WYOMING GAME AND FISH DEPARTMENT

FISH DIVISION

ADMINISTRATIVE REPORT

TITLE: Ham's Fork River Instream Flow Report

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A study was conducted during the 1982 field season to obtain instream flow information from a portion of the Ham's Fork River below the Kemmerer City Reservoir. 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 proposed water development activities.

STUDY AREA

The Ham's Fork River below Kemmerer City Reservoir is recognized as a Class 2 stream by the Wyoming Game and Fish Department (WGFD). Stream classifications range from Class 1 (highest rating) to Class 5 (lowest rating). Class 2 streams support trout fisheries of statewide importance. Less than 6% of all streams in the state are Class 2 streams. This section of the Ham's Fork contains populations of rainbow and brown trout. Rainbow trout are currently stocked in the Ham's Fork by the WGFD. Young-of-the-year rainbow trout have been found in this section of the Ham's Fork; however, it is unknown if any of these were wild fish. Brown trout are not stocked in this stream segment as they are known to spawn in this section of the Ham's Fork. The WGFD has recently purchased easements that provide public fishing access to a portion of the Ham's Fork below Kemmerer City Reservoir. Because this section of the Ham's Fork River supports an important trout fishery and has public access available through easements purchased by WGFD, this segment of the stream was identified as a critical reach.

All of the field data used in this study were collected from a 536 foot long study site located on State property in the northwest quarter of Section 36, Township 23 North, Range 117 West. This site is located approximately 1/2 mile downstream from the Kemmerer City Reservoir (Figure 1). This site contained a combination of pool and riffle habitat for trout that was representative of trout habitat features found throughout this portion of the stream. Results and recommendations were applied to a portion of the stream extending from the west boundary of the NW 1/4 NW 1/4 of Section 36, T23N, R117W downstream to the boundary of the Wyoming Game and

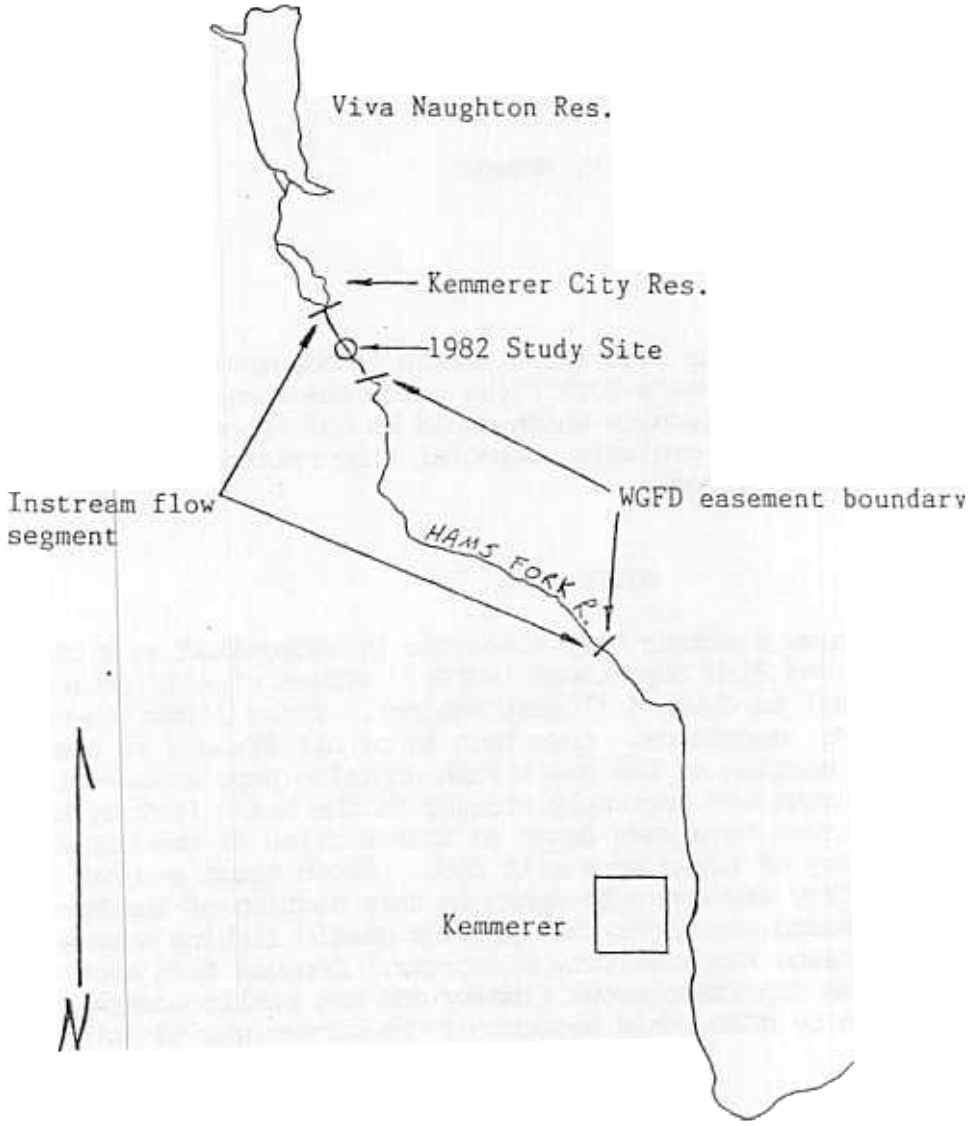

Figure 1. Map showing location of 1982 study site on the Ham's Fork River below Kemmerer City Reservoir.

Fish Department public fishing easement, located in the NW 1/4 of S21, T22N, R116W. This is a distance of approximately 11 stream miles.

METHODS

In accordance with the 1986 Instream Flow legislation, the objective of this study was to determine instream flows necessary to maintain the existing trout fishery in the Ham's Fork River. This objective can be accomplished by maintaining adequate flows for 1) winter survival of trout, 2) fish passage and aquatic insect production areas, and 3) existing levels of trout production during the late summer months. Two habitat models were used to make these instream flow determinations.

A Habitat Retention method (Nehring 1979) 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 needed to provide passage for all life stages of trout between different habitat types, maintain winter survival of trout, and maintain survival of aquatic macroinvertebrates. Data from single transects placed across three riffles within the study area were analyzed with the IFG-1 computer program (Milhous 1978). Flow data were collected during three different flow events (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 1. Dates and discharges when instream flow data were collected.

Date	Discharge (cfs)
07-30-82	115
08-21-82	47
09-19-82	23

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 WGFD (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 one pound of trout. Analyses obtained from this method apply to the time of

year that governs trout production. On the Ham's Fork 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 Ham's Fork were measured on the same dates and at the flow levels that data were collected for the Habitat Retention model (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 for flows lower than those which were measured. Gage data were obtained from a U.S. Geological Survey gage located below the downstream end of the instream flow segment for the period 1945 to 1972, and from the Utah Power and Light gage at Viva Naughton Reservoir for the period 1971 to 1988.

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 from the Habitat Retention model were used to identify a flow from October 1 to June 30 which would maintain trout survival and passage and aquatic insect survival.

RESULTS

Results from the Habitat Retention model showed that the hydraulic criteria in Table 2 are met at flows of 22.3, 22.1 and 34.5 cfs for riffles 1, 2 and 3 respectively (Appendix A). 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 34.5 cfs. An instream flow of 34.5 cfs is therefore recommended between October 1 and June 30.

Results from the HQI analyses (Figure 2) indicate that trout standing crop in this portion of the Ham's Fork would be maximized at an average late summer flow of approximately 115 cfs. Based on existing late summer flows, this stream segment presently provides approximately 53 HU's per acre. A flow of 41 cfs is the minimum flow that will maintain 53 HU's per acre. At lower flows, the model indicates that reductions in the fishery would occur. These reductions would largely be the result of lower critical period flow, higher annual flow variation and higher stream water temperatures. Significant increases in stream flow above 41 cfs would not result in significant increases in trout standing crop, but small reductions below this flow would result in large reductions in trout standing crop (Figure 2). A 1983 analysis of HQI data at an additional site downstream on the Ham's Fork near Frontier also demonstrates the effect of flow reductions on trout standing crop. At existing late summer conditions (about 25 cfs) the stream reach near Frontier provided 8.5 HU's. The reduction in the HU's between these two sites is largely due to the reductions in flows at the downstream (Frontier) site. The difference in the actual number of HU's between the two sites at 25 cfs (8.5 versus approximately 23) reflects other differences in physical habitat between the two sites.

Based on the results from the HQI analysis, an instream flow of 41 cfs is recommended to maintain existing levels of trout production between July 1 and September 30.

Figure 2. Number of potential trout habitat units at several late summer flow levels in the Ham's Fork River.

CONCLUSIONS

Based on the analyses and results contained in this report, the instream flow recommendations in Table 3 apply to an 11 mile segment of the Ham's Fork River extending from the North section line of S36, T23N, R117W to the boundary of the Wyoming Game and Fish Department's public fishing easement in the NW 1/4 of S21, T22N, R116W.

Table 3. Summary of instream flow recommendations to maintain the existing trout fishery in the Ham's Fork River.

Time Period	Instream Flow Recommendation (cfs)
July 1 to September 30	41
October 1 to June 30	34.5

REFERENCES

Binns, N. and F. Eiserman. 1979. Quantification of fluvial trout habitat in Wyoming. Trans Amer Fish Soc. 108 (3): 215-228.

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

Nehring, R. 1979. Evaluation of instream flow methods and determination of water quantity needs for streams in the state of Colorado. Colo Div Wildl. Fort Collins, CO. 144p.

APPENDIX A

Simulated hydraulic criteria for three riffles on the Ham's Fork River. Average daily flow = 149.0 cfs. Bank full discharge = 964 cfs.

Riffle 1

Average Depth (ft)	Average Velocity (ft/sec)	Wetted Perimeter (ft)	Discharge (cfs)
2.57	8.75	102.7[1]	964.0
1.29	2.95	61.6[1]	205.8
1.25	2.76	53.6	181.0
1.19	2.52	50.7	149.0
1.14	2.27	46.1	116.9
0.94	1.94	45.3	81.3
0.66[1]	1.55	44.5	45.2[2]
0.49[1]	1.26	36.8	22.3[2]
0.47	1.22[1]	36.1	20.4
0.37	1.00[1]	34.6	10.6

Riffle 2

3.94	8.47	97.9[1]	964.0
1.21	2.75	58.7[1]	183.9
1.13	2.59	55.4	161.7
1.09	2.50	54.9	149.0
0.98	2.27	53.6	118.3
0.83	1.95	49.5	80.3
0.71	1.67	44.8	52.5
0.63[1]	1.45	40.1	36.5[2]
0.54[1]	1.14[1]	35.9	22.1[2]
0.50	1.00[1]	33.9	15.5

Riffle 3

1.16	13.96	67.8	964.0
0.82[1]	3.37	60.8	149.0
0.60[1]	1.07[1]	59.4	37.9[2]
0.58	1.00[1]	58.9	34.5[2]
0.55	0.84	57.8	26.8
0.47	0.54	56.0	14.1
0.35	0.27	51.1	4.8
0.27	0.13	42.0[1]	1.4
0.29	0.12	40.7[1]	1.3
0.47	0.03	13.7	0.2

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