It is assumed that return flow is high and most of it is returned to the streams very quickly therefore no adjustment is made.

The out-of-basin diversions include those on Billy Creek and its tributaries and Coon Creek. As discussed previously the Coon Creek diversions are above the gaging station so their influence is accounted for in the gaging station records. The Billy Creek diversions total 7.75 cfs plus 23.86 cfs for supplemental supplies. This is much more water than is available at the point of diversion since the diversion is very high in the drainage. To account for these diversions, the drainage area above the diversion (2.5 square miles) is assumed to be completely diverted so that the contributing area to the downstream end of the instream flow segment is reduced from 22.9 square miles to 20.4 square miles for the assumed irrigation months of April through September. Thus the 20.4 square miles would produce 28.1% (20.4/72.7) of the flow at gaging station number 066238.

From this, the following equations were developed to generate flows at the downstream end of the instream flow segment:

Y	=	Flow at Downstream end of instream flow segment in CFS
X	=	Flow at Gaging Station Number 066238

October-March	$Y = X + 0.315 X + 15$
April	$Y = X + 0.281 X + 15$
May-June	$Y = X + 0.281 X + 200$
July-September	$Y = X + 0.281 X + 15$

These equations were used to generate the flows at the downstream end of the instream flow segment which are presented in Table 9 for 1965 to 1989. Note that the constant added to the computed flow is the mandatory release from Hog Park Reservoir. Thus, when comparing the flow computed by these equations to the recorded flow at gaging station number 066240, the releases from the reservoir add to the natural flows.

TABLE 9

SOUTH FORK GRAND ENCAMPMENT RIVER
INSTREAM FLOW SEGMENT NO. 1
Generated Flows at Downstream End
Average Monthly Flows (cfs)

YEAR	OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	TOTAL(AF)
1965	41.76	44.42	44.06	42.31	48.72	42.75	52.41	432.69	1116.34	408.31	106.78	90.84	149085
1966	94.62	61.12	52.41	50.08	41.77	43.00	80.37	624.92	559.62	93.97	50.25	39.30	108436
1967	42.79	35.82	35.11	32.73	34.25	34.97	41.86	449.96	939.69	335.95	81.48	66.28	128672
1968	48.73	39.46	35.36	33.49	31.77	33.20	41.81	374.79	1105.88	254.79	90.91	58.13	129438
1969	57.88	41.92	30.33	29.29	29.16	29.29	79.27	711.53	742.59	203.23	64.34	48.65	125144
1970	54.24	48.31	47.02	43.89	44.40	47.70	48.86	563.10	1143.93	397.35	81.04	71.91	156495
1971	66.59	55.67	54.83	52.96	51.96	47.24	77.51	539.43	1322.32	484.42	96.20	69.70	176141
1972	58.78	48.93	43.85	39.91	37.99	46.52	65.22	530.33	835.16	126.95	54.58	51.34	117049
1973	54.03	51.25	43.97	39.39	37.92	42.69	41.99	470.29	938.84	260.50	83.56	54.84	127930
1974	45.84	41.04	35.32	33.07	35.38	38.50	56.67	798.97	1206.06	197.07	61.08	47.19	156745
1975	50.33	47.65	41.38	37.99	36.61	35.32	39.76	382.31	1062.24	618.11	96.78	54.62	151305
1976	53.90	50.51	47.74	42.83	39.04	38.04	53.14	554.22	880.63	260.79	78.22	51.55	129950
1977	48.85	35.82	40.96	36.59	31.20	30.65	66.53	393.67	493.44	75.87	47.27	39.43	80966
1978	43.85	35.47	43.80	38.16	40.41	41.98	69.87	515.00	1371.09	469.42	82.44	53.08	169175
1979	42.48	38.84	41.13	39.35	37.21	36.76	54.62	585.50	1348.80	442.98	84.51	47.32	168962
1980	44.78	49.98	44.35	43.34	42.71	41.05	58.59	595.91	1257.30	270.79	64.83	49.16	154521
1981	47.19	45.64	42.06	38.04	37.63	37.28	91.39	430.34	573.37	97.69	49.55	45.62	92710
1982	63.87	47.91	48.12	42.69	35.62	34.48	61.59	564.88	1293.55	624.09	105.34	67.10	180676
1983	73.45	60.41	49.87	48.94	45.39	44.86	46.00	373.06	1316.87	595.16	111.45	62.53	170672
1984	74.04	61.03	57.21	44.65	41.93	42.48	46.42	657.77	1221.38	451.49	105.54	96.22	175250
1985	80.24	65.93	49.15	43.34	41.72	41.89	93.53	743.31	942.43	192.89	70.04	56.80	146334
1986	65.39	53.27	50.04	47.49	48.68	55.13	103.43	674.96	1311.78	308.72	82.39	70.47	173238
1987	75.03	56.95	52.92	45.00	40.92	41.68	98.56	581.33	432.25	79.55	50.70	38.79	96506
1988	39.99	41.96	37.62	39.33	36.43	36.70	70.21	557.40	978.85	132.47	58.94	53.30	125605
1989	41.56	38.41	38.93	37.22	37.22	40.77	226.72	544.59	567.65	103.00	52.92	43.69	107040
#RECORDS	25	25	25	25	25	25	25	25	25	25	25	25	25
AVERAGE	56.41	47.91	44.30	40.88	39.44	40.20	70.65	546.01	998.48	299.42	76.45	57.11	139922
STD DEV	14.10	8.60	6.60	5.59	5.46	5.69	36.80	113.75	290.84	171.87	19.90	14.35	28347
MIN	39.99	35.47	30.33	29.29	29.16	29.29	39.76	373.06	432.25	75.87	47.27	38.79	80966
MAX	94.62	65.93	57.21	52.96	51.96	55.13	226.72	798.97	1371.09	624.09	111.45	96.22	180676
REQUEST	54	54	54	54	54	54	54	54	54	54	54	54	

V. MEAN MONTHLY FLOW ANALYSIS

The mean monthly flows generated for the downstream end of the instream flow segment are presented in Table 9. Included with the 25-year means are the standard deviation, minimum and maximum flows, and the flows requested by WGFD. Figure 2 graphically compares the mean monthly flows to the requested flows.

As can be seen, the requested flow is available in the average year during the months of April through October. The requested flow is not available during the winter months of November through March.

VI. DRY YEAR FLOW ANALYSIS

The ranking, in ascending order, of the generated flows for the proposed instream flow segment are presented in Table 10. The table shows the flows in acre-feet ranked by yearly flow and ranked by flow during each instream flow period. The ability of South Fork Grand Encampment River to meet the requested instream flows was evaluated for dry years using two methods. First, the requested flows are compared to those available in the driest year on record determined by total annual flow. Second, the requested flows are compared to the flow during the average of the lowest three years by instream flow period. This second procedure was utilized because the lowest flow period does not necessarily correspond to the lowest year by total annual flow. The average of the lowest three years gives a better indication of general low flow conditions.

FIGURE 2:S. FORK GRAND ENCAMPMENT

AVERAGE MONTHLY AND REQUESTED FLOWS

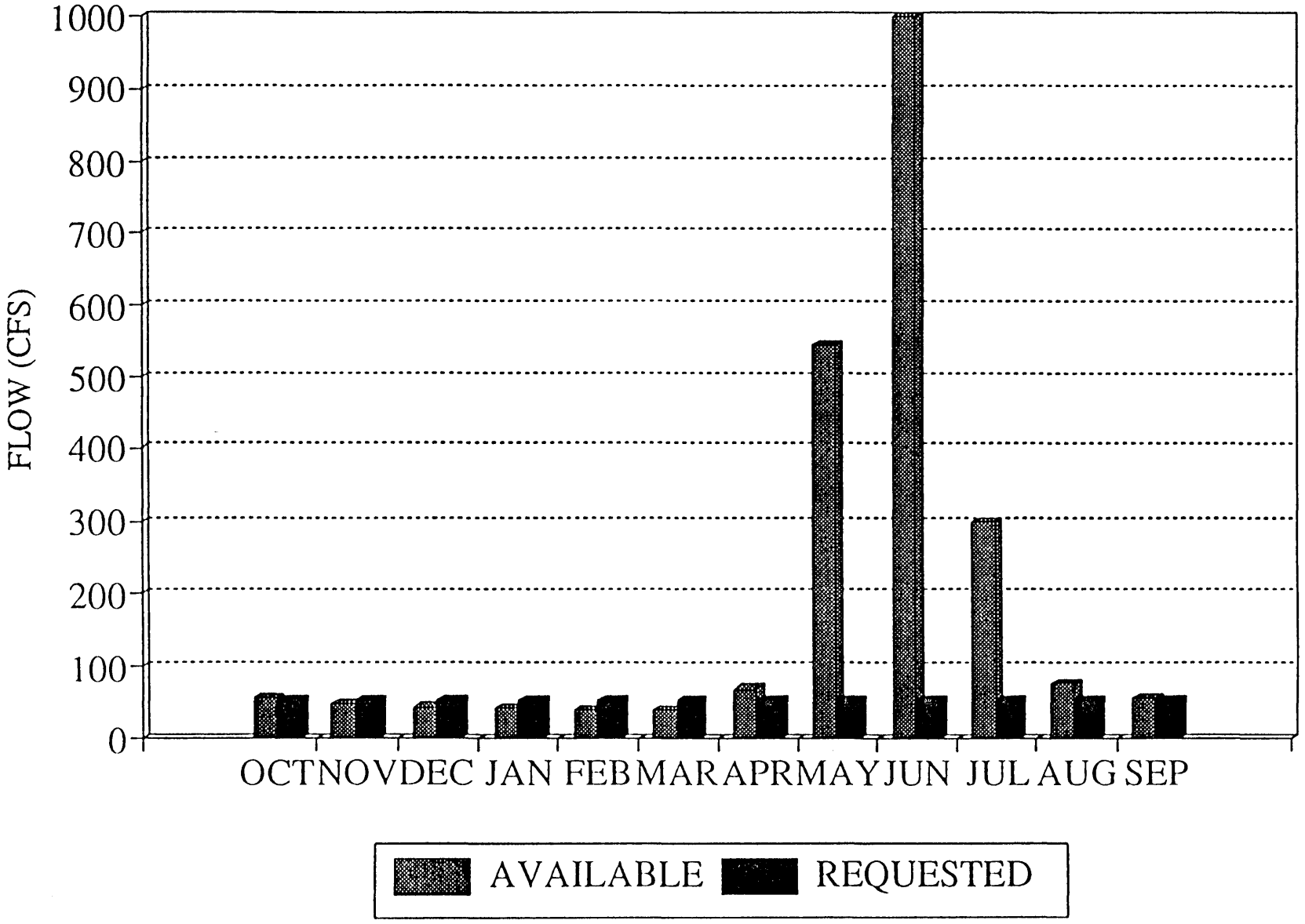


TABLE 10

RANKING OF FLOWS IN ASCENDING ORDER
South Fork Grand Encampment River
Downstream End of Instream Flow Segment
Total Flow (Acre-Feet)

OCTOBER-MARCH		APRIL-JUNE		JULY-SEPTEMBER		TOTAL YEAR	
Year	AF	Year	AF	Year	AF	Year	AF
1967	12986	1977	57288	1977	10109	1977	80917
1969	13141	1981	65740	1987	10518	1981	92673
1968	13383	1987	67055	1966	11432	1987	96432
1977	13521	1989	73672	1981	12007	1989	100208
1974	13798	1966	76092	1989	12438	1966	108244
1988	13967	1967	85468	1972	14522	1972	116798
1989	14098	1972	85630	1988	15265	1969	124990
1979	14199	1973	86662	1974	19104	1988	125270
1978	14672	1975	88438	1969	19789	1973	127886
1981	14925	1976	89022	1985	19994	1967	128779
1975	15015	1968	90675	1980	24115	1968	129357
1965	15856	1969	92061	1976	24474	1976	129891
1980	16016	1965	95459	1973	24995	1985	146056
1973	16229	1988	96038	1968	25299	1965	149303
1976	16395	1983	103243	1986	28919	1975	151841
1982	16460	1970	104797	1967	30325	1980	154189
1972	16646	1985	106626	1970	34516	1974	156177
1970	17199	1980	114059	1979	36113	1970	156512
1987	18859	1982	114489	1965	37989	1979	168881
1986	19281	1984	114963	1978	38004	1978	169200
1984	19389	1971	115606	1971	40834	1983	171057
1985	19437	1978	116524	1984	40965	1986	173012
1983	19466	1979	118569	1983	48348	1984	175317
1971	19826	1974	123275	1975	48388	1971	176267
1966	20721	1986	124811	1982	50068	1982	181017

Using annual total flows, the driest year on record for the generated flows is 1977. A summary of data for that year is presented in Table 11:

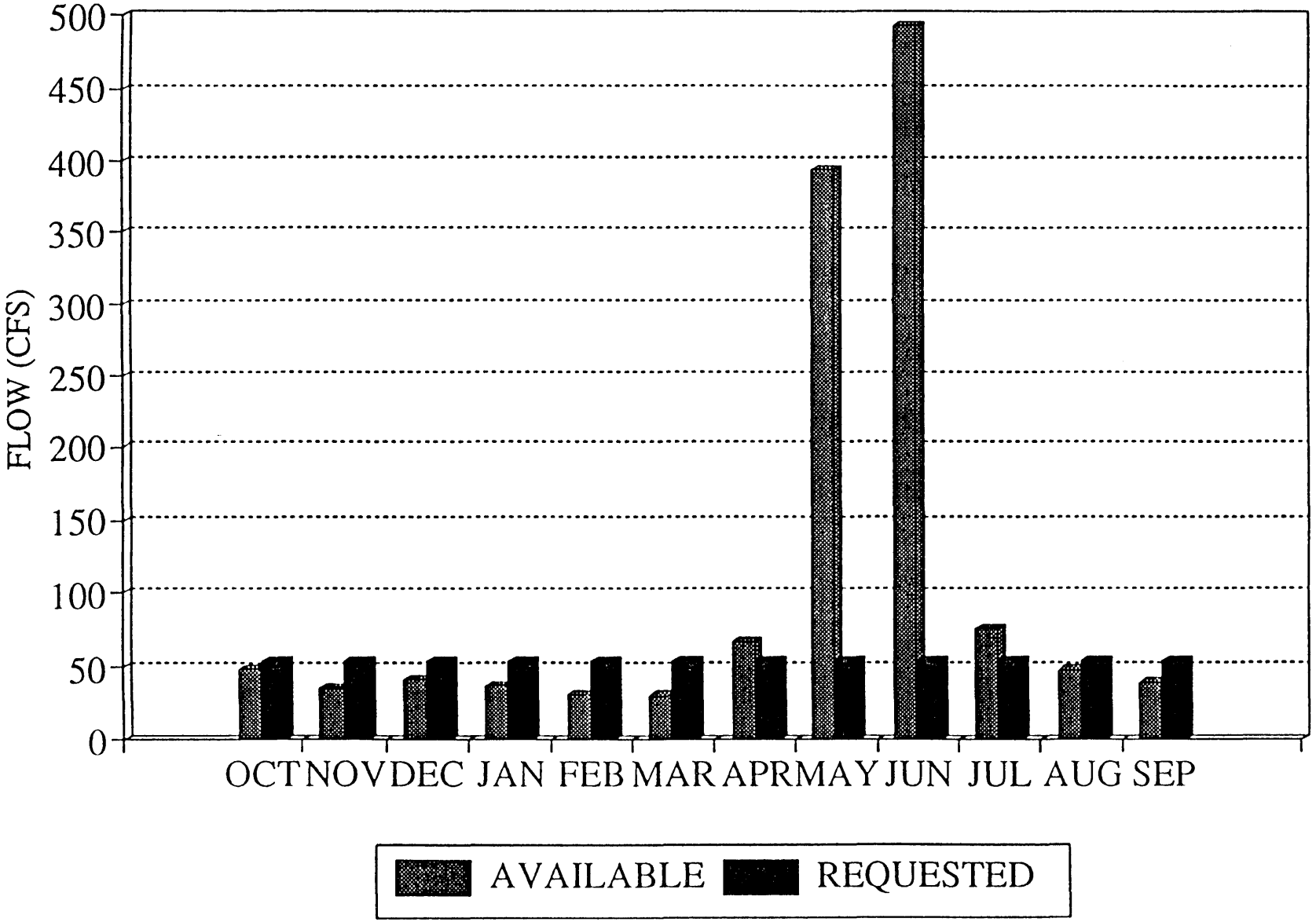
Table 11
Monthly Flow During Driest Year on Record (1977) and Requested Flow
South Fork Grand Encampment River at Downstream End
of Instream Flow Segment No. 1

Month	Monthly Flow (cfs)	Requested Flow (cfs)	Shortfall (cfs)	Volume of Shortfall (AF)
October	48.9	54	5.1	314
November	35.8	54	18.2	1,083
December	41.0	54	13.0	799
January	36.6	54	17.4	1,070
February	31.2	54	22.8	1,266
March	30.7	54	23.3	1,433
April	67.9	54	----	
May	391.6	54	----	
June	490.2	54	----	
July	77.5	54	----	
August	48.1	54	5.9	363
September	40.1	54	13.9	827
			TOTAL	7,155

Shortages occur during the winter months of November through March as they do in an average year. Additionally the late summer and fall months of August through October experienced shortages. A bar graph comparing the 1977 monthly flows to the requested flow is presented on Figure 3.

FIGURE 3: S. FORK GRAND ENCAMPMENT

DRIEST YEAR (1971) AND REQUESTED FLOWS



Using the three lowest flow years by instream flow period results in different years being utilized. By period, the three driest years are:

October - March	1967, 1969, 1968
April - June	1977, 1981, 1987
July - September	1977, 1987, 1966

Averages of the monthly flows for the three driest years by period are presented in Table 12.

Table 12
Monthly Flows During the Average of 3-Driest Years by Period and Requested Flows
South Fork Grand Encampment River at Downstream End of Instream Flow Segment

Month	3-Year Mean Monthly Flow (cfs)	Requested Flow (cfs)	Average Shortfall (cfs)	Volume of Shortfall (AF)
October	49.8	54	4.2	258
November	39.1	54	14.9	887
December	33.6	54	20.4	1,254
January	31.8	54	22.2	1,365
February	31.7	54	22.3	1,238
March	32.5	54	21.5	1,322
April	87.4	54	----	
May	465.5	54	----	
June	496.4	54	----	
July	84.9	54	----	
August	50.3	54	3.7	288
September	39.8	54	14.2	845
			TOTAL	7,397

This analysis is very similar to that for the driest year. The volume of shortfall is very close 7,155 AF versus 7,397 AF with the same months, August through March, falling below the requested flow of 54 cfs. Figure 4 is a bar chart relating the average of the three lowest years by period to the requested flow.

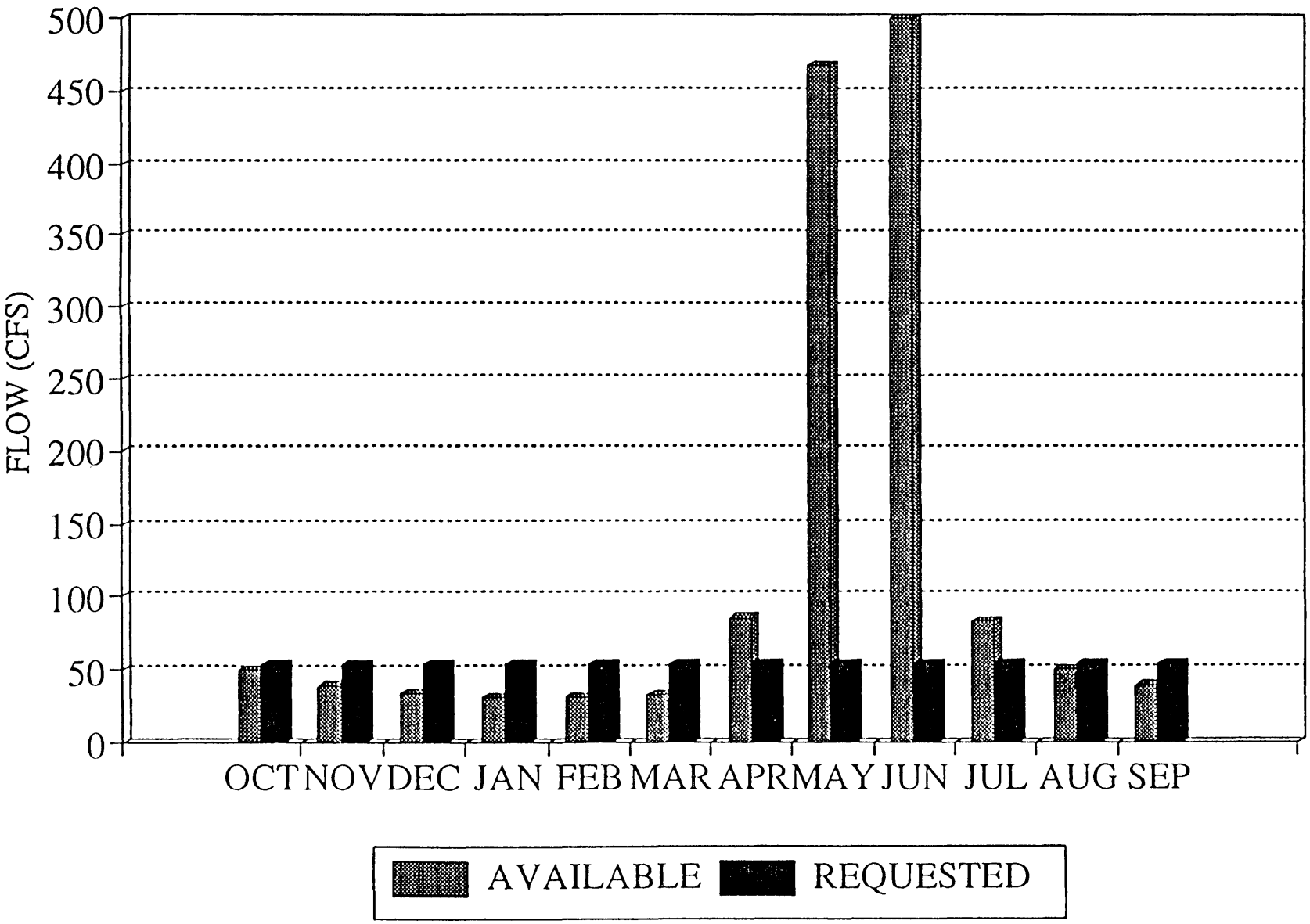
VII. RESERVOIR OPERATION STUDY

Since the estimated historic flows of the South Fork of the Grand Encampment River at the downstream end of the proposed Instream Flow Segment No. 1 are not always sufficient to fulfill the requested flows, a cursory study was conducted to estimate whether storage could provide water to satisfy the entire request and/or the request for the critical period of July through September. The WGFD does not consider that storage is necessary to supplement natural winter flows.

For informational purposes a simple water balance was completed to determine the feasibility of utilizing storage to supplement flows during dry years and to supplement winter flows. Storage of water in the North Platte River is a complex issue beyond the scope of this report. The North Platte system is over appropriated and any construction of storage facilities or alteration in the operation of existing facilities would require careful analysis to determine impacts to downstream users and existing agreements. Therefore this analysis only considers quantities of water, not regulatory or political feasibility.

FIGURE 4: S. FORK GRAND ENCAMPMENT

3-DRIEST YEAR AVG. AND REQUESTED FLOWS



For this analysis the average year, driest year and the average of the three driest years are considered and presented in Table 13. The excess water was calculated by subtracting the requested instream flow from the predicted streamflow.

Table 13
Annual Flow Shortages and Excesses (Acre-Feet)

	Average Year	Driest Year	Driest 3-Year By Period
Shortfall for Entire Year	3,422	7,155	7,397
Shortfall for July-September	-0-	1,190	1,133
Excess Flow	104,000	49,000	55,500

From this analysis it is shown that from a water balance point of view, storage could easily be used to supplement flows even in the driest years. Again, this does not consider the constraints of existing agreements or water rights.

VIII. DAILY FLOW EXCEEDENCE ANALYSIS

The WGFD considers that an instream flow request is "feasible" if, during the late summer period (July 1 - September 30) the requested is available 50% of the time. The WGFD has not developed exceedence criteria for other times of the year. Therefore a daily flow duration analysis was conducted. For completeness the analysis includes all three instream flow periods. Daily flow-duration data were obtained by periods from the Wyoming Water Research Center WRD System for Station No. 066238.00 above Hog Park Creek. These data were adjusted by adding the predicted flows from Hog Park Reservoir

and the balance of the drainage area above the downstream end of the instream flow segment to the data for the gaging station. To be conservative for the entire April to June period, the flow from Hog Park Reservoir was limited to the minimum of 15 cfs when actually it is usually much nearer 200 cfs for May and June.

The daily duration curves for the gaging station Encampment River above Hog Park Creek and as adjusted for the downstream end of the instream flow segment are presented in Figures 5 through 7. A summary of the WGFD exceedence criteria and the actual exceedence values are presented in Table 14. While the WGFD has no exceedence criteria for times of year other than July through September, they have stated that instream flows at the other times should equal natural flows up to the recommended amounts.

Table 14
Daily Flow Exceedence Summary

Period	Requested Instream Flow (cfs)	WGFD Exceedence Criteria % of Time	Exceedence Calculated for Period of Record % of Time
October - March	54	N/A	18
April - June	54	N/A	80
July - September	54	50	76

This indicates that the flow of 54 cfs during the July - September period is available 76% of the time which exceeds the WGFD exceedence criterion of 50%. The two other periods do not have exceedence criteria. It can be seen that for the April - June period the exceedence is at least 80% using the conservative assumption of 15 cfs from Hog Park

FIGURE 5: S. FORK GRAND ENCAMPMENT

DAILY DURATION CURVES OCT-MAR

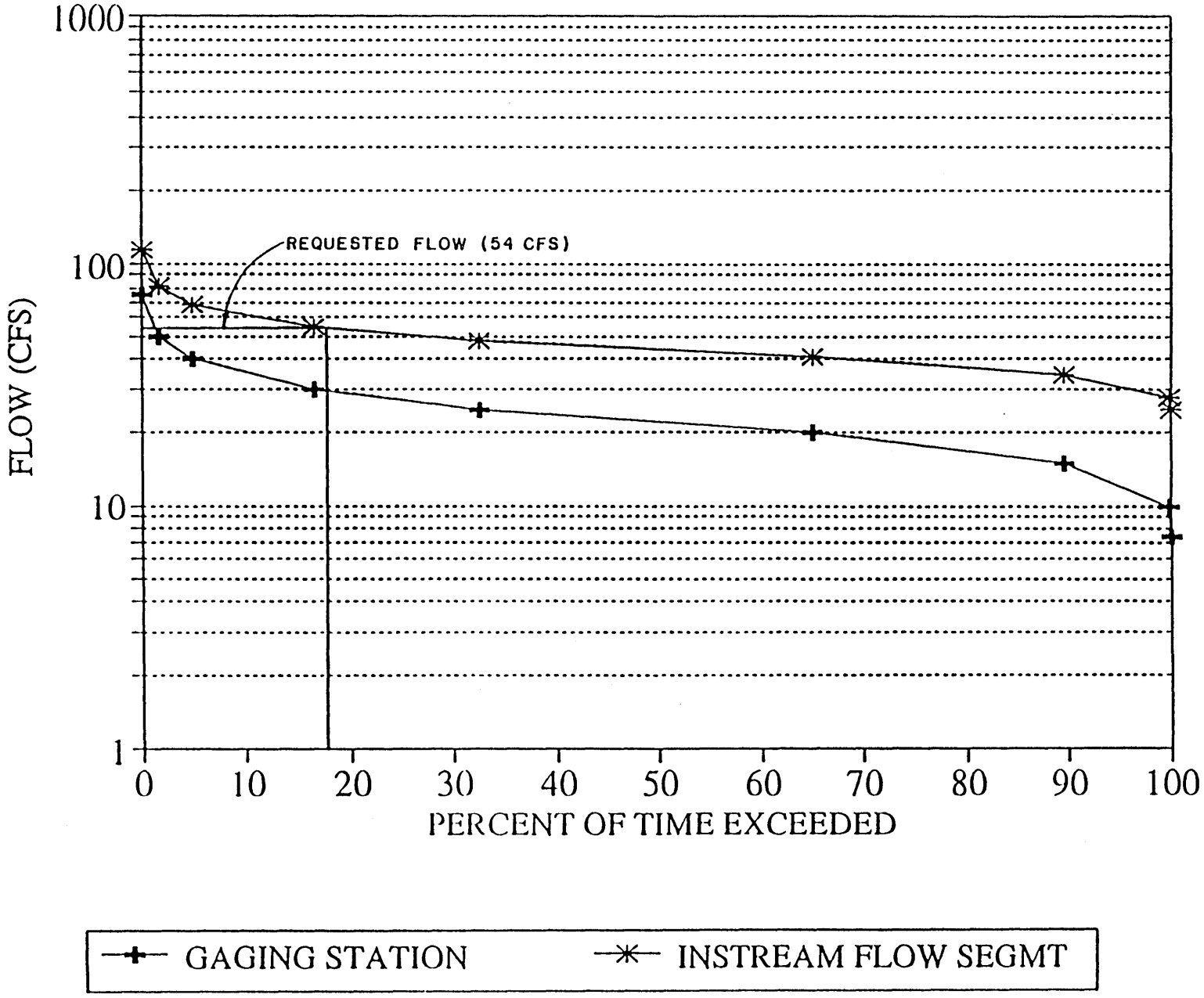


FIGURE 6: S. FORK GRAND ENCAMPMENT

DAILY DURATION CURVES APR-JUN

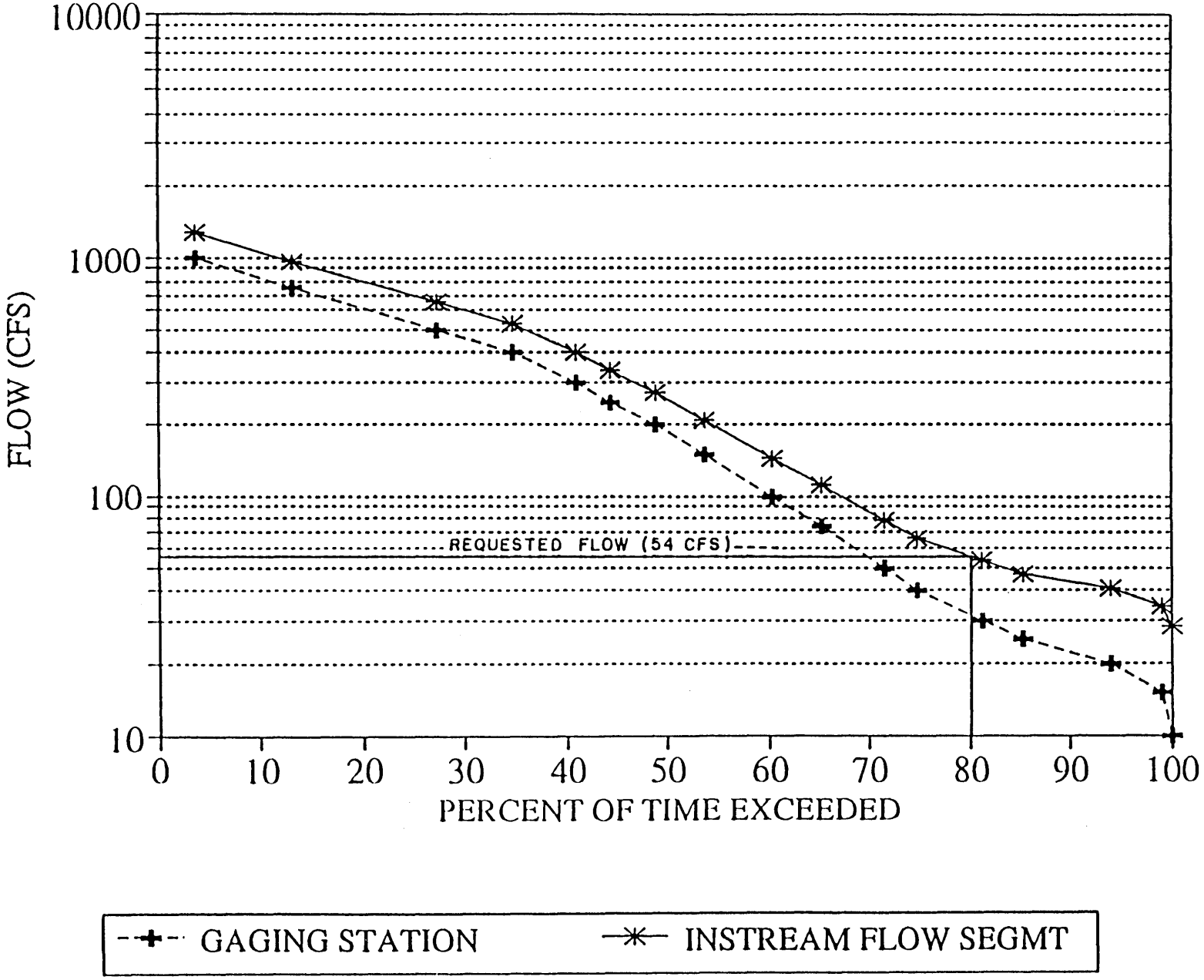
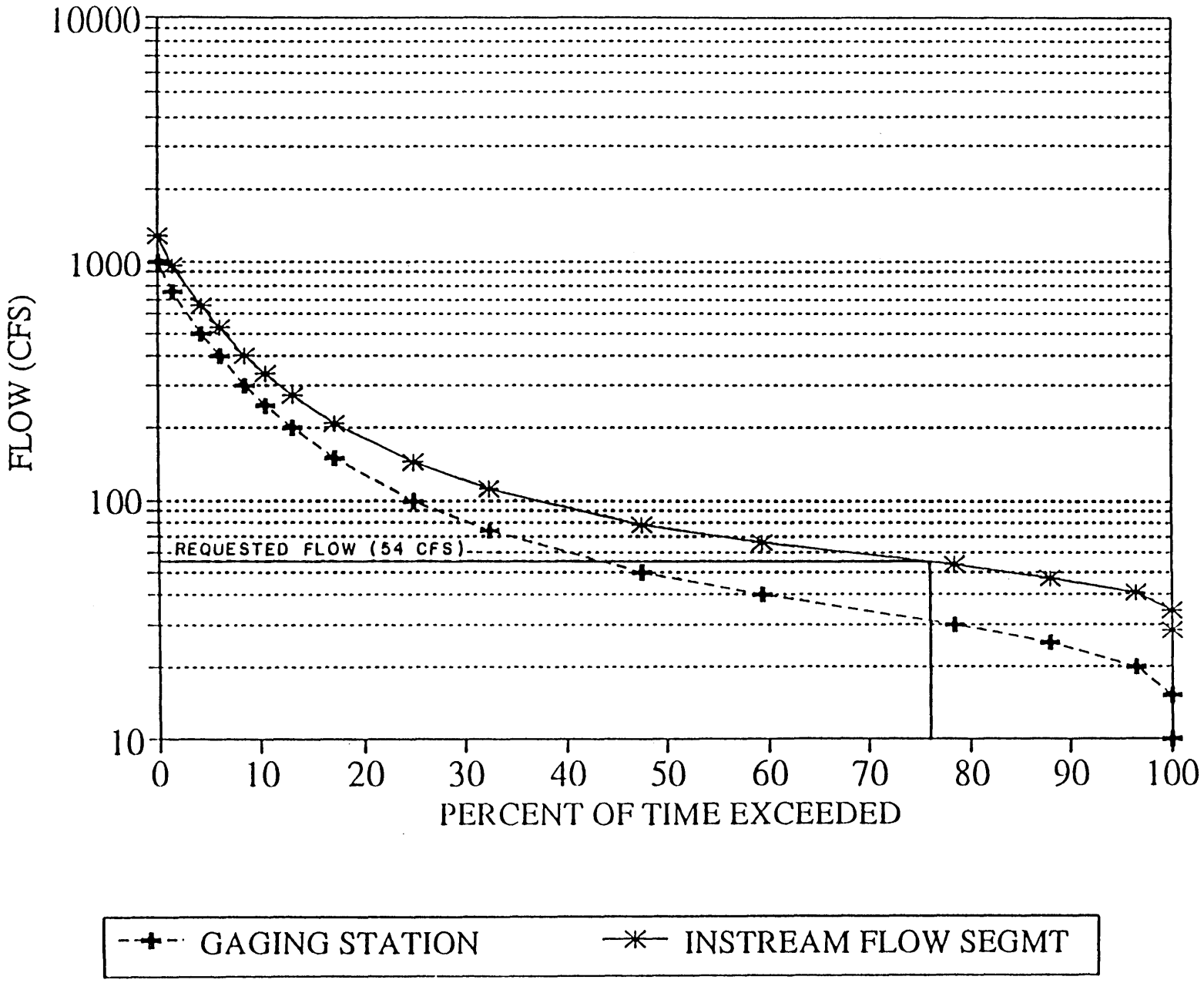


FIGURE 7: S. FORK GRAND ENCAMPMENT

DAILY DURATION CURVES JUL-SEP



Reservoir. Actually the exceedence is near 100% for the months of May and June since the discharge is usually near 200 cfs. This would make the exceedence for the period well over 90%. Flows during the October - March period show 18% exceedence. Much of the exceedence occurs in October and early November before the stream reaches it's lowest baseflow which is less than 54 cfs.

IX. CONCLUSIONS

The mean monthly flow analysis indicates that on average for the South Fork Grand Encampment River Instream Flow Segment No. 1, the WGFD instream flow request of 54 cfs can be met except for some shortfall the late fall and winter period from November through March. During extremely dry years this period is extended to include the late summer and early fall months from August through October. Shortages could easily be met with storage but there are many regulatory and legal constraints to such an option and the WGFD does not consider storage is necessary if the July through September flow request is met at least 50% of the time. The daily exceedence criterion of 50% during the late summer period is easily met, the actual exceedence is 76%.

APPENDIX I

WYOMING GAME AND FISH DEPARTMENT REPORT

AND

APPLICATION TO WYOMING STATE ENGINEER

TEMPORARY FILING NO. 26 5/399

WYOMING GAME AND FISH DEPARTMENT

FISH DIVISION

ADMINISTRATIVE REPORT

TITLE: Encampment River Instream Flow Report

PROJECT: IF-5088-07-8801

AUTHOR: Gerald F. Vogt, Jr. and Thomas C. Annear

DATE: February 1989

INTRODUCTION

Data were collected during the 1981 field season to conduct instream flow analyses for a segment of the Encampment River located approximately 2 miles upstream from the Town of Encampment, Wyoming. The study was designed to provide results which could be used to determine instream flow needs for trout as well as to evaluate potential flow related impacts of stream flow modifications to the stream fishery.

METHODS

Study Area

The Encampment River is considered a Class 2 stream by the Wyoming Game and Fish Department (WGFD). Stream classifications throughout Wyoming range from Class 1 (highest rating) to Class 5 (lowest rating). Class 2 streams are generally considered important trout fisheries on a statewide basis. Less than 6% of all streams in the state are Class 2 or better streams.

The Encampment River contains naturally reproducing populations of rainbow, brown and brook trout. The stream is currently managed as a wild fishery for rainbow trout; therefore no fish are stocked here by the WGFD. The study segment of the Encampment River passes almost exclusively through public lands making it generally accessible to the public. Because this section of the Encampment River supports an important trout fishery and has public access, this segment was identified as a critical reach.

Data Collection

All of the field data used in this study were collected from a 339 foot long study site located on Bureau of Land Management property in the southwest quarter of S13, T14N, R84W. This site is located approximately 2 miles upstream from the town of Encampment (Figure 1). This site contained a combination of pool and riffle habitat for trout that was representative of trout habitat features found throughout

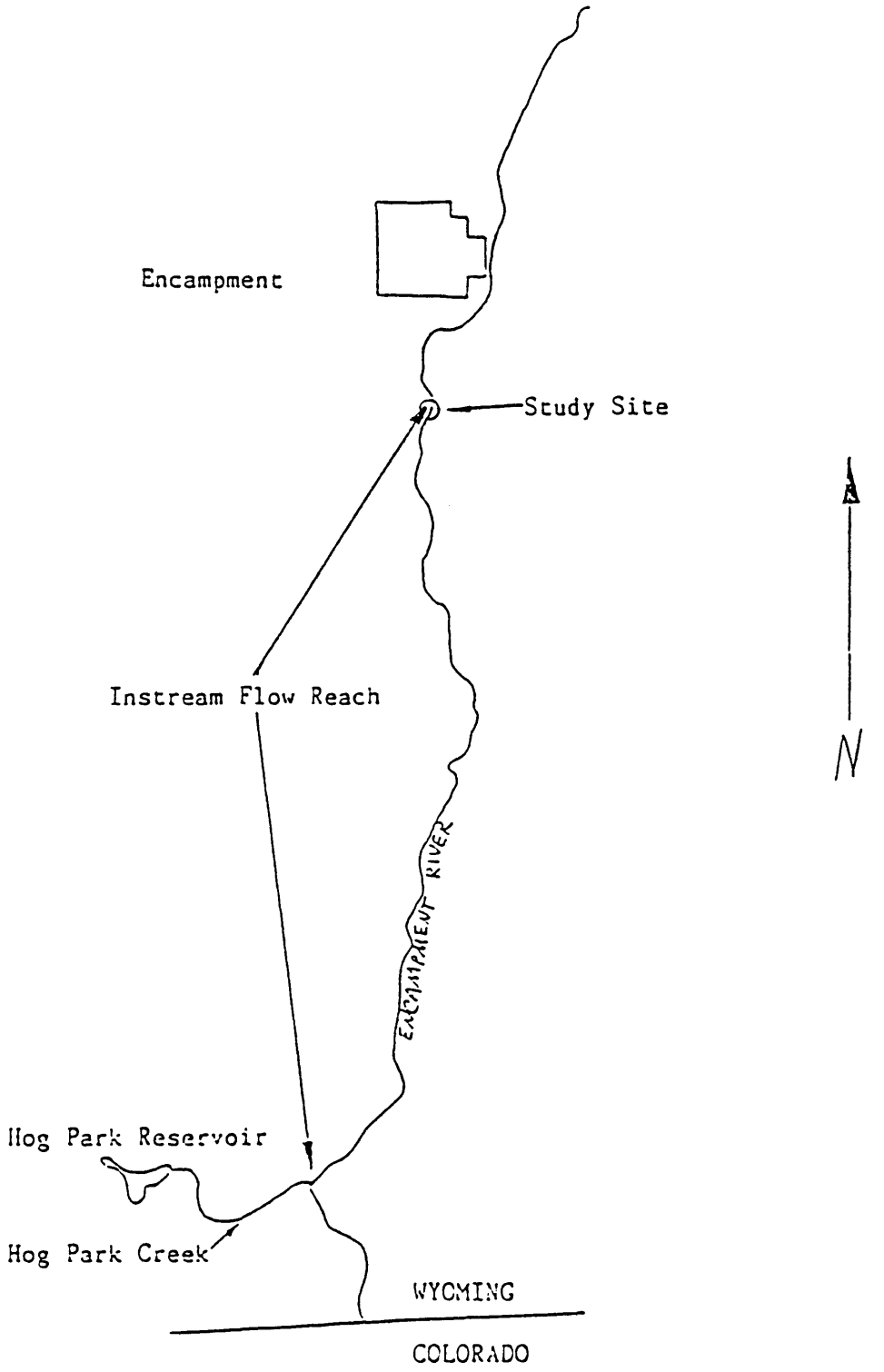


Figure 1. Map showing location of 1981 study site on the Encampment River near Encampment, WY.

this portion of the stream. Results and recommendations were applied to a portion of the stream extending from the north boundary of the NW 1/4, NW 1/4 of S13, T14N, R84W upstream to the mouth of Hog Park Creek in the NE 1/4, NW 1/4, S10, T12N, R84W.

In accordance with the 1986 Instream Flow legislation, the goal of this study was to determine instream flows necessary to maintain or improve the existing trout fishery in the above segment of Encampment River. The specific objectives of this study were to determine instream flows necessary to 1) maintain or improve physical habitat for rainbow trout spawning during the spring, 2) maintain or improve hydraulic characteristics in the winter that are important for survival of trout, fish passage and aquatic insect production, and 3) maintain or improve adult trout production during the late summer months. Three habitat models were used to make these determinations.

Models

A physical habitat simulation model (PHABSIM) developed by the Instream Flow Service Group of the U.S. Fish and Wildlife Service (Bovee and Milhous 1978) was used to quantify incremental changes in the amount of physical habitat available for rainbow trout spawning and incubation at various discharge rates. The amount of physical habitat available at a given discharge is expressed in terms of weighted usable area (WUA) and reflects the composite suitability of depth, velocity and substrate at a given flow. Depth, velocity and substrate data were collected at six transects as described in Bovee and Milhous (1978). Dates and discharge rates when data were collected are given in Table 1. The WUA for rainbow trout was simulated for flows ranging from 10 to 500 cubic feet per second (cfs) using calibration and modeling techniques outlined in Milhous et al. (1984)

Table 1. Dates and discharges when instream flow data were collected.

Date	Discharge (cfs)
04-15-81	115
05-14-81	210
08-26-81	44

A Habitat Retention method (Nehring 1979; Annear and Conder 1984) was used to identify a maintenance flow. A maintenance flow is defined as a continuous flow that is needed to maintain minimum hydraulic criteria at riffle areas in a stream segment. These criteria are important at all times of year to maintain passage between different habitat types for all life stages of trout. These criteria are also important for maintaining survival rates of fish and aquatic macroinvertebrates during the winter that approximate rates observed under natural stream flow conditions. Data from single transects placed across four riffles within the study area were analyzed with the IFG-1 computer program (Milhous 1978). Flow data were collected at three different flow levels (Table 1). The maintenance flow is identified as the discharge at which two of the three criteria in Table 2 are met for all riffles in the study area.

Table 2. Hydraulic criteria used to obtain an instream flow recommendation using the Habitat Retention method.

Category	Criteria
Average Depth (ft)	Top width[1] x 0.01
Average Velocity (ft per sec)	1.00
Wetted Perimeter (percent)[2]	60

1 - At average daily flow
2 - Compared to wetted perimeter at bank full conditions

The Habitat Quality Index (HQI) developed by the Wyoming Game and Fish Department (Binns and Eiserman 1979) was used to estimate potential changes in trout standing crops over a range of late summer flow conditions. This model incorporates seven attributes that address chemical, physical and biological components of trout habitat. Results are expressed in habitat units (HU). One HU is defined as the amount of habitat quality which will support 1 pound of trout. Analyses obtained from this method apply to the time of year that governs trout production. On the Encampment River this time period is between July 1 and September 30.

By measuring habitat attributes at various flow events as if associated habitat features were typical of late summer flow conditions, HU estimates can be made for a range of theoretical summer flows. Habitat attributes on the Encampment River were measured on the same dates and flow levels that data were collected for the PHABSIM and Habitat Retention models (Table 1). To better define the potential impact of other late summer flow levels on trout production, some attributes were derived mathematically or obtained from existing gage data. Gage data were obtained from a U.S. Geological Survey gage located on the Encampment River upstream from the mouth of Hog Park Creek for the period 1965 to 1986. A regression equation was developed to relate the discharges at the USGS gage with discharges measured at the study site. This equation was used to determine the annual stream flow variation and critical period stream flow, two variables of the HQI, at the study site.

Results from the PHABSIM analysis were used to identify the flows needed to maintain or improve physical habitat for the rainbow trout spawning and incubation period. This period extends from April 1 to June 30.

Results from the Habitat Retention model were used to identify a flow from October 1 to March 31 which would maintain trout survival and passage and aquatic insect survival.

Results from the HQI model were used to identify the flow needed to maintain existing levels of trout production between July 1 and September 30.

RESULTS

Results from the Habitat Retention model showed that the hydraulic criteria in Table 2 are met at flows of 54.1, 48.8, 22.6 and 25.0 cfs for riffles 1, 2, 3 and 4, respectively (Table 3). The maintenance flow derived from this method is defined as the flow at which two of the three hydraulic criteria are met for all riffles in the study site which in this case is 54.1 cfs. Maintenance of this flow at all times of

year except when higher flows are needed for other fishery purposes will maintain this stream fishery.

Table 3. Simulated hydraulic criteria for four riffles on the Encampment River. Average daily flow = 246 cfs. Bank full discharge = 1592 cfs.

Riffle 1

Average Depth (ft)	Average Velocity (ft/sec)	Wetted Perimeter (ft)	Discharge (cfs)
2.25	6.2	110.0	1591.6
1.28	2.5	92.6	246.0
1.20	2.3	91.8	198.8
1.00	2.1	91.2	162.5
0.85[1]	1.8	90.0	112.6
0.76[1]	1.7	87.1	93.1
0.71	1.6	89.1	82.9
0.64	1.5	78.1[1]	66.4[2]
0.63	1.4[1]	65.8[1]	54.1[2]
0.53	1.0[1]	41.8	22.1

Riffle 2

1.90	6.9	85.1	1591.6
1.40	4.4	68.7	401.6
1.10	3.5	66.0	246.0
1.00	3.3	64.9	204.4
0.70[1]	2.6	59.8	113.8
0.64[1]	2.4	58.0	91.7
0.60	2.2	56.7[1]	70.2[2]
0.46	2.0	51.1[1]	48.8[2]
0.30	1.7[1]	39.8	21.7
0.03	1.0[1]	0.0	0.0

Riffle 3

2.60	5.5	82.3	1591.6
1.90	2.6	73.7	363.9
1.70	2.1	71.1	246.0
1.60	1.9	69.9	200.2
1.30	1.3[1]	64.8	108.3
1.00	1.0[1]	62.2	66.1
0.90	0.8	60.7	43.5
0.80[1]	0.6	58.6	30.7[2]
0.71[1]	0.5	55.3[1]	22.6[2]
0.56	0.4	49.4[1]	11.0

Riffle 4

2.10	9.2	88.7	1591.6
1.30	4.0	72.1	375.0
1.10	3.1	69.4	246.0
1.00	2.4	67.8	157.1
0.90	2.1	67.3	124.5
0.70[1]	1.8	66.3	85.0
0.68[1]	1.7	66.1	74.4
0.60	1.4	64.4[1]	48.9[2]
0.45	0.9[1]	53.2[1]	25.0[2]
0.40	1.0[1]	58.6	23.4

1 - Minimum hydraulic criteria met
2 - Discharge at which 2 of 3 hydraulic criteria are met

Results of the PHABSIM analysis indicate that under existing flow conditions during the month of April (average daily flow of approximately 52 cfs), physical habitat for rainbow trout spawning is approximately 10% of the maximum amount available, which occurs at a discharge of 400 cfs (Figure 2). Further reductions in physical habitat for spawning occur at flows lower than 52 cfs. Flows greater than 100 cfs result in substantial increases in physical habitat for spawning.

Physical habitat for rainbow trout incubation is maximized at a discharge of 250 cfs. This analysis indicates that at flows between 30 and 200 cfs, physical habitat for incubation is only slightly reduced; however, at flows less than 30 cfs and greater than 300 cfs, physical habitat is greatly reduced. Since gage records indicate that existing flows during May and June often exceed 500 cfs, any fairly stable flow between 30 and 450 cfs will maintain or improve the existing physical habitat for rainbow trout incubation. However, flows less than 52 cfs will reduce the existing amount of physical habitat for trout that may still be spawning during May and June.

Although PHABSIM results indicate that an instream flow of 52 cfs will maintain or improve physical habitat for rainbow trout spawning and incubation between April 1 and June 30, this flow is below the fishery maintenance flow (54 cfs). To meet the dual objective of maintaining or improving existing physical habitat for rainbow trout spawning and incubation, and maintenance flow criteria, a flow of 54 cfs is recommended for the period April 1 to June 30.

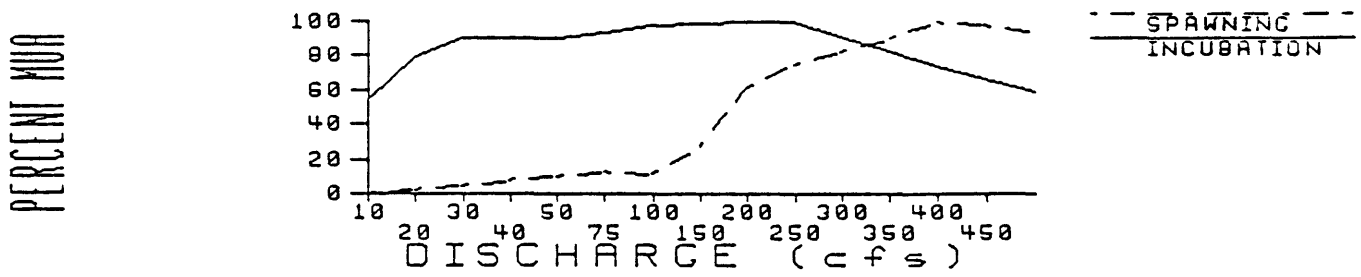


Figure 2. Percent of maximum usable area (MUA) for spawning and incubation life stages of rainbow trout.

Results from the HQI analyses (Figure 3) indicate that under existing late summer conditions, the stream presently supports approximately 46 HUs. According to the model, 46 HUs would be realized at a late summer flow of 60 cfs. The current fishery management objective is to maintain or improve the existing number of HUs, and a discharge of 53 cfs is the minimum flow that will accomplish this objective. At late summer flows below 53 cfs, the model indicates that reductions in the present fishery would occur. These reductions would largely be the result of lower critical period flow and increased annual stream flow variation. Increases in stream flow from 60 cfs to 210 cfs would increase trout HUs over present conditions. The model indicates that flows above 210 cfs would result in large reductions in trout HUs, as would reductions in discharge below 53 cfs (Figure 3).

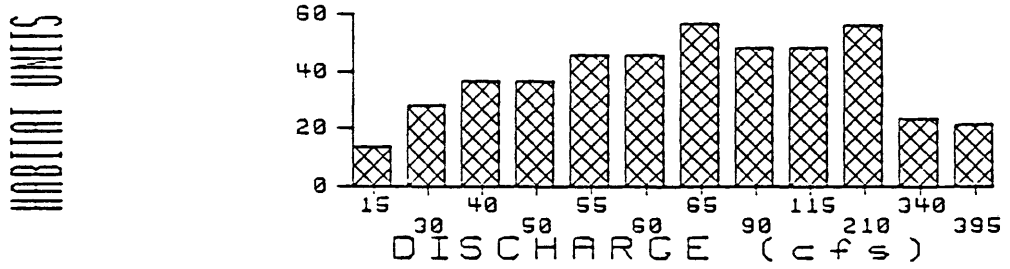


Figure 3. Number of potential trout habitat units at several late summer flow levels in the Encampment River.

Based on the results from the HQI analysis, the fishery maintenance flow of 54 cfs will maintain existing levels of trout production between July 1 and September 30. In addition, this discharge will maintain minimum hydraulic criteria that allow fish passage between different habitat types.

CONCLUSIONS

Based on the analyses and results contained in this report, the instream flow recommendations in Table 4 apply to approximately 14 miles of the Encampment River extending from the north boundary of the NW 1/4 NW 1/4 of S13, T14N, R84W to the mouth of Hog Park Creek in the NE 1/4, NW1/4, S10, T12N, R84W.

Table 4. Summary of instream flow recommendations to maintain the existing trout fishery in the Encampment River.

Time Period	Instream Flow Recommendation (cfs)
April 1 to June 30	54
July 1 to September 30	54[1]
October 1 to March 31	54

1 - Feasibility determined by availability at the 50% exceedence level during the specified time period

LITERATURE CITED

Bovee, K. and R. Milhous. 1978. Hydraulic simulation in instream flow studies: theory and technique. Instream Flow Information Paper 5, FWS/OBS-78/33, Cooperative Instream Flow Service Group, U.S. Fish and Wildlife Service. Fort Collins, Colorado.

Binns, N. and F. Eiserman. 1979. Quantification of fluvial trout habitat in Wyoming. Transactions of the American Fisheries Society 108:215-228.

Milhous, R.T., D.L. Wegner, and T. Waddle. 1984. User's guide to the Physical Habitat Simulation System. Instream Flow Paper 11, FWS/OBS-81/43, U.S. Fish and Wildlife Service, Fort Collins, Colorado.

Milhous, R.T. 1984. PHABSIM technical notes. Unpublished. U.S. Fish and Wildlife Service, Fort Collins, Colorado.

Milhous, R.T. 1978. A computer program for the determination of average hydraulic and shape parameters of a stream cross section. Washington State Dept of Ecology, Olympia.

Nehring, R. 1979. Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado. Colorado Division of Wildlife, Fort Collins.

Form S.W. 1
Rev. 10-85

NOTE: Do not fold this form. Use typewriter or print neatly with black ink.

STATE OF WYOMING

OFFICE OF THE STATE ENGINEER

APPLICATION FOR PERMIT TO APPROPRIATE SURFACE WATER

THIS SECTION IS NOT TO BE FILLED IN BY APPLICANT

Filing/ Priority Date

THE STATE OF WYOMING. } SS.
STATE ENGINEER'S OFFICE }

This instrument was received and filed for record on the 4th day of August, A.D. 1989, at 10:30 o'clock A. M.

Frank J. Trelease
FRANK J. TRELEASE, for State Engineer

Recorded in Book _____ of Ditch Permits, on Page _____.

Fee Paid $ 25.00. Map Filed E

WATER DIVISION NO. 1 DISTRICT NO. 7 Temp. Filing No. 26 5/399

PERMIT NO. _____

NAME OF FACILITY South Fork Grand Encampment River - Instream Flow Segment No. 1

1. Name(s), mailing address and phone no. of applicant(s) is/are Wyoming Water Development Commission, Herschler Building, Cheyenne, Wyoming 82002

(If more than one applicant, designate one to act as Agent for the others)

2. Name & address of agent to receive correspondence and notices Francis Perera, Wyoming Game & Fish Department, 5400 Bishop Blvd., Cheyenne, WY 82009; Michael Purcell, Wyo. Water Development Comm., Herschler Bldg., Cheyenne, WY

3. (a) The use to which the water is to be applied is Instream Flow

(b) If more than one beneficial use of water is applied for, the location and ownership of the point of use must be shown in item 10 of the application and the details of the facilities used to divert and convey the appropriation must be shown on the map in sufficient detail to allow the State Engineer to establish the amount of appropriation. In multiple use applications, stock and domestic purposes are limited to 0.056 cubic feet per second.

4. The source of the proposed appropriation is South Fork Encampment River tributary of the North Platte River, and Hog Park Reservoir

5. The instream flow segment extends from the confluence of Hog Park Creek and the South Fork Encampment River in the NE¼NW¼ of Section 10 T. 12 N., R. 84 W., and downstream to the north boundary of NW¼NW¼ of Section 13 T. 14 N., R. 84 W.

Length of stream segment approximately 13.6 miles.

6. Are any of the lands crossed by the proposed facility owned by the State or Federal Government? If so, describe lands and indicate whether State or Federally owned.

The land crossed by this stream segment in the E½ SE¼ S 13, T. 14 N., R. 84 W and Lot 3, S 1, T. 13 N., R. 84 W. are privately owned. All other lands crossed by this stream segment are Federal lands owned by the BLM or US Forest Service.

7. The carrying capacity of the ditch, canal, pipeline or other facility at the point downstrem of reach (see remarks) cubic feet per second.

8. The accompanying map is prepared in accordance with the State Engineer's Manual of Regulations and Instructions for filing applications and is hereby declared a part of this application. The State Engineer may require the filing of detailed construction plans.

9. The estimated time required for the commencement of work is 30 days. for completion of construction is 30 days. and to complete the applicaton of water to the beneficial uses stated in this application is 30 days.

Permit No. _____ Page No. _____
(Leave Blank)

10. The land to be irrigated under this permit is described in the following tabulation. (Give irrigable acreage in each 40-acre subdivision. Designate ownership of land, Federal, State or private. If private, list names of owners and land owned separately.) If application is for stock, domestic, or for purposes other than irrigation, indicate point of use by 40-acre subdivision and owner.

Township	Range	Sec.	NE¼				NW¼				SW¼				SE¼				TOTALS
			NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	NE¼	NW¼	SW¼	SE¼	
12	84	10		X			X												
		3				X								X	X		X	X	
		2		X			X	X	X			X							
13	84	35		X	X		X									X	X		
		26		X	X											X	X		
		23	X			X									X	X	X	X	
		14													X			X	
		13					X	X	X			X							
		12		X	X					X	X			X					
		1			X		Lot 3			X	X					X	X		
14	84	36						X	X	X	X			X					
		26													X			X	
		25						X	X	X	X	X	X						
		24						Lot 4	X			X	X						
		23	Lot 1			X									X			X	
		13						X	X	X	X		X	X					

Number of acres to receive original supply 0

Number of acres to receive supplemental supply 0

Total number of acres to be irrigated 0

REMARKS

MONTHLY INSTREAM FLOW REQUESTED

Month	Flow (CFS)
Oct.	54
Nov.	54
Dec.	54
Jan.	54
Feb.	54
Mar.	54
Apr.	54
May	54
June	54
July	54
Aug.	54
Sept.	54

Based on the results of a study conducted in 1981 by the Wyoming Game and Fish Department (attached), a flow right of 54 cfs is requested from October 1 to March 31 to maintain hydraulic conditions for existing levels of trout survival. A flow of 54 cfs is requested from April 1 to June 30 to maintain the existing level of rainbow trout spawning and incubation. A flow of 54 cfs is requested from July 1 to September 30 to maintain existing levels of trout production.

Intervening ditches - None

The length of stream segment is 13.6 miles.

Location of instream flow control gage not identified. If one is needed a gage will be installed near the North boundary of NW¼NW¼ S 13, T. 14 N., R. 84 W., ~~at the expense of~~ the Wyoming Game and Fish Department.

Under penalties of perjury, I declare that I have examined this application and to the best of my knowledge and belief it is true, correct and complete.

Michael E. Arnold
Signature of Applicant or Agent

3/4/89
Date

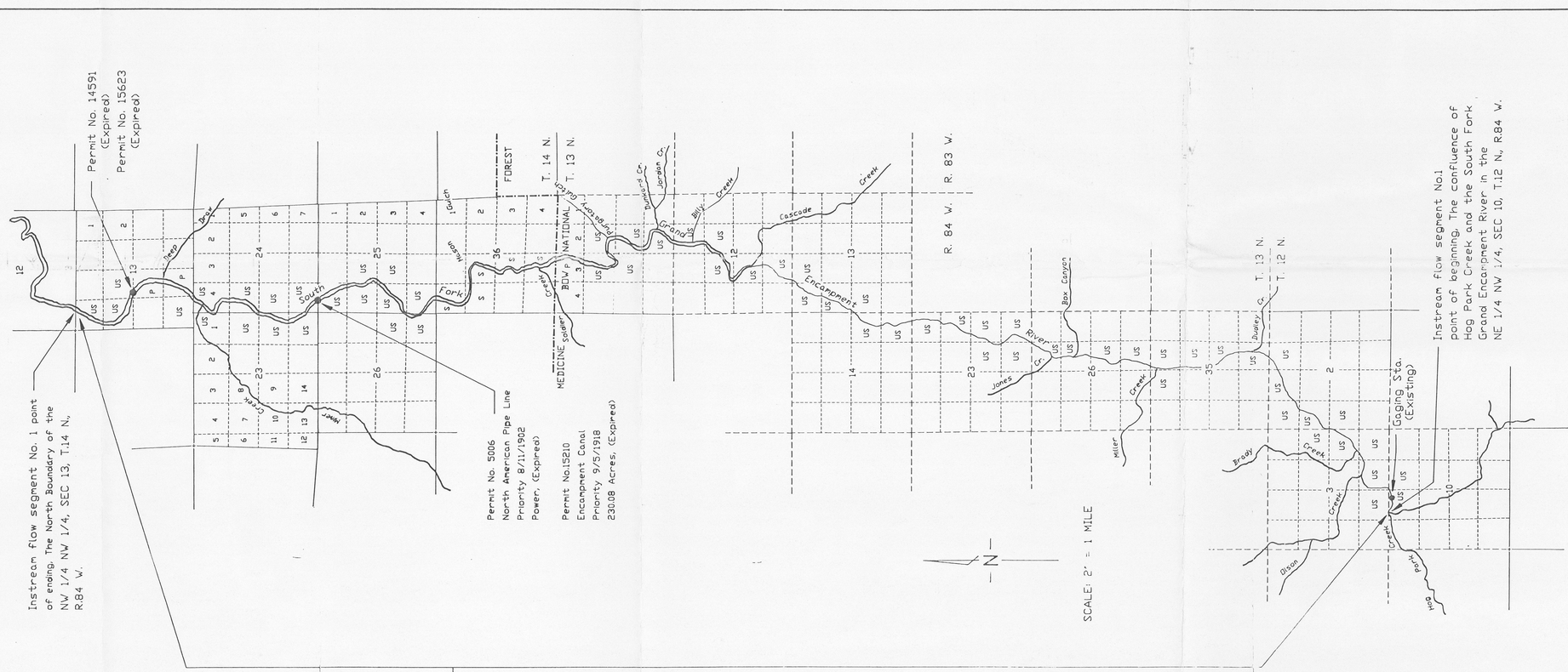
REMARKS CONTINUATION

W.R.F. NO. _____

The recommended year-round instream flow of 54 cfs is comprised of natural flows from the South Fork Ground Encampment River above Hog Park Creek and flows released into the Encampment River from Hog Park Reservoir via Hog Park Creek. The City of Cheyenne has agreed to release a minimum flow of 15 cfs at all times from Hog Park Reservoir (see attached easement, page 4, item 20) to "provide and maintain favorable conditions of waterflows" as part of their easement for the Stage II Water Project. An instream flow right of 15 cfs is therefore requested for releases from Hog Park Reservoir into the South Fork Ground Encampment River via Hog Park Creek for the entire year. An additional flow right of 39 cfs from direct stream flows is requested for the ~~South~~ Fork Ground Encampment River for the entire year. The total of these two instream flow rights meets the recommended instream flow of 54 cfs for the Encampment River.

The 15 cfs currently released from Hog Park Reservoir is equivalent to the stream flow into the reservoir plus additional stored water, except when inflow exceeds 15 cfs. Therefore, the amount of water from storage required to meet the requested right of 15 cfs released into the South Fork Ground Encampment River will vary according to natural stream flow into Hog Park Reservoir.

PERMIT NO. _____ PAGE NO. _____



Location of Instream Flow Control Gage:

1. A specific site has not been identified.
2. If the State Engineer orders a gage to be installed, it will be located near the downstream end of the stream segment in the NW 1/4 Section 13, T. 14 N., R. 84 W.

Amounts of Instream flow requested at the downstream end of stream segment No.1

MONTH	FLOW (cfs)
Oct.	54
Nov.	54
Dec.	54
Jan.	54
Feb.	54
Mar.	54
Apr.	54
May	54
June	54
July	54
Aug.	54
Sep.	54

SOUTH FORK GRAND ENCAMPMENT RIVER
INSTREAM FLOW SEGMENT NO. 1
(Length of stream segment No. 1 = 13.6 miles)
(No Intervening Ditches)

CERTIFICATE OF SURVEYOR

STATE OF WYOMING)
)ss
COUNTY OF LARAMIE)

I Jon S. Ogden of Cheyenne, Wyoming do hereby certify that this map was made from the Encampment, Wyo. and Dudley Creek, Wyo.- Colo. U.S. Geological Survey Maps dated 1961 (7 1/2 minute series), the Surface Management Quadrangles for T 12-13 N, R 84 W (SE-26) and for T 14-18 N, R 84 W (SE-20) published by the U.S. Department of The Interior, Bureau of Land Management Revised September 1978, the G.L.O. Plats For Partial Township No.12 Range 84 West dated September 12, 1901, Township No.13 North Range No.84 West dated June 20,1899 and Fractional Township No.14 North Range No.84 West dated June 20, 1899 and that it correctly represents the South Fork Grand Encampment River and the land that it flows through to the best of my knowledge and belief.

Jon S Ogden
4/28/80

LEGEND

US - Federal Land
S - State Land
P - Private Land

Approved _____

Gorden W. Fassett State Engineer

MAP
TO ACCOMPANY
APPLICATION FOR
SOUTH FORK GRAND ENCAMPMENT RIVER
INSTREAM FLOW SEGMENT NO. 1
APPLICANT
WYOMING WATER DEVELOPMENT COMMISSION
HERSCHLER BUILDING
CHEYENNE, WYOMING 82002