WYOMING GAME AND FISH DEPARTMENT

FISH DIVISION

ADMINISTRATIVE REPORT

TITLE: Wind River Instream Flow Report

PROJECT: IF-2088-07-8801

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DATE: February 1989

INTRODUCTION

Data were collected during the 1988 field season to conduct instream flow analyses for a segment of the Wind River located near Dubois, Wyoming. The studies were designed to provide the basis for determining instream flows which would maintain or improve the existing fishery in the section of the Wind River that passes through the Wyoming Game and Fish Department Public Fishing Easements east of Dubois.

METHODS

Study Area

The Wind 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 streams.

The Wind River contains populations of rainbow, brown and Snake River cutthroat trout, as well as incidental brook trout and Yellowstone cutthroat trout. The stream is currently managed under the basic yield concept for rainbow and brown trout. Rainbow and brown trout spawning is limited in this section of the Wind River; tributaries such as the Jakey's Fork probably contribute most of the natural recruitment to this section of the stream (K. Connell, WGFD, personal communication). Fingerling and catchable rainbow trout are currently stocked in this section by WGFD to supplement the natural reproduction. No brown trout are stocked in this segment. The study segment of the Wind River is contained within two public fishing easements purchased by the WGFD that are separated by approximately 1/4 mile of private land. The entire segment is accessible to the public by floating or at either of the two public fishing access areas. Because this section of the Wind River supports an important trout fishery and has public access, this segment was identified as a critical reach for instream flow recommendations.

Data Collection

All of the field data used in this study were collected from a 463 foot long study site located within a WGFD public fishing easement in the northeast quarter of Section 25, Township 41 North, Range 106 West. This site was located approximately 6.5 miles east of Dubois (Figure 1). This site contained a combination of pool and riffle habitat for trout that was representative of trout habitat features found throughout the stream reach. Results and recommendations were applied to a portion of the stream extending from the south boundary of the NW1/4 NE1/4 of Section 5, Township 40 North, Range 105 West upstream to the west boundary of the SW1/4 NE1/4 Section 23, Township 41 North, Range 106 West. This is a distance of approximately 5.5 stream miles.

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 the Wind River. The specific objectives of this study were to determine instream flows necessary to 1) maintain or improve hydraulic characteristics at all times of year that are important for survival of trout, fish passage and aquatic insect production and, 2) maintain or improve adult trout production during the late summer months. Two habitat models were used to make these determinations.

Models

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

Date	Discharge (cfs)
06-22-88	800
07-18-88	301
09-05-88	165

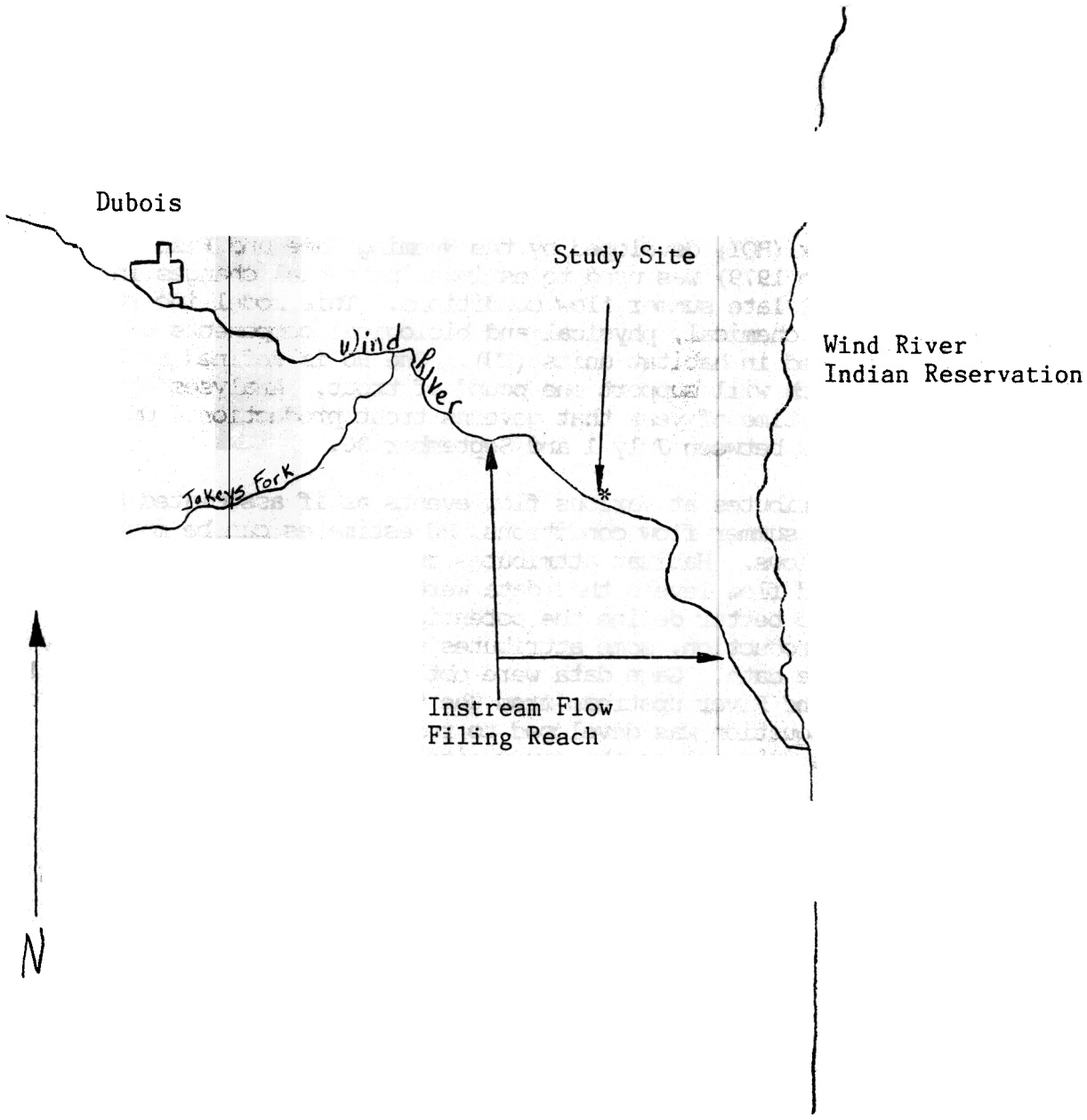

Figure 1. Map of study area on the Wind River.

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 one pound of trout. Analyses obtained from this method apply to the time of year that governs trout production. On the Wind 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 Wind River were measured on the same dates and 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. Gage data were obtained from a U.S. Geological Survey gage located on the Wind River upstream from the town of Dubois for the period 1946 to 1987. A regression equation was developed to relate the discharges at the U.S.G.S. gage with discharges measured at the study site.

Results from the Habitat Retention model were used to identify a flow from October 1 to March 31 which would meet the objective of maintaining trout survival and passage and aquatic insect survival. This flow will also maintain any existing brown trout spawning that may occur during this period. Although rainbow trout spawning is very limited in this section of the Wind River, the maintenance flow will also maintain the existing level of rainbow trout spawning between April 1 and June 30.

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 39.4, 59.0 and 102 cfs for riffles 1, 2, and 3, 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 102 cfs.

Table 3. Simulated hydraulic criteria for three riffles on the Wind River. Average daily flow = 223 cfs. Bank full discharge = 1443 cfs.

Average Depth (ft)	Average Velocity (ft/sec)	Wetted Perimeter (ft)	Discharge (cfs)
Riffle 1			
2.41	5.01	121.4	1443.0
2.05	4.43	118.1	1053.7
1.90	3.74	98.4	692.6
1.60	3.04	88.3	424.4
1.41	2.42	72.9[1]	248.8
1.37	2.31	70.8	223.0
1.23	2.03	67.5	167.0
0.94	1.41	54.6	72.0
0.70[1]	1.08	51.6	39.4[2]
0.63	1.00[1]	50.7	33.0
Riffle 2			
2.12	4.39	155.1	1443.0
1.96	4.02	154.2	1210.9
1.74	3.52	152.0	926.2
1.52	3.07	149.3	692.7
1.30	2.68	145.7	504.5
1.10[1]	1.96	111.0	236.3
1.08	1.89	110.1	223.0
0.70	1.35	100.8	94.8
0.54	1.18	93.1[1]	59.0[2]
0.39	1.00[1]	64.1	25.8
Riffle 3			
2.68	3.89	138.8	1443.0
2.35	3.33	137.0	1067.4
2.14	2.99	134.5	856.7
1.93	2.68	131.9	679.4
1.74	2.13	110.9	410.1
1.78	1.61	83.3[1]	237.4
1.76	1.55	81.6	223.0
1.53	1.00[1]	65.4	101.9[2]
1.38	0.71	56.4	54.9
0.81[1]	0.15	33.5	4.6

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

Results from the HQI analyses (Figure 2) indicate that under existing late summer conditions, the stream presently supports approximately 63 HUs. According to the model, 63 HUs would be realized at a late summer flow of 165 cfs. The current fishery management objective is to maintain or improve the existing number of HUs, and a discharge of 110 cfs is the minimum flow that will accomplish this objective. At late summer flows below 110 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 temperatures. Increases in stream flow from 165 cfs to 500 cfs would increase trout HUs over present conditions. The model indicates that flows above 500 cfs would result in large reductions in trout HUs, as would reductions in discharge below 110 cfs (Figure 2).

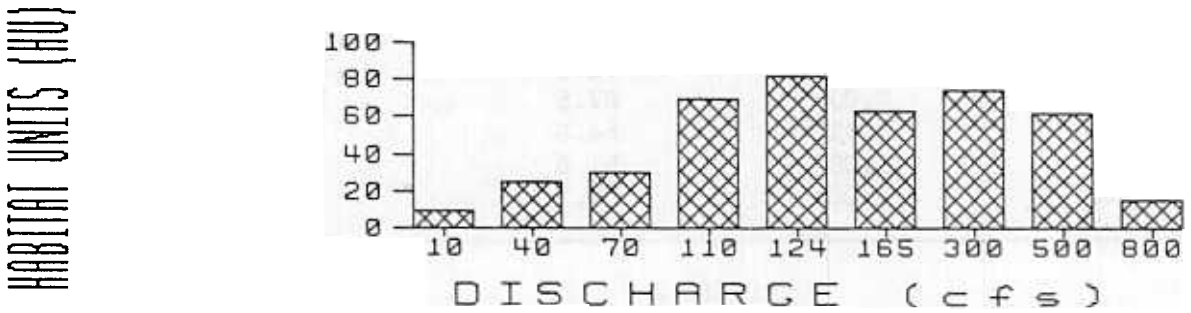

Figure 2. Number of potential trout habitat units at several late summer flow levels in the Wind River.

Based on the results from the HQI analyses, an instream flow of 110 cfs is recommended to maintain or improve existing levels of trout production between July 1 and September 30.

CONCLUSIONS

Based on the analyses and results contained in this report, the instream flow recommendations in Table 4 will maintain or improve the existing fishery of the Wind River. These recommendations apply to a 5.5 mile segment of the Wind River extending from the south boundary of the NW1/4 NE1/4 of Section 5, Township 40 North, Range 105 West upstream to the west boundary of the SW1/4 NE1/4 of Section 23, Township 41 North, Range 106 West.

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

Time Period	Instream Flow Recommendation (cfs)
April 1 to June 30	102[1]
July 1 to September 30	110[1]
October 1 to March 31	102[2]

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

2 - To maintain the existing natural flows up to the specified amount

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