

FINAL REPORT

WHITE RIVER FALLS FISH PASSAGE PROJECT

TYGH VALLEY, OREGON

VOLUME II: APPENDIX A

FISHERIES HABITAT INVENTORY

MT. HOOD NATIONAL FOREST

BY

U.S.D.A., Mt. Hood National Forest

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BARLOW RANGER DISTRICT

- Tygh Creek
- Badger Creek
- Little Badger Creek ('82 survey)  
('83 survey)
- Jordan Creek
- Threemile Creek
- Gate Creek
- Boulder Creek
- Forest Creek
- Hazel Hollow/Owl Hollow
- Pine Creek
- Rock Creek
- Gumjuwac Creek

BEAR SPRINGS RANGER DISTRICT

- Clear Creek ('83 survey)  
('82 survey)
- Frog Creek
- Barlow Creek
- Buck Creek
- Bonney/Red Creek
- Iron Creek
- Alpine Creek
- McCubbins Gulch
- White River

## FISHERIES HABITAT INVENTORY

### ABSTRACT

Stream habitat inventories on 155 stream miles in the White River drainage on the Mt. Hood National Forest are summarized in this report. Inventory, data evaluation, and reporting work were accomplished within the framework of the budgetary agreements established between the USDA Forest Service, Mt. Hood National Forest, and the Bonneville Power Administration, in the first 2 years of a multiyear program.

One hundred forty-two stream miles of those inventoried on the Forest appear suitable for anadromous production. The surveyed area appears to contain most or all of the high quality fish habitat which would be potentially available for anadromous production if access is provided above the White River Falls below the Forest boundary.

About 34 stream miles would be immediately accessible without further work on the Forest with passage at the Falls. Seventy-two additional miles could be made available with only minor (requiring low investment of money and planning) passage work further up the basin. Thirty-six miles of potential upstream habitat would likely require major investment to provide access.

## WHITE RIVER DRAINAGE FISH HABITAT INVENTORY

### INTRODUCTION

One-hundred fifty-five miles of stream habitat were inventoried and evaluated on the Mt. Hood National Forest during the first 2 years of this multiyear project. Inventory, data evaluation and reporting work were accomplished within the original budget established between the USDA Forest Service, Mt. Hood National Forest, and the Bonneville Power Administration.

Initial tasks included field inventory and evaluation of habitat conditions on the White River and tributary streams thought to have the highest potential for supporting anadromous fish populations. All streams inventoried were located on the Mt. Hood National Forest. Primary objectives of the inventory were to:

1. Describe current fish habitat conditions - accessibility, quantity, and quality of habitat.
2. Stratify individual streams into reaches of generally similar habitat character.
3. Locate and describe all irrigation diversions.
4. Identify fish habitat rehabilitation and enhancement opportunities.
5. Establish baseline data to assist in future management of White River fish habitat and fisheries resources.

The inventory and reporting procedures used are similar to those in the Mt. Hood National Forest ongoing Riparian Area Resource Assessment Program. All procedures were coordinated with appropriate ODFW personnel involved in the White River Project.

Summary tables, included in Section II of this report, and individual stream reports, Sections III, IV, and V, present findings of this inventory.

### METHODS

On each stream, the assessment was conducted by a two-person team. The team gathered a variety of information (spawning gravel, rehab/enhancement projects, special habitats, and fish numbers) on a continuous basis while walking the streams. Additional, more detailed information (flow, channel morphology, pool/riffle measurement, riparian area conditions, etc.), was gathered at transects located approximately every one-half mile of stream. Lower portions of major tributaries were also surveyed. (A copy of the field data reporting forms is included at the end of this introductory section.) For certain situations (fish passage barriers, tributary streams, landslides, etc.), special case forms were completed.

Semiquantitative models, developed on the Mt. Hood National Forest, have been used to provide a quality index for both fish habitat and riparian habitat.

These indexes rate habitat quality on a 0 (poorest) to 10 (best) scale. To date these models have not been field verified. They are, *however*, intended to be used as tools to assist in project planning, helping to identify and discuss limiting factors and/or areas of concern.

A relatively new element in the data gathering/reporting process *focuses* on the instream role of large woody debris. An effort to better quantify how this material controls spawning and rearing habitat was made. Table VI summarizes this information for each stream in each stream's data summary section.

In general, this inventory represents medium intensity data gathering sufficient for drainage-wide planning. It is designed to identify generalized conditions occurring on each stream. It is not intended for, nor should it be used in place of, site-specific reconnaissance and interpretation for the planning of individual projects.

## RESULTS

A total of 155 miles on 18 stream systems in the White River drainage on the Forest have been inventoried and area assessed in this report. The surveyed area appears to contain most or all of the high quality anadromous fish habitat in the drainage. Habitat conditions appear suitable for steelhead, coho, and chinook salmon, and possibly sockeye (See Tables II-IV, in Section II, Drainage Summary Section). One hundred twenty-four miles of potential anadromous fish habitat were identified in the survey. Currently, 33.5 miles of this habitat would be readily accessible to anadromous fish. An additional 72 miles of habitat could be accessed with only minor passage improvement work. About 36 miles of habitat, however, will require major investment to provide fish passage. (See Table I, Drainage Summary Section), Four large lakes (Boulder, 14 acres; Badger, 45 acres; Clear, 550 acres; Rock Creek Reservoir, 90 acres) appear to be well-suited for rearing anadromous fish, although passage enhancement would be needed before self-sustaining runs could be established in any of the lakes. Potential lake rearing habitat (101,494,48 square yards) was not included in the rearing area and volume totals presented in Summary Tables II, III, and IV in Section II of this report.

## REPORTING FORMAT

The emphasis of this report is on summarizing and interpreting pertinent data. The goal is to provide information which is understandable and easy to locate by a wide range of users. Section II contains five tables which summarize basic anadromous fish habitat conditions for all streams evaluated. Additionally, a drainage map has been included to graphically reflect anadromous habitat conditions.

The individual reports for each stream are broken into three basic sections, representing different levels of summarization and interpretation. These are:

1. The general summary section. Here the most pertinent aspects of the information are generalized to provide a good basic overview of each stream's riparian area resources.

2. The second section, which is a more detailed summary of various resource conditions by reach of stream. summaries include: reach characteristics; aquatic habitat conditions; riparian area conditions; and rehab/enhancement project opportunities.
3. The third section, which includes a wide range of detailed resource data. This is organized into a number of information tables. These include: aquatic habitat parameters; spawning gravel; fish species and relative abundance; stream channel and hydrologic characteristics; floodplain and riparian area parameters, etc. In addition, a stream order map, selected photos, a detailed assessment area map, and special case forms are included.

#### ADDITIONAL ACTIVITIES

In addition to finishing the stream survey habitat inventory work summarized in this report, the 1984 Mt. Hood field season accomplishments include Pacific Northwest freeze-core sampling of mainstem spawning gravels to determine spawning habitat quality, and providing assistance to the Oregon Department of Fish and Wildlife in selecting and intensively sampling selected habitat parameters on sample stream reaches.

SUMMARY

WHITE RIVER DRAINAGE

WHITE RIVER DRAINAGE  
Mt. Hood National Forest

TABLE I - ACCESSIBLE ANADROMOUS FISH HABITAT AND  
POTENTIAL WITH PASSAGE ENHANCEMENT

	<u>Accessible</u>	<u>Passage Enhancement</u>		<u>Total Habitat</u>
		<u>Level 1</u>	<u>Level 2</u>	
Tygh Creek	1.2	2.2	3.5	6.9
Badger Creek	10.3	3.6	6.7	20.6
Little Badger	1.9	3.6	2.0	7.5
Jordan Creek*	0.0	0.0	7.4	7.4
Threemile Creek	7.3	0.0	0.0	7.3
Gate Creek	2.0	4.0	3.8	9.8
Boulder Creek	1.0	9.7	0.0	10.7
Forest Creek	0.0	1.3	1.1	2.4
White River	6.8	14.4	0.0	21.2
Clear Creek	1.4	10.9	1.0	13.3
Frog Creek	0.0	8.8	0.0	8.8
Barlow Creek	0.0	6.8	0.0	6.8
Buck Creek	0.0	1.0	0.0	1.0
Bonney Creek	0.0	0.7	0.0	0.7
Iron Creek	0.0	5.0	0.5	5.5
Rock Creek	1.6	0.0	5.3	7.3
McGubbins Gulch	0.0	0.0	4.8	4.8
Alpine Creek	<u>0.0</u>	<u>0.4</u>	<u>0.0</u>	<u>0.4</u>
Total	33.5	72.4	36.1	142.0

\*Two 20-25 foot high falls located on State land block potential anadromous fish migration onto National Forest land.

LEGEND: Accessible: Miles of habitat presently accessible from the White River mainstem.  
Passage Enhancement: Additional miles of habitat accessed by improvement of passage conditions at existing barriers.

Level 1 = removal or alteration of all relatively small-scale obstructions (generally requiring low investment) such as log jams, small falls (1-6 feet) and low head irrigation diversion structures, up to the first major barrier.

Level 2 = removal or alteration of all remaining migration barriers, including major project sites likely requiring a relatively high level of planning and investment.

TABLE II - HABITAT SUMMARY OF ACCESSIBLE STREAM MILES\*

Stream	Length (Mi.)	Width	-----REARING-----		Volume (Yd <sup>3</sup> )	Spawning (Yd <sup>2</sup> )		Spp. Pot.
			P:R	Area (Yd <sup>2</sup> )		1-3"	3-6"	
Tygh Creek	1.2	8	5:5	2,816	929	77	36	St, co
Badger Creek	10.3	9	4:6	21,754	10,877	603	310	Ch, St, Co
Little Badger	1.9	7	5:5	3,901	1,287	28	0	St
Threemile Creek	7.3	9	4:6	15,418	5,088	443	244	St, co
Gate Creek	2.0	5	6:4	3,520	1,760	112	20	St, co
Boulder Creek	1.0	18	4:6	4,224	2,830	148	104	Ch, St, Co
White River	6.8	2s	2:8	19,947	13,364	77	17	Ch, St, Co
Clear Creek	1.4	17	3:7	4,189	2,807	18	26	Ch, St, Co
Rock Creek	1.6	4	8:2	3,004	2,003	39	<b>27</b>	St, co
Total	33.5			78,773	40,945	1,545	784	

LEGEND: Miles : Miles of anadromous fish habitat.  
 Width : Weighted average low flow stream width, in feet.  
 P:R : Weighted average ratio of pool area to riffle area.  
 Area : Total low flow pool surface area in square yards.  
 Volume : Total low flow pool volume in cubic yards.  
 Spawning : Number of square yards of gravels observed in the **1"-3"**  
 and **3"-6"** size classes.  
 Spp. POT.: Potential anadromous fish species apparently suited to  
 habitat conditions present on each stream system. St =  
 steelhead, Co = chinook, So = sockeye  
 \* : Stream miles from Table I.

TABLE III - HABITAT SUMMARY OF STREAM MILES ACCESSED  
BY MINOR PASSAGE ENHANCEMENT (LEVEL I\*)

Stream	-----REARING-----							Sppm	Pot.
	Length (Mi.)	Width (Ft.)	P:R	Area (Yd <sup>2</sup> )	Volume (Yd <sup>3</sup> )	Spawning 1-3"	3-6"		
Tygh Creek	2.2	8	6:4	6,195	2,044	142	63	St, co	
Badger Creek	3.6	15	3:7	9,504	4,752	200	73	Ch, St, Co	
Little Badger	3.6	5	4:6	4,224	1,394	134	75	St	
Gate Creek	4.0	5	5:5	5,867	2,934	198	18	St, co	
Boulder Creek	9.7	16	3:7	27,315	18,301	1,455	603	Ch, St, co, so	
Forest Creek	1.3	6	6:4	2,746	906	68	21	St, co	
White River	14.4	16	2:8	27,034	18,113	112	43	Ch, St, Co	
Clear Creek	10.9	14	5:5	44,763	29,991	1,024	279	Ch, St, Co	
Frog Creek	8.8	6	7:3	21,683	7,155	247	26	St, co	
Barlow Creek	6.8	10	6:4	23,936	7,899	421	317	Ch, St, Co	
Buck Creek	1.0	4	5:5	1,173	387	105	44	St, co	
Bonney Creek	0.7	3	4:6	493	163	60	25	St, co	
Iron Creek	5.0	14	3:7	12,320	8,254	34	11	Ch, St, Co	
Alpine Creek	0.4	5	5:5	598	179	23	0		
Total	72.4			187,851	102,472	4,223	1,598		

LEGEND: Miles : Miles of anadromous fish habitat.  
Width : Weighted average low flow stream width, in feet.  
P:R : Weighted average ratio of pool area to riffle area.  
Area : Total average low flow pool surface area in square yards.  
Volume : Total low flow pool volume in cubic yards.  
Spawning : Number of square yards of gravels observed in the 1"-3"  
and 3"-6" size classes.  
Spp. POT.: Potential anadromous fish species apparently suited to  
habitat conditions present on each stream system. St =  
steelhead, Co = coho, Ch = chinook, So = sockeye.  
\* : Stream miles from Table I.

TABLE IV - HABITAT SUMMARY OF STREAM MILES ACCESSED BY  
MAJOR PASSAGE ENHANCEMENT (LEVEL II\*)

Stream	Length (Mi.)	Width (Ft.)	REARING**		Volume (yd <sup>3</sup> )	Spawning (yd <sup>2</sup> )	L3-36" (yd <sup>2</sup> )	Spp. POT.
			P:R	Area (yd <sup>2</sup> )				
Tygh Creek	3.5	6	5:5	6,160	2,033	237	98	St, co
Badger Creek	6.7	10	4:6	13,235	5,632	173	77	Ch, St, Co
Little Badger	2.0	3	3:7	1,056	348	46	16	St
Jordan Creek	7.4	8	3:7	6,336	3,168	536	183	St, co
Gate Creek	3.8	6	4:6	5,350	2,675	192	21	St
Forest Creek	1.1	15	2:8	1,936	639	48	13	St, co
Clear Creek	1.0	3	5:5	880	590	86	2	St, co, so
Iron Creek	0.5	5	3:7	440	295	2	2	St
Rock Creek	5.3	4	3:7	3,437	1,146	103	17	St so
McCubbins Creek	4.8	11	2:8	61,952	4,139	393	20	
Total	36.1			100,782	20,656	1,516	449	

LEGEND: Miles : Miles of anadromous fish habitat.  
Width : Weighted average low flow stream width, in feet.  
P:R : Weighted average ratio of pool area to riffle area.  
Area : Total low flow pool surface area in square yards.  
Volume : Total low flow pool volume in cubic yards.  
Spawning : Number of square yards of gravels observed in the 1'-3'  
and 3"-6" size classes.  
Spp. POT.: Potential anadromous fish species apparently suited to  
habitat conditions present on each stream system. St =  
steelhead, Co = coho, Ch = chinook, So = sockeye.  
\*\* : Rearing areas, volumes do not include lakes or reservoirs.

TABLE V - IRRIGATION DIVERSION STRUCTURES (MHNf)

Stream	Location	Type	Passage		Pass. Enh.		Comments
			Up (Mi.)	Down	Up	Down	
Tygh Creek	15.2	LH N	(5.7)	N	H	H	Log structure with board spillway 6 feet high, 6 feet long.
Badger Creek	15.3	LH N	(7.0)	N	H	H	Concrete structure with board slat inserts.
Gate Creek	8.6	LH N	(6.2)	N	M	M	Concrete structure with board slat inserts.
Boulder Creek	3.1	LH P	(7.6)	N	H	H	Log structure with board slat inserts.
Forest Creek	1.6	LH N	(0.8)	N	L	L	Log and concrete with board slat inserts.
Clear Creek	7.8	LH N	(4.0)	N	H	H <u>1/</u>	Concrete structure with board slat inserts (5 feet high).
Frog Creek	4.6	LH N	(4.0)	N	H	H	Earth fill structure with concrete and board slat spillway.
Rock Creek	8.3	D N	(4.8)	N	L	L	Fifty-foot tall earth fill structure.

L/ Screening may be required on both the Clear Creek ditch outlet and the Frog Creek ditch inlet which enters Clear Creek in the diversion impoundment area.

LEGEND: Location : Location on stream, in miles moving upstream from the mouth (RM).  
 Type : LH = Low head structure, less than 8-foot tall.  
 D - dam, greater than 8-foot tall.  
 Passage : Does structure present an obstruction to fish migration?  
 cp: Passable to upstream migration? F = full passage; P = partial (low flow) barrier; N = impassable. Miles of potential habitat lying above the structure are provided in parenthesis ( 1.  
 Down: Passable to downstream migrants? N = No, and screening would likely be required to prevent loss of emigrating smolts.  
 Pass. Enh.: Relative priority of passage enhancement both up and downstream at the structure, based on the quantity and quality of potential anadromous fish habitat lying upstream.

TYGH CREEK

BARLOW RANGER DISTRICT

Surveyors: David Wiswar County: Wasco  
Doug Kinzey

Dates Surveyed: September 12, 14-15, Mouth Location: T.4S., R.13E.,  
and 20, 1983 Sec. 11

Tributary to: White River Watershed Area: 77,200 acres  
230.6 sq. miles

Drainage: Deschutes Stream Order: VI

TRI Compartments: Stream Length: 20 miles  
Flag 1402, Jordan 1405  
Ball 1404, Tygh 1406

Game Fish: Rainbow trout Low Flow Width (Avg.): 6 feet

Potential Anadromous Species: Distance Surveyed:  
Steelhead trout Mainstem: 6.1 mi. (RM 14.0 - 20.1)  
Coho salmon Tributary B: 0.75 mi.

Average Fish Habitat Condition Rating: 5.8 (Fair)

Average Riparian Condition Rating: 6.4 (High)

## TYGH CREEK

### Survey Summary

#### A. Stream Summary

Tygh Creek is a major 6th order tributary of White River. Major drainages contributing to Tygh Creek are Badger Creek near RM 3 and Jordan Creek at RM 6.0. Hootnanny Point and Jordan Butte are situated along the northern slopes, and Flag Point and Ball Point are to the south. The survey area lies above where the old North-South Road crosses the stream at RM 14.0. Below this point ownership is a mixture of public and private land. At RM 15.2, an irrigation diversion is present. Forest Service Road 27 crosses Tygh Creek at RM 15.1 and Road 2720 parallels the northern ridge. Forest Service trails present in the drainage are the Tygh Creek Trail, Jordan Cut-Off Trail, and Pen Way Trail. Rainbow trout were observed along the survey route in low number from RM 14.0-18.0.

#### B. Watershed Characteristic6 and Geomorpholgy

Tygh Creek flows through a broad (200+ foot), flat bottom V-shaped valley from RM 14.0 to RM 15.1, where Forest Service Road 2720 crosses the stream. Above this point, Tygh Creek flow6 in a narrow, V-notched valley. Floodplain width is generally between 50-60 feet until RH 18.2, where the floodplain width decreases to less than 30 feet. Sideslopes are

moderately steep to steep (50-70 percent) throughout the stream's length up to about RM 19.3, where they are moderate (30 percent). Stream channel gradient is low (4 percent) between RM 14.0 and 16.4. From RM 16.4 to RM 18.2, the gradient is high (8 percent) with short, steeper sections (14-23 percent). The stream has a stair-stepped profile with boulders and large woody debris (LWD) the primary elements of channel structure. Gradient decreases again above RM 18.2, averaging 5 percent. Substrate materials are gravel and sand in this area, whereas below they are dominated by boulders and rubble. The slopes throughout the surveyed length are highly dissected with numerous ephemeral tributaries contributing to flows. Tributary B is perennial and contribute6 approximately 50 percent of the flow (2 cfs) at its confluence with Tygh Creek (RM 17.4). Small wetland6 adjacent to the stream are common in the upper reach. (RM 18.2 - 20.1). The Tygh Creek flow regime appears flashy. It was reported that on August 5, 1983, the diversion structure at RM 15.2 had diverted more than 80 percent of the flow (3.5 cfs) into the ditch line. Inspection of the stream at that time below the structure revealed heavy sediment loading and poor pool quality.

c. Reach Description

Four reaches were identified along the mainstem of Tygh Creek and one for Tributary B. The reaches are delineated primarily on the basis of substrate composition, gradient, and LWD influence. Pool and riffle surface area is approximately even throughout the survey length (P:R = 5:5). On approximately 70 percent of the surveyed length, boulder6 and

rubble dominate the substrate and gradient is moderate. Gravel and sand comprise the bottom composition in Reach IV (RM 18.2 - 20.1). Gradient is highest (10 percent) in Reach II (RM 16.4 - 18.2).

The influence of large woody debris is highest in Reach III (RM 17.4-18.2), establishing a stair-stepped profile; in Reach IV, LWD is important in gravel retention.

#### D. Fisheries

The overall Habitat Condition Rating (HCR) for Tygh Creek is fair (5.8). Spawning gravel<sup>6</sup> are numerous, totalling 1038 square yards. Approximately 60 percent are considered marginal quality primarily due to channel placement. Sixty percent of the total gravels (643 square yards) are suitable for anadromous fish utilization. Gravel bed size between RM 14.0 - 18.2 is small, 1-2 square yards, with 80 percent of the gravels suitable for anadromous fish. Above RM 18.2, bed size increases to 3-4 square yard<sup>6</sup> with 50 percent suitable for anadromous species. The overall influence of LWD on gravel retention in the lower two reaches is relatively low (30 percent). In the upper reaches (RM 17.4 - 20.1), its importance increases (70 percent). In all reaches, high quality gravel bed formation and retention is highly dependent on LWD.

Pool size throughout the surveyed length average<sup>6</sup> less than 3 square yards. Depths are low, with the exception of Reach II (RM 16.4 - 17.4),

where they are moderate. Effective cover is moderate to high, decreasing to low in Reach IV (18.2 0 - 20.1) and Tributary B. The importance of LWD in pool formation is low (40 percent) between RM 14.0 - 18.2. In the upper reach, LWD has an influence on 70 percent of the pool development. Several migration barriers are present, including the diversion structure and four high gradient areas (17-23 percent) occurring between RM 16.8 and 18.2. These sections are 100 feet long and are dominated by boulder substrate. Six logjam (debris accumulations) obstructions are also identified between RM 15.2 and 16.8. Shallow pool development below these structures may present passage problem<sup>6</sup> during low flows. The habitat appears suitable for winter steelhead trout and marginal for coho salmon. Rainbow trout were observed in low number<sup>6</sup> to RM 18.0.

#### E. Riparian Area

The quality of the riparian habitat varies between moderate and high. Reaches I and IV have high quality habitat. Positive factors include deciduous overstory species, a broader floodplain, an overall high number of habitat units, and special habitats (rock outcrops, snag patches, and wetlands). Other reaches have reduced quality due to a narrow floodplain and fewer special habitat units. The overall Riparian Condition Rating (RCR) is high (6.4).

## F. Rehabilitation and Enhancement

Rehabilitation and enhancement opportunities exist for improving fish passage at the migration barrier<sup>6</sup> and increasing pool quality. Presently, 4.9 miles of stream are blocked due to the diversion structure at RM 15.2. Additional barrier<sup>6</sup> which block almost 400 square yard<sup>6</sup> of potential spawning habitat in Reach IV include three high gradient (20 percent) areas between RM 17.25 and 18.2 on the mainstem and at RM 0.4 on Tributary B. Pool quality is fair to low over most of the surveyed section. Increasing pool size and depth in Reaches I and III would improve rearing habitat conditions.

## TYGE CREEK

### Reach Summary

#### Reach I; RM 14.0 - 16.4:

1. Valley configuration narrows at RM 15.1 from a very wide (200 feet), flat bottom V-shaped valley to a narrow (60 feet wide), flat bottom valley at the end of the reach. For most of its length below RM 15.1, the stream runs against the southwest floodplain slope. Bank cutting is common throughout this lower section.
2. Gradient is low (4 percent).
3. Rubble and gravel dominate the substrate composition (55 percent).
4. Pool to riffle ratio is equal (P:R = 5:5).
5. Stream shading is high (85 percent).

#### Reach II: RM 16.4 - 17.4:

1. Valley configuration decreases to a narrow (45 feet wide), flat bottom, V-shaped valley.

2. Gradient increases to high (averaging 10 percent), with maximums of 17 percent and 20 percent at RM 16.8 and 17.25, respectively.
3. Substrate sizes increase with boulder and rubble dominating (70 percent).
4. Pools are slightly more common than riffles (P:R = 6:4).
5. Stream shading is high (90 percent).

Reach III: RM 17.4 - 18.2:

1. Valley configuration remains a narrow (55 feet wide), flat bottom, V-shaped valley.
2. Gradient decreases to moderate (5 percent).
3. Substrate size classes decrease slightly from the previous reach, remaining boulder and rubble dominated (60 percent).
4. Pool and riffle ratio is even (P:R = 5:5).
5. Stream shading remains high (80 percent).

Reach IV; RM 18.2 - 20.1:

1. Valley configuration narrows to a 25 foot wide, V-shaped floodplain with gentle (30 percent) sideslopes.
2. Gradient remains moderate (6 percent) and has a stair-step profile controlled by LWD.
3. Substrate size decrease6 substantially with the gravel size class dominating (70 percent).
4. Pool to riffle ratio remains even (P:R = 5:5).
5. Stream shading decrease6 to moderate (75 percent).

Tributary B; 0.0 - 0.75:

1. Valley configuration is a narrow to moderate (70 feet wide), flat bottom, V-shaped valley.
2. Gradient averages 7 percent, increasing from 8 percent at the confluence with Tygh Creek to a high of 22 percent at RM 0.4 and then decreasing to 5 percent above that point.

3. Substrate is predominantly rubble (45 percent).
4. Pool-to-riffle ratio averages 4:6.
5. Stream shading is high (90 percent).

## TYGH CREEK

### Fish Habitat Summary

The overall fish habitat quality is rated fair (HCR = 5.8). Positive components of the score include high spawning gravel counts in most reaches, a fairly even pool-to-riffle ratio, and high stream surface shading. Negative factors are poor to fair pool development and low base flow.

#### Reach I; RM 14.0 - 16.4:

1. The fish habitat quality is rated fair (HCR = 6.3). Low numbers of trout were observed throughout this section.
2. Spawning gravels total 363 square yards. Seventy percent (242 square yards) are marginal quality due to channel placement. They are in small accumulations of 1-2 square yard<sup>6</sup> along the stream banks above the low flow channel. The higher quality gravels are also in small accumulations. Boulder structure is dominant and account<sup>6</sup> for most of the gravel retention. The influence of LWD on gravel retention is low (35 percent); however, 75 percent of the high quality beds are LWD dependent. Fifty percent (184 square yards) are in the 1.5-3 inch size class, and 35 percent (129 square yards) are in the 3-6 inch size class.

3. Pool and riffle areas are even (P:R = 5:5), with fair rearing habitat. Pools are generally 3 square yards with shallow depths. Effective cover is moderate and is provided by instream boulders and root wads along undercut banks. The role of LWD in pool formation is low (15 percent). As with gravel retention, boulder structure is far more significant. High quality pools are rare. Of those observed, only 30 percent are LWD formed.
4. The diversion structure at RM 15.2 is a complete barrier to fish migration. The structure is approximately 6 feet high and spans 15 feet across the channel. The pool at its base is about 20 square yard<sup>6</sup> in area and greater than 3 feet deep. Other structures considered low flow barriers are three debris accumulations between RM 15.15 and 15.75. They are approximately four feet high and consist of one or two logs across the channel with small woody debris (branches) and sediment deposited behind them. Pool development below them is poor. At RM 16.3, the gradient increases to 13 percent for a 150 foot section over a boulder substrate. Fish passage at this point may be difficult.

Reach II; RM 16.4 - 17.4:

1. The fish habitat quality remains fair (HCR = 6.5). Trout were observed in moderate numbers in this reach.
2. Pools have a slight dominance in stream surface area (P:R = 6:4). Rearing habitat is of a higher quality in this reach than elsewhere in the

survey. Average pool size is small at 2 square yards; however, pool depths are moderate and effective cover is high. Cover is provided by surface turbulence and the undercut bases of boulders and large rubble. The influence of LWD on pool formation is low (10 percent; see Table VI).

3. Spawning gravels total 74 square yards. Sixty-five percent (47 square yards) are marginal due to channel placement. Gravel bed size and placement, LWD influence, boulder structure and size classification are similar to Reach I. The results are summarized in Tables III, V, and VI.
4. Stream gradient in the upper part of this reach increases substantially for short sections of about 100 feet. Near 16.8, the gradient is about 15 percent and at RM 17.25, it increases to 20 percent. Substrate composition in these areas is dominated by boulders.

Reach III: RM 16.4 - 18.7:

1. The fish habitat quality is rated fair (HCR = 6.2). Rainbow trout were observed in low numbers.
2. Spawning gravels total 139 square yards with the majority (80 square yards) considered marginal, again due to channel placement. The gravel bed size increases from the previous two reaches to 3-4 square yds. The influence of LWD on gravel retention increases significantly; approximately 70 percent of the gravel beds are located behind single log

structures. Eighty percent of the high quality gravels are associated with LWD. Fifty-one square yards (40 percent of the total) are in the 1.5-3 inch size class; 15 square yards in the 3-6 inch size class; and 50 percent (73 square yards) are in the 0.5-1.5 inch trout size class, an increase from the downstream reaches of 30-35 percent.

3. Pool size is variable through this reach. Pools associated with the boulder-rubble substrate have a higher frequency of occurrence (70 percent). They are small, 1-2 square yards, with shallow depths and moderate effective cover. The cover is surface turbulence and undercut instream rubble and boulders. LWD accounts for about 30 percent of the total pool development. These pools tend to be larger than the boulder formed pools; however, their depths are shallower and effective cover is low. High quality pools are still rare. Of the few observed, 90 percent are boulder formed.
  
4. The stream shows two consistent and distinct variations with respect to gradient. The boulder-rubble sections generally exhibit an 8 percent gradient. The gradient above LWD accumulations is 3-5 percent over a gravel and sand substrate. Exceptions to this general trend occur at RM 17.6 where the gradient over a 50-foot long bedrock chute is 23 percent, and at RM 18.2 where the gradient is 22 percent for approximately 100 feet over a boulder substrate.

Reach IV; RM 18.2 - 20.1:

1. The fish habitat quality is rated fair (HCR = 4.9). No fish were observed in this reach.
2. Spawning gravels are in their highest concentrations in this reach, totalling 391 square yards. The occurrence of good and marginal quality gravel is about even. Beds of 3-4 square yards are commonly located behind instream LWD. LWD influences 70 percent of the total gravel retention and is important in the formation of 90 percent of the high quality beds. Gravel in the 0.5-1.5 size class accounts for slightly more than 50 percent of the spawning beds. Forty-five percent of the gravels (179 square yards) are in the 1.5-3 inch size class, and the remainder (9 square yards) are in the 3-6 inch size class.
3. Pool and riffle surface area is even (P:R = 5:5). Pools are small in size, one square yard, with shallow depths and low effective cover. LWD is the dominant instream structure and accounts for 70 percent of the total pool development. High quality pools are very rare. Of those present, 80 percent are LWD dependent. Bottom composition of the pools is gravel and sand.

Tributary B; RM 0.0 - 0.75:

1. The fish habitat quality is rated fair (HCR = 5.3). Rainbow trout were noted in low numbers. Tributary B enters Tygh Creek at RM 17.4.
2. Spawning gravels total 71 square yards with a 50:50 breakdown between high quality and marginal beds. Gravels are scarce between RM 0.0 and 0.4. Stream gradient is high, ranging from 8 percent to 22 percent at RM 0.4. Above RM 0.4, the gradient decreases to 3 percent. Most of the gravels are located here. Bed size is greater than 4 square yards. Seventy-five percent (53 square yards) are in the 0.5-1.5 size class. LWD plays a moderate role in gravel retention with 35 percent of the beds LWD dependent. However, high quality gravels are almost exclusively dependent on LWD.
3. Riffles have a slight dominance in the stream surface area (P:R = 4:6). Average pools are 1 square yard with shallow depths and low effective cover. Forty percent of the pool development is LWD dependent. One to two high quality pools (LWD formed) per 0.1 mile were noted below RM 0.4. These pools are approximately 2 square yards with moderate depths. Effective cover is provided by surface turbulence and LWD.
4. The 22 percent gradient at RM 0.4 likely precludes access to reaches above this point. The stream at this point flows over a boulder substrate with poor pool development.

TYGH CREEK

Riparian Habitat Summary

Reach I; RM 14.0 - 16.4:

1. The Riparian Condition Rating is high (RCR = 7.0).
2. The floodplain width is variable, decreasing from very wide (greater than 200 feet) at the lower end of the reach to narrow (60 feet) at the upper end.
3. Five habitat units are present (grass-forb, shrub-seedling-sapling, poles, small sawtimber, and large sawtimber).
4. The coniferous overstory averages two species per transect, grand fir, and western red cedar. Occasional Douglas-fir are also present. Three deciduous species (black cottonwood, big leaf maple, red alder) are present in the reach, averaging one species per transect.
5. Two special habitats occur in the reach. An oak and maple covered rock ridge extends into the riparian zone at RM 15.65, and a snag patch is located at RM 15.8.

Reach II; RM 16.4 - 17.4:

1. The riparian habitat quality decreases to moderate (RCR = 5.3).
2. The floodplain width is narrow (45 feet), in a flat bottom, V-shaped valley.
3. All five habitat units remain.
4. Coniferous overstory diversity increases from the previous reach. An average of four species per transect are present, with cedar, grand fir, and Douglas-fir most common. Noble fir, western hemlock, and ponderosa pine also occur. Deciduous overstory diversity decreases somewhat from the previous reach, with an average of one species (red alder or cottonwood) per transect.
5. Special habitats are a rock outcrop (RM 16.7) and a moss-covered talus slope (RM 16.8).

Reach III; RM 17.4 - 18.2:

1. The riparian habitat remains moderate in quality (RCR = 4.8).
2. The floodplain width remains narrow (55 feet), forming a flat bottom, V-shaped valley.

3. Habitat units decrease to four. Grass-forbs are generally lacking.
4. Coniferous overstory diversity decreases from the previous reach, with three species (cedar, grand fir, Douglas-fir) present. No deciduous species were observed.
5. No special habitats were noted.

Reach IV; RM 18.2 - 20.1:

1. The riparian quality rates high with the highest score of any reach (RCR = 7.4).
2. The floodplain width is very narrow (averaging 25 feet), alternating between a flat bottom, V-shaped valley and a narrow V-notch. This reach contains the only wetlands occurring over the stream length surveyed, covering 40 percent of reach length.
3. Four habitat units are present. Large sawtimber is generally lacking.
4. Coniferous overstory diversity is high (averaging four species per transect), changing from the cedar and grand fir domination of the previous reaches to a predominantly lodgepole, spruce, noble fir, and western larch canopy. Cedar, grand fir, hemlock, Douglas-fir, ponderosa pine, and white pine occur occasionally. Cottonwoods are also present.

5. Special habitats include a small (1/2 acre) grassy wetland at RM 18.35, snag patches at RM 19.2 and 19.5, a small (1 acre) spring/wetland area at RM 19.3, a large wetland (old channel braid) from RM 19.3 to 19.5, a dry legume meadow near the mouth of Tributary C (RM 19.6), and a wet marsh tributary system entering the mainstem at RM 20.0.

Tributary B; RM 0.0 - 0.75:

1. The riparian habitat is rated moderate (RCR = 4.7).
2. The floodplain width is narrow to moderate (70 feet), forming a flat bottom, V-shaped valley.
3. Four habitat units occur. Grasses and forbs are generally lacking.
4. Coniferous overstory diversity is high, with five species (cedar, hemlock, Douglas-fir, grand fir, and white pine) commonly present. No deciduous species were observed.
5. No special habitats were noted.

## TYGH CREEK

### Rehabilitation/EnhancementSummary

#### Passage Enhancement; EM 15.2, 17.2 - 18.2; Tributary B (RM 0.4)

Four passage barriers on the Tygh Creek mainstem and one on Tributary B presently would prevent potential anadromous access to a total of 4.9 miles of stream and 865 square yards of spawning habitat. Improving access throughout this system would be a high priority if anadromous fish production from this drainage is desired.

The first barrier is the ditch diversion structure at RM 15.2. Due to its height (6 feet) and length (6 feet), redesign may be necessary. Screening of the irrigation inlet to prevent smolts from entering the ditch would likely also be required.

The remaining passage barriers (mainstem RM 17.25, 17.6, 18.2; Tributary B EM 0.4) are boulder and bedrock chutes approximately 100 feet long with greater than 20 percent gradients. Some form of resting pool development or alternative passage (Alaska steep-pass) could likely alleviate passage problems in these areas.

Rearing Pool Development; RM 14.0 - 15.2, 17.6 - 20.0:

Although existing pool quantity is good throughout the stream length surveyed, quality is low due to shallow depths and small size. Placement of boulder berms or log sills could serve to enhance pool rearing habitat. Poor road access prohibits the use of heavy equipment throughout most of this system.

Riparian Protection; RM 18.4, 19.3 - 19.5, 20.0

The only wetlands occurring along the stream length surveyed are the small springs and marshy areas located in Reach IV. Maintenance of these areas would appear to be a high concern for riparian habitat diversity. Presently, a flyline for a planned road connecting Road 2720 and the Flag Point Lookout Road crosses the stream near these locations.

TYGH CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>				<u>POOLS</u>				<u>RIFFLES (%)</u>					
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>11-1"</u>	<u>SD</u>	
1(14.0-16.4)	6.3	85	5:5	4	L	3	M	0	25	25	30	10	10	3
11(16.4-17.4)	6.5	95	6:4	10	L-M	2	H	0	45	25	15	10	5	3
111(17.4-18.2)	6.2	80	5:5	5	L	3	M	0	25	35	25	10	5	2
IV(18.2-20.1)	4.9	75	5:5	6	L	1	L	0	*	5	70	15	10	1
Tributary B (0.0-0.75)	5.3	90	4:6	7	L	1	L	0	15	45	20	15	5	3

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%I  
d: Average maximum depth (L 12", M = 12 - 29", H \_ 30")  
A: Average pool area (square-yards)  
EC: Effective cover (L \_ 40%, M = 40-60%. H \_ 60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>SPECIES</u>	<u>REACH</u>				<u>TRIBUTARIES</u>
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>TRIB. B</u>
Rainbow trout	L	M	L	(	L

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

**TYGH CREEK**

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (14.0 - 16.4)	363	121	242
II (16.4 - 17.4)	74	27	47
III (17.4 - 18.2)	139	59	80
IV (18.2 - 20.1)	391	185	206
Tributary B (0.0 - 0.75)	71	34	37
 	<hr/>	<hr/>	<hr/>
TOTAL	1038	426	612

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (RM)</u>	<u>TYPE</u>	<u>ID#</u>	<u>PASSABLE</u>	<u>RECOMENDATIONS*</u>
15.15	<b>Logjam</b>	<b>J1</b>	P	Low priority
15.2	Diversion structure		N	Modify for passage
15.7	<b>Logjam</b>	J2	P	Low priority
15.75	<b>Logjam</b>	<b>J3</b>	P	Low priority
16.1	Falls	<b>F1</b>	<b>P</b>	Low priority
16.45	<b>Logjam</b>	<b>J4</b>	<b>P</b>	Low priority
16.7	<b>Logjam</b>	<b>J5</b>	<b>P</b>	Low priority
16.8	17% gradient	<b>B1</b>	<b>P</b>	Low priority
16.81	<b>Logjam</b>	<b>J6</b>	<b>P</b>	Low priority
17.25	20% gradient	<b>B2</b>	<b>N</b>	Modify for passage
17.6	Chute (23% gradient)	<b>B3</b>	<b>N</b>	Modify for passage
18.2	22% gradient	<b>B4</b>	<b>N</b>	Modify for passage
Tributary B (RM 0.4)	22% gradient	<b>B5</b>	<b>N</b>	Low priority, limited habitat above

LEGEND:  
 F = full passage  
 P = partial passage  
 N = no passage

\*Refer to special case form for barrier characteristics.

TYGH CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	MILES		REARING			SPAWNING		COMMENTS
	Avail.	Pot.	P:R	Area	Depth	1-3"	3-6"	
I (14.0-16.4)	1.2	1.2	5:5	3	1	184	129	Diversion structure at RM 15.2 is complete barrier.
II (16.4-17.4)	0.0	1.0	6:4	3	2	35	23	High gradient sections ( 17%) at RM 16.8 and 17.5.
III (17.4-18.2)	0	0.8	5:5	2	1	51	15	Chute and high gradient boulder cascade (RM 17.6 and 18.2, respectively).
IV (18.2-20.1)	0	1.9	5:5	1	1	179	9	
Tributary B	0	0.75	4:6	1	1	7	11	
TOTAL	1.2	<u>5.65</u>				456	187	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R: Ratio of pool length:riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (14.0-16.4)	25	75	15	30	Var	S+M	1-2	1-2	M
II (16.4-17.4)	30	60	10	25	Var	S+M	1-2	1-2	L
III (17.4-18.2)	70	80	30	10	Perp	S+M	1-2	1-2	L
IV (18.2-20.1)	70	90	70	80	Perp	S+M	1	1-2	L
Tributary B	35	100	40	90	Perp	S	1-2	1-2	L

LEGEND: Total: Percent of total habitat area dependant on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TYGE CREEK

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANEFULL CONDITIONS

<u>Reach (R.M.)</u>	<u>SUMMER</u>				<u>BANEFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>Q</u>	<u>W</u>	<u>D</u>	
I (14.0-16.4)	<b>8</b>	<b>.5</b>	<b>1</b>	<b>4</b>	13	2	60-200+
II (16.4-17.4)	8	.3	1.5	3.5	12	2	30-60
III (17.4-18.2)	6	.4	1	2.5	7	1	50-60
IV (18.2-20.1)	3	.2	1.5	1	4	.5	15-35
Tributary B	4	.3	1	1	6	1	70

LEGEND:

w,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q= Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>	<u>A/W A/W</u>	
I (14.0-16.4)	9/12,14/83	4	85	E	52/50-62/57		1200-1700
II (16.4-17.4)	9/14/83	4	95	SE	54/47-60/50		1525-1700
III (17.4-18.2)	9/14-15/83	2	<b>80</b>	SE	55/47		1600-1800
IV (18.2-20.1)	9/15,20/83	1	75	NE	40/39-54/46		1340-1745
Tributary B	9/15/83	2	<b>90</b>	<b>E</b>	<b>57/47</b>		1315

TYGH CREEK  
TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR VALLEY</u>		<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>FP (ft)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special</u>	<u>Habitat</u>
			<u>Con.</u>	<u>Dec.</u>					
I(14.0016.4)	7.0	135	5	2	1	I			2
II (16.4-17.4)	5.3	45	5	4	1	I			2
111(17.4-18.2)	4.8	55	4	3	0	I			
IV (18.2-20.1)	7.4	25	4	4	1	I	M	S	5
Tributary B (0.0-0.75)	4.7	70	4	5	0	II			

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain width in feet  
 H.U. : #Habitat units A \_ 4; M = 2-3; L \_ 1  
 Con: # Conifer species  
 Dec: # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands;  
 H 50%; M = 25-50%; L 25%  
 Size: Size of wetlands  
       S = small (less than 1 acre)  
       L = large (greater than 1 acre)

KAnderson:paw (WP-PJS-5275N)



The stream gradient in Reach 1 is low (4%) and has an even pool-to-riffle ratio (P:R=5:5). The substrate is predominantly boulder and rubble. Rearing habitat is fair with pools averaging 3 square yards and shallow depths. Spawning habitat is good, with 363 square yards of gravels counted. Most are in small pockets (2 sq. yds.) along the stream margins. (Photo at RM 14.5.)



The diversion structure at RM 15.2 is a complete barrier to fish migration which blocks an additional 6.85 miles of potential fish habitat. The structure is about 5 feet high and has a good size pool below it (20 sq. yds.). At the time of the survey, no flows were diverted; however, it has been reported that as much as 80% of the stream low flow (3.5 cfs) was diverted to the ditch line.



In Reach II, the stream gradient increases to high (10%). The substrate size class also increases, with large boulders functioning as the main structural component. Pool size is slightly smaller (2 sq. yds.) than Reach I; however pool depths and effective cover are greater.



Pool sizes and gradient are variable in Reach III (RM 16.4 shown). Boulder-rubble sections are 8% gradient, with low quality pool development. Other interspersed sections are influenced by large woody debris (LWD) with associated large sediment plain development. Pools behind the LWD are larger (6-10 sq. yds.) but have shallow depth and low effective cover. Pool area dominates the boulder-rubble sections (70%).



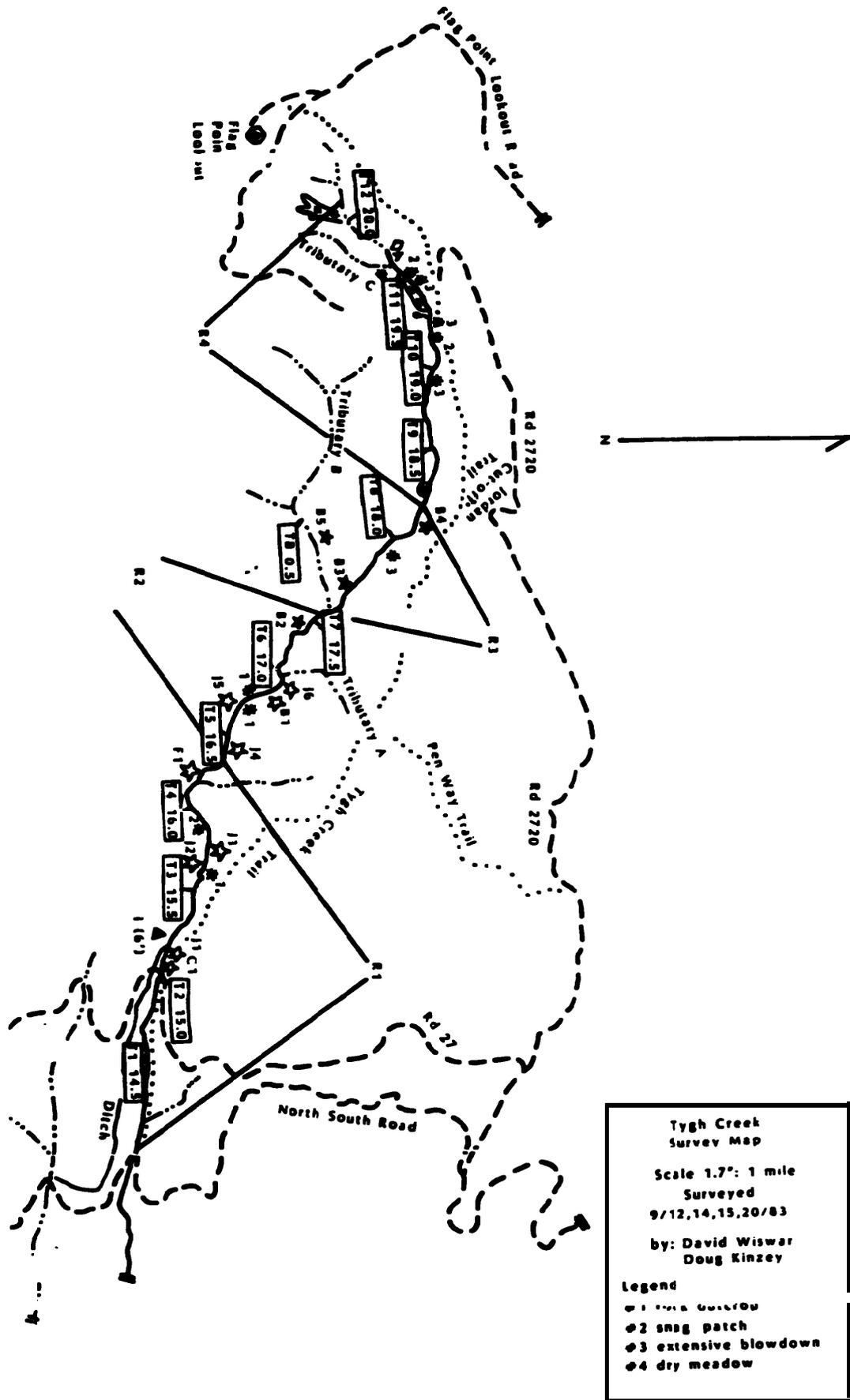
Reach IV contains the highest concentrations of spawning gravels, totaling 391 square yards (photo at 17.9). Good and marginal quality gravels occur in about even amounts. Beds of 3-4 square yards are commonly located behind instream LWD. LWD influenced 70% of the total gravel retention. About 50% of the gravels are suitable for anadromous fish.

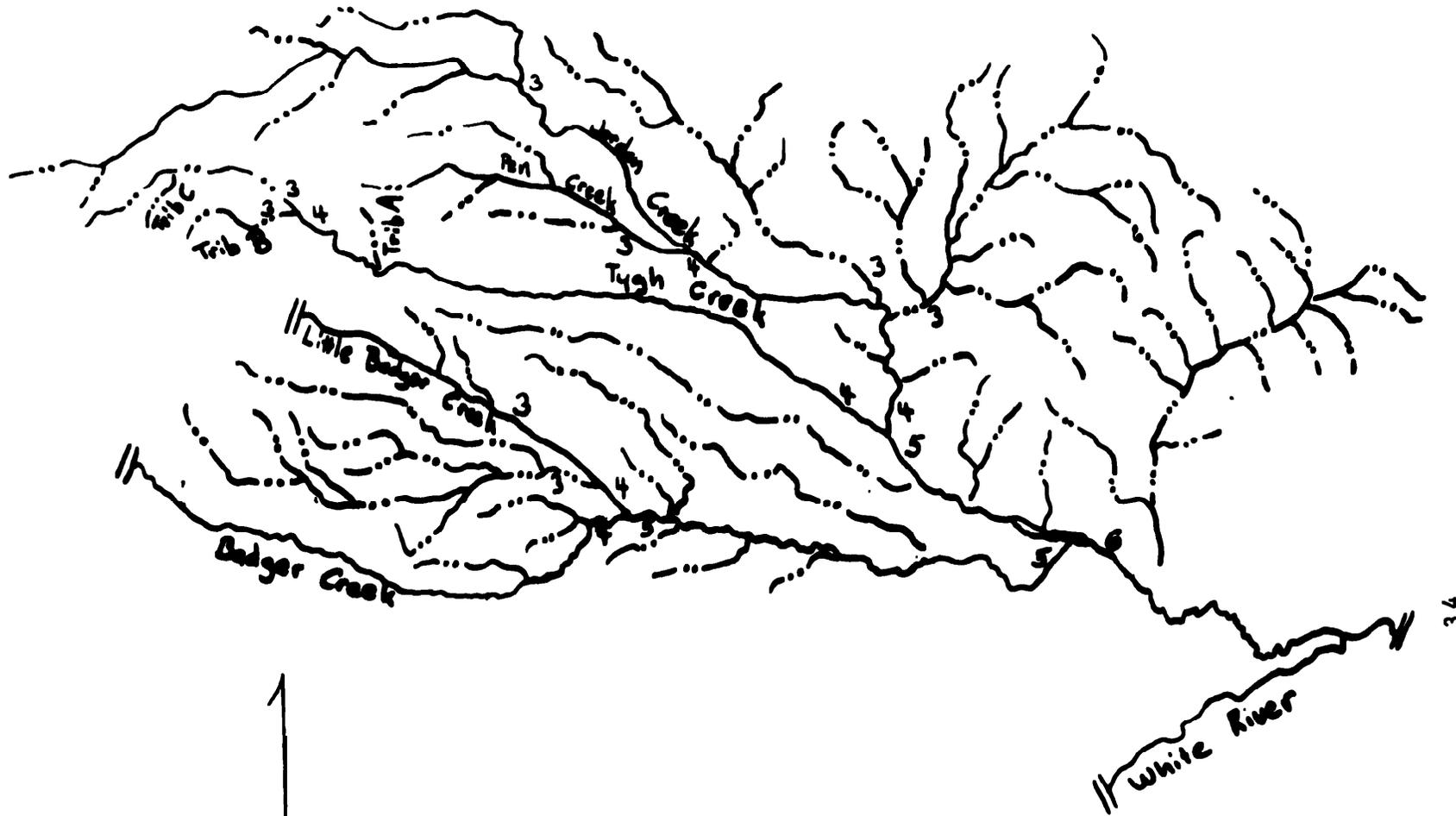


Reach IV has high quality riparian habitat which includes five-special habitat units (grassy wetlands, spring line, dry meadow and this large snag patch at RM 19.5). Most of the snags are lodgepole pines, although larch are also common.



Substrate composition in Tributary B (R.M. 0.7 shown) is predominantly gravel and rubble intermixed with large woody debris. Pools are small and shallow but have high effective cover. Pacific yew is common along the stream margins with an overstory comprised of hemlock and cedar.





**Stream Order 6th**

**TYGH CREEK**

**Scale 0.5 in: 1 mi**

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

R<sub>1,II,III</sub> REACH # and SECTION

T<sub>1</sub> 1.0 TRANSECT # and RIVERMILE

★ OBSTRUCTION                      ★ BARRIER

J<sub>1,2,3</sub> JAM and #  
 F( )<sub>1,2,3</sub> FALLS, HEIGHT, and #  
 C<sub>1,2,3</sub> CULVERT and #  
 B<sub>1,2,3</sub> CHUTE and #

▲ DIVERSION STRUCTURE (I - water Is used for irrigation purposes)

⚡ MINE or PIT SITE

— BRIDGE

↪ LANDSLIDE, SLUMP

⚡ DEBRIS TORRENT TRACK

— SPRING

◇ UPPER LIMIT OF FISH PRESENT (A - limit of potential anadromous fish habitat)

▲ BANK EROSION (EXTENSIVE/SEVERE)

\* 1,2,3, : MISCELLANEOUS

☪ WETLAND HABITAT

— ROAD AND ID NUMBER

☪ EARTHFLOW

BADGER CREEK  
BARLOW RANGER DISTRICT

Surveyors: Jeff Uebel county: Wasco, Hood River  
Tom Cain

Dates Surveyed: August 30-31, 1983 Mouth Location: T4S, R13E, Sec. 5  
September 1-15, 1983

Tributary to: Tygh Creek Watershed Area: 32,000 acres  
50 sq. miles

Drainage: Deschutes Stream Length: 22.1 miles

Distance Surveyed:  
17.1 miles mainstem  
0.2 miles Gumjuwac Creek

TRI Compartments: Morrow 1420 Average Low Flow Width: 12 feet  
Sling 1419  
Grasshopper 1418 Stream Order: V  
Pine 1407  
Drop 1406  
Badger 1405

Game Fish: Rainbow Trout

Potential Anadromous Species: Chinook  
Steelhead  
Coho

Average Fish Habitat Condition Rating: 7.0 (Good)

Average Riparian Condition Rating: 6.7 (High)

## BADGER CREEK

### Survey Summary

#### A. Stream Summary

Badger Creek heads in Badger Lake and flows east 22 miles to its confluence with Tygh Creek. Ninety percent of low flows (20 cfs) are diverted at RM 15.3 into the Highland Ditch for field irrigation. Fish habitat quality is substantially impacted for three miles downstream by the flow reduction (flows increase from 2 to 5 cfs in this area.).

The drainage area is approximately 32,000 acres (50 sq. miles) with almost 90 percent (29,008 acres) lying on Mt. Hood NF. Approximately 2,000 acres of the drainage within the contiguous Forest boundary are owned by the State of Oregon and private landholders. The upper 60 percent of the Badger Creek drainage, as well as part of the adjacent drainage of Tygh Creek, is included in the proposed Badger Creek Wilderness Area which is part of the Oregon Forest Wilderness Act of 1983 (RR 1149). This proposal is currently awaiting deliberation by the Senate.

Road access to most of Badger Creek is poor. Forest Service Road S-4860140 provides access to Badger Lake (RM 22.0) and the head of Badger Creek Trail. This trail closely parallels the north side of the stream down to Bonney Crossing (RM 11.7). Good access is found at Bonney

Crossing where S-2710 crosses the stream and S-2710140, S-2710160, and a spur road roughly parallel the stream moving downstream along the valley rim. Bonney Crossing Campground is located in the valley bottom at the road crossing (RM 11.7); this area appears to receive heavy recreational useage. The Oregon Department of Fish and Wildlife (ODPW) currently uses this area to stock legal size rainbow trout into Badger Creek.

A total of 17.1 miles of Badger Creek's mainstem (RM 5.0-22.1) and 0.2 miles of Gumjuwac Creek were surveyed August 29-31, and September 1-15, 1983. The area from the mouth to RM 5.0 was surveyed in the summer of 1983 by ODFW personnel.

B. Geomorphology and Watershed Characteristics

The valley configuration is typically a flat-bottom V with moderate to steep sideslopes. Upper slopes are talus up to a vertical rock rim (100 ft. high). The floodplain width generally decreases moving upstream. It ranges from about 150 ft. at RM 5.0 to about 40 feet near the headwaters. Perennial tributaries (excluding Little Badger Creek, refer to survey for information) are generally small. All are located above RM 17.0. The largest are Gumjuwac Creek, which contributes 35 percent (5 cfs) of the combined low flow with Badger Creek, and Pine Creek, contributing 10 percent (2 cfs). The flow regime of Badger Creek appears flashy, likely due to the abundance of short, steep first and second order intermittent tributaries. Several of these observed had

recently experienced sluice-outs (RM 12.6, 12.8, 14.1). The mainstem appears heavily scoured throughout the survey area below the confluence with Gumjuwac Creek, RM 20.0.

c. Reach Descriptions

Three reaches were delineated and are distinguished by gradient, flow, pool to riffle ratio, and shading. Reach I is evenly balanced with pools and riffles, has a very low gradient (1 percent), and low shading (30 percent). Reaches II and III are riffle dominated with increased gradients and shading. The average flow in Reach III is more than triple the flow in Reach II, due to the irrigation diversion at the reach break.

D. Fisheries

The overall habitat condition rating is 7.0 (good). Moderate numbers of rainbow trout were observed throughout the survey area. The mainstem habitat appears suitable for steelhead trout, chinook, and coho salmon. Additional tributary habitat for anadromous species exists on Little Badger and Gumjuwac Creeks.

Pool rearing area is good throughout with moderate to large size pools (averaging 10-20 sq. yds.) and low to moderate (1-2 foot) depths. Effective cover is moderate (Reaches I and II) to high (Reach III) and is predominantly provided by the boulder substrate and water turbulence.

Spawning habitat is fair, with 65 percent of the 1,873 sq. yds. of gravels counted rated marginal quality due to poor channel placement.

Seventy-five percent are of a size class suitable for anadromous utilization. Most gravels are located in small pockets along stream margins at about the mean high water level.

Passage is good through Reaches I and II with only one partial barrier logjam present. The diversion dam at RM 15.3 is a total barrier which restricts access to the additional 7.2 miles of potential anadromous habitat in Reach III. Reach III has several barriers (chutes, falls, and logjams) which would need to be modified if all potential anadromous habitat is to be utilized.

#### E. Riparian Area

The overall riparian condition rating is 6.7 (high). Positive factors influencing this score include the wide floodplain development (Reach I), good overstory diversity including deciduous and coniferous species (Reaches I and II), and good representation of special habitats, especially talus slopes, rock cliffs and snag patches. Negative factors include the limited floodplain width of Reaches II and III, the low levels of floodplain wetland development, and reduced vegetative cover and bank stability due to cattle grazing (RM 5.7-7.0). Signs of wildlife were abundant, including sightings of beaver, mink, turkey, and other game and non-game wildlife.

F. Rehabilitation and Enhancement

Enhancing passage at logjam J6 (RM 8.3) and at the diversion dam (RM 15.3) would access up to 10 miles of high quality salmonid habitat and therefore should be given the highest relative priority. Abundant opportunities exist for enhancing pool rearing habitat quality and quantity throughout the mainstem, as well as off-channel rearing habitat in Reaches I and II. The Highland ditch diversion inlet could be screened to prohibit loss of trout and (potentially) anadrowus fish juveniles from the system. Increasing spawning habitat through installation of gravel catchment structures would improve the mainstem habitat conditions for anadrowus fish. Riparian rehab/enhancement opportunities include fencing and revegetation of areas impacted by cattle grazing, and revegetating campground areas, especially at Bonney Crossing and Badger Lake. Small ponds could be created on the mainstem or in riparian areas to help supplement low flows, improve rearing conditions and riparian wildlife habitat.

G. Special Interest

The Highland Ditch, constructed in 1915, is the major water source to Pine Hollow Reservoir. Also, the area from RM 10.3 to 11.5 is located on the

margin of the 1974 Rocky Bum. The fire in this area had relatively low heat intensity which resulted in good snag development within this section. Subsequent regeneration in the floodplain and sideslope area has created excellent wildlife habitat.

## BADGER CREEK

### Reach Summary

#### Reach I; RM 5.0-8.0

1. The valley configuration is a wide (200-300 ft.) flat bottom V, with broad valley bottom terraces and an average floodplain width of 130 feet.
2. The stream gradient is very low (1-2 percent).
3. The riffle substrate composition is predominantly boulder/rubble (65 percent).
4. The pool to riffle ratio is balanced (P:R=S:S). Bedrock outcrops are common, which have created long, large pool areas.
5. Shading is low (30 percent) due to a sparse overstory and a wide (30') stream channel.

#### Reach II: RM 8.0-15.3

1. The valley bottom narrows and the average floodplain width decreases to 70 feet. Stream adjacent terraces (100 ft.) are discontinuous, and found primarily along the north bank.

2. The gradient increases to 3 percent.
3. The riffle substrate size increases with boulders composing 70 percent.
4. Riffles increase to 70 percent of the stream area.
5. Shading doubles from Reach I levels (60 percent) as the overstory density increases and topographic shading begins to occur. Bedrock cliffs commonly form the south bank of this reach.
6. An atypical stretch occurs between RM 10.3-11.5, (above a short bedrock gorge area). The valley bottom and floodplain width are generally wider and the gradient is lower (1-2 percent). The substrate size is small boulder/rubble as the stream actively meanders through large depositional plain created by old logjams. LWD is important for providing channel structure in these sediment plains.

Reach III; RM 15.3-22.1

1. The average floodplain width decreases to 40 feet as the valley becomes a narrow V-notch and the stream channel is entrenched (10-15 ft.) in bedrock.
2. The gradient increases to 6 percent.
3. The substrate remains boulder dominated (60 percent).

4. The pool to riffle ratio is similar to Reach II.
5. Shading increases to 80 percent.
6. An atypical area begins at RM 21.8 and extends to the spillway of Badger Lake (RM 22.1). The gradient is low (1-3 percent), and channel braiding is common. LWD plays a major structural role in habitat development, which is atypical for this predominantly boulder controlled stream. Wetland development is high in this area.

## **BADGER CREEK**

### Fish Habitat Summary

Approximately 23.3 miles of potential anadromous fish habitat exists within the Badger Creek drainage above RM 5.0. This includes 17.0 miles of mainstem habitat and a combined 6.3 miles of habitat in Gumjuwac and Little Badger Creeks (See Little Badger Creek Survey). The mainstem habitat appears suitable for steelhead (RM 5.0-22.1), as well as chinook (RM 5.0-20.0), and coho salmon (RM 5.0-15.3). Badger Lake (RM 22.1), with a surface area of 35 acres, could potentially be utilized to rear juvenile anadromous fish (including sockeye salmon) to seed the Badger Creek system. Primitive road access is available to this lake.

#### Reach I; RM 5.0-8.0

1. The habitat condition rating is 6.9 (fair to good). A flow of 5 cfs was consistent through this reach and is one-fourth of the amount observed above the diversion dam at RM 15.3.
2. Pool rearing habitat is good. Pools comprise 50 percent of the stream area and are typically large (20 sq. yds.) with moderate depths (1-2 feet) and low to moderate effective cover. The largest pools are generally created on the outside of stream bends where the stream flow is directed

against bedrock sidewalls. These pools may also provide fair to good holding areas for potential anadrowus species (especially summer steelhead).

3. Moderate amounts of spawning gravel were observed (381 sq. yds.), of which 60 percent were rated marginal due to poor channel placement. Seventy percent of the gravels are of a size class suitable for anadrowus utilization.
4. No migration barriers were observed.
5. Water temperatures as high as **65°F** were recorded in this reach. Summer water temperatures could be a concern, especially in long, hot drought periods.

Reach II; RM 8.0-15.3

1. The fish habitat is fair (HCR=5.9), largely due to reduced flow below the irrigation diversion at RM 15.3. The amount of flow seeping through the diversion was 2 cfs. Flows increase to 5 cfs at the lower end of this reach (RM 8.0).
2. The quantity of pool rearing habitat decreases; the reach is riffle dominated (70 percent) and the average pool size decreases to 8 sq. yds.

The pool quality remains similar to Reach I with moderate (1-2 ft.) depths and moderate effective cover provided by the boulder substrate.

3. The spawning habitat is fair. Over 60 percent of the 878 sq. yds. of gravel are rated marginal due to poor channel placement. Seventy percent are in the anadrowus size class.
4. A logjam (J6, RM 8.25) creates a partial passage barrier to potential anadrowus migration. The diversion dam (D, RM 15.3) marks the upper extent of Reach II. The dam is 2.5 feet high with a 4 foot long cement apron which restricts jump pool development. It is a total upstream migration barrier to adult fish as well as an obstruction to downstream juvenile fish migration.

Reach II; RM 15.3-22.1

1. The fish habitat improves with the increased flows above the diversion dam. Flows were 20 cfs at the dam and averaged 15 cfs for the reach. The habitat condition rating is 8.2 (excellent).
2. The pool to riffle ratio is similar to Reach II (30:70). The pool quality is greatly improved. Pools are moderate size (14 sq. yds.) with depths averaging 1-3 feet and high effective cover. Numerous exceptionally high

quality pools (greater than 3 feet deep with high effective cover) were associated with bedrock outcroppings and could provide good holding habitat.

3. Spawning habitat is similar to the previous reaches. Approximately 60 percent of the 634 sq. yds. of gravel observed are marginal due to channel placement and 70 percent are of a size class suitable for anadromous species.
4. Several passage obstructions occur between RM 18.2-19.3 and include chutes (B1-B4), falls (F1-F2), logjams (51-32) and an impassable log sill at RM 18.3. The chutes and logjams would require minor modifications to enhance passage. The falls range from 4-15 feet in height and would likely require a higher degree of planning to modify.

Gumjuwac Creek; RM 0.0-0.2

1. Fish habitat is rated 4.9 (poor to fair).
2. Rearing habitat is fair, with riffles and cascades dominating (70 percent) the stream area. Stream gradient is steep, 12 percent. Pools average 2 sq. yds. in area, moderate depth (1-2 ft.) and have moderate effective cover.

3. Spawning habitat is limited. Eighteen sq. yds. of gravel was observed. About 45 percent were rated marginal and 80 percent of a size class suitable for anadrowus fish.
  
4. A four foot log sill with no jump pool at RM 0.1 forms an impassable barrier. High gradient above this point likely makes passage enhancement a low priority. An estimated 0.4 miles of potential anadrowus habitat extends above the sill.

## BADGER CREEK

### Riparian Habitat Summary

Two distinct vegetative zones and a transitional area occur along Badger Creek: (1) An overstory of predominantly ponderosa pine and oak with large grass clearings on the wide valley floor typifies the area from RM 5.0 to approximately 13.0. The sideslopes in this stretch are generally talus and felsemeer with rock cliffs along the valley rim; (2) A transitional area (RM 13.0-17.0) shows a gradual change in deciduous species from oak and alder to cottonwood and big leaf maple towards the upstream end. Also, the presence of cedar increases while ponderosa pine decreases. The sideslopes are steep with occasional oak and grass clearings in the moderately wide valley bottoms; (3) A predominantly dense cedar/hemlock overstory is present from RM 17.0 to 22.1. The sideslopes are heavily forested with intermittent talus slopes. The valley is V-notch shaped, with little floodplain or valley bottom development.

The riparian understory, ground cover and bank stability has been heavily impacted by cattle grazing from RM 5.7 to 7.0. A range fence at RM 7.0 limits grazing above this point. The Forest boundary occurs at RM 6.3.

Wildlife sign and sightings in the survey area included beaver, mink, deer, elk, wood ducks, golden eagle, ruffed grouse, and wild turkey. The valley is heavily utilized as a travel corridor by big game. Ladybugs, apparently

preparing to over-winter, were also observed concentrated in masses covering patches of vegetation and the ground along several miles of the stream.

The general lack of road access and low levels of harassment within the riparian habitat gives this area a disproportionately high value for wildlife.

#### Reach I; RM 5.0-8.0

1. The Riparian Condition Rating is 7.3 (high).
2. The floodplain is wide (130 ft.) in the flat bottom "V" valley.
3. An average of four habitat units are present. Large saw timber is generally scarce.
4. The sparse overstory is a mix of conifers and deciduous species including Douglas-fir, a true fir, ponderosa pine, oak, and red alder.
5. An average of two special habitat units are present with the predominant ones being rock cliffs and dry grass meadows.

#### Reach II; RM 8.0-15.3

1. The Riparian Condition Rating remains high (RCR=7.4).

2. The floodplain width decreases to 70 ft. as the valley narrows.
3. Four habitat units are present. The presence of grass/forb is greatly reduced while the occurrence of large saw timber is increased.
4. The overstory averages a mix of 4 conifers and 2 deciduous species with the addition of cedar, cottonwood, and big leaf maple to the species list of Reach I.
5. Similar to Reach I, an average of two special habitats are present between transect points including rock cliffs, dry meadows, talus slopes, and snag patches (which are predominantly located between RM 11.0-11.5 and are remnants of the Rocky Bum of 1974).

Reach III; RM 15.3-22.1

1. The Riparian Condition Rating decreases to 5.6 (moderate).
2. The floodplain width decreases to 40 feet.
3. Four habitat units are present (shrub/seedling/sapling, poles, small and large saw timber).
4. An average of four conifer species make up the overstory. No deciduous species are included in the overstory, although cottonwood was

occasionally observed between RM 15.3-18.0. Its presence and role in the riparian overstory is very limited.

5. Small wetlands (RM 21.9-22.1) and bedrock cliffs are the predominant special habitats.

Gumjuwac Creek; RM 0.0-0.2

1. The riparian conditions were rated 4.4 (moderate).
2. Floodplain is narrow (15 ft.)
3. Four habitat units are present (shrub/seedling/sapling, pole, small and large saw timber).
4. Four conifer species are well represented (cedar, hemlock true and Douglas-fir).
5. No special habitat units were observed.

## BADGER CREEK

### Rehabilitation and Enhancement Summary

#### Passage Enhancement, RM 8.3-19.3

Several logjams (RM 8.3, 19.0, 19.3) chutes and falls (RM 18.2-19.1) and a diversion structure (RM 15.3) present partial to full migration barriers for salmonids. Alteration of log jam J6 (RM 8.3) and the diversion structure (RM 15.3) to provide passage would appear to be a very high priority if anadrowus fish are introduced to the Badger Creek system. This would access ten additional miles of high quality holding, spawning, and rearing habitat for chinook and steelhead. Altering the barriers RM 18.2 to 19.3 for passage would be comparatively easy and would access 3 additional miles of fair-good quality habitat for steelhead. The value of this added anadrowus habitat may be outweighed however by its value as an area for wild trout management.

If anadrowus fish are introduced above the diversion structure, the inlet to the ditch should also be screened to prevent loss of smolts to the irrigation system.

#### Rearing/Holding Pool Enhancement, RM 5.0-15.3

Pool depth in Reaches I and II may limit present resident trout and potential anadrowus fish habitat capability. Pools in this area generally lack volume

and effective cover during low flow conditions. This is largely due to the diversion of 90 percent of the streamflow to the Highland Ditch (RM 15.3). Holding habitat quality (particularly depth) for anadromous fish is greatly lessened by this flow reduction. At high flow, the amount and quality of pools decrease due to the general lack of large channel structure (P:R decreases from 4:6 to 2:8). Relatively safe, protected overwintering habitat is particularly important considering the very flashy flows and high bedload movement in the mid and lower reaches of Badger Creek.

Increasing pool depth (principally), area and effective cover appears to be a high priority for improving habitat capability for salmonids, particularly in Reach II (RM 8.0-15.3). This could be accomplished through pool excavation, installation of large channel structure and/or increasing low flow discharge past the diversion structure. In-channel work will likely be very limited due to the remote character of the drainage and the relatively large size of material needed to construct and maintain a structure in the high flows of Badger Creek (i.e., 3 ft. diameter boulders). Felling and anchoring large logs (available on-site) in the channel using hand tools and labor may be an option in remote sections.

An excellent opportunity is available at Bonney Crossing (RM 11.7). Good heavy equipment access and bedrock and boulder substrate are present; habitat improvement through pool blasting and/or constructing boulder clusters or

berms (using on-site material) could be implemented at this site. Enhancement activity in this area would have additional recreational benefits (fishing, swimming, etc.) due to the adjacent campground area.

#### Spawning Habitat Enhancement, RM 5.0-15.3

Spawning habitat is relatively scarce and patchy in distribution throughout the potential anadromous habitat on Badger Creek. Gravel area averages 90 sq. yds. per mile, with 65 percent rated marginal due to poor channel placement. The sections from RM 7-8 and 11-16 are particularly low in gravels. This condition appears to be related to the lack of large channel structure necessary for gravel catchment in these areas. Providing additional channel structure in these areas would likely improve habitat capability for anadromous fish. Project design and implementation will be complicated by the lack of access and flashy nature of the stream. Project design could be integrated with rearing habitat enhancement (see above) for added benefit. The Bonney Crossing area would appear to be a high priority site for initial treatment.

#### Side-Channel Rearing and Riparian Habitat Improvement, RM 5.0-17.0

Broad valley bottom terraces (100-300 ft. wide) are common along Badger Creek throughout this area (except for an atypical gorge section RM 8.4-10.3) The terraces are broader in the downstream reaches (especially RM 5.0-8.4). These areas provide an opportunity to increase rearing areas through the creation of

small side channels. In some cases, old stream channels or intermittent tributary channels are present, and could easily be converted to perennial flowing stream areas with a small diversion structure. In other areas, Badger Creek has downcut 5-10 feet below the terraces. At these sites, supplying flow to and constructing proposed sidechannels may be more difficult.

Constructing these channels would provide refuge habitat for fish during high flows (and heavy bedload movement) as well as provide excellent juvenile rearing habitat. They would also create additional benefits through riparian habitat enhancement. Greatly added benefits to fish and wildlife could be expected if side channel development was coupled with the creation of ponded areas in the terraces. An excellent opportunity for this type of improvement is located in the broad terrace on the south bank at RM 11.4-11.5. Heavy equipment access appears to be limited to this area, adjacent to the Bonney Creek campground. The terrace is in the Rocky Bum area, with abundant snags and relatively high wildlife habitat diversity. Pond and/or side channel development would improve the habitat for fish, big game, furbearers and waterfowl. Pond development in these areas may also help supplement summer low flow conditions downstream in the main channel. Project planning should take into account the potential of reducing mainstem low flow habitat in areas adjacent to these project areas, if flow is diverted to side channels and ponds.

Riparian Rehabilitation, RM 5.7-7.0, 11.7, 21.8-22.0

Riparian vegetation has been heavily impacted by grazing RM 5.7-7.0. Reduced vegetative cover, compacted soils, and bank erosion due to livestock activity has decreased the riparian quality and bank stability in this area. Complete removal of the coniferous canopy (logging) plus the grazing damage has virtually eliminated stream shading and encouraged channel widening to occur. Management of grazing to enhance revegetation of the banks in this area would greatly improve fish habitat. Heavy recreational use at the Bonney Crossing (RM 11.7) and Badger Lake campgrounds (22.0) has denuded large areas of the valley bottom and stream banks, with much ground compaction evident. Management to decrease human impact, possibly coupled with educational exhibits, could assist in the recovery of the area. Both grazing and recreation damaged areas could benefit from seeding and planting to reduce surface erosion.

Forest Service Road S-2710 has inadequate cross drainage and drainage now is occurring down the road surface. This could be a source of sediment introduction into Badger Creek. The addition of waterbars, ditching and/or culverts along the road surface could prevent further erosion.

Badger Creek

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM							POOLS							RIFFLES (%)				
	HCR	S	P:R	G	d	A	EC	-	6-12BR	1-6"	.1-1"	SD	D						
I (5.0-8.0)	6.9	30	5:5	1	L	20	M	*	30	35	30	*		5					
II (8.0-15.3)	5.9	60	3:7	3	L-M	8	M	*	70	20	10	*		4					
111(15.3-22.1)	8.2	80	3:7	6	M	14	H	*	60	20	10	*	*	6					
Gumjuwac Cr. (0.0-0.2)	4.9	80	2:8	12	L-M	2	M	-	70	10	20	-	-	4					

LEGEND: ECR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq$  12", M = 12 - 29", H  $\geq$  30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq$  40%, M = 40-60%, H  $\geq$  60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

Badger Creek

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>Reach</u>			<u>Tributaries</u>					
	I	II	III	Little	Badger	Pine	Gumjuwac	D	A
Rainbow Trout - a	M	M	M	L		(L)	M	(L)	(L)
Rainbow Trout - j	M	M	L	L		(L)	L	(L)	<b>(L)</b>

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (RM 5.0-8.0)	361	142	219
II (RM 8.0-15.3)	878	303	575
III (15.3-22.1)	634	256	378
Gumjuwac Cr.	18	8	10
Trib I	60	30	30
<b>TOTAL</b>	<b>1,951</b>	<b>739</b>	<b>1,212</b>

Badger Creek

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
8.25	Logjam	J6	P	Partial removal.
15.3	Diversion dam	D1	N	Develop jump pool
18.2	Chute	B4	N	Modify for passage
18.3	Chute	B3	F	Possible velocity barrier
18.3	Log sill	None	N	Modify for passage
18.9	Falls	F2	N	Modify for passage
19.0	<b>Log jams</b>	J2	N	Modify for passage
19.1	Chutes	B1 and B2	N	Remove logs from B1
19.1	Falls	F1	N	Modify for passage
19.3	Logjam	J1	N	Modify for passage
Gumjuwac (0.2)	Log sill	None	N	None

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

<u>REACH (RM)</u>	<u>Miles</u>		<u>P:R</u>	<u>Rearing</u>		<u>Spawning</u>		<u>Comments</u>
	<u>Avail.</u>	<u>Pot.</u>		<u>Area</u>	<u>Depth</u>	<u>1'-3"</u>	<u>3"-6"</u>	
I (5.0-8.0)	3.0	0	5:5	20	L-2	172	101	
II (8.0 - 15.3)	7.3	0	3:7	8	1	432	209	
III (15.3-22.1)	-	6.8	3:7	14	1-2	334	132	
Total	10.3	6.8				938	442	

Legend: i l . : Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length : riffle length.  
Area: Average pool area (Sq. Yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of Sq. Yards of gravels observed in the 1"-3" and 3".6" size classes.

Badger Creek

TABLE VI - LWD HABITAT QUALITY INFLUENCE

<u>Reach (R.M.)</u>	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (5.0-8.0)	10	5	10	5	P	S/M	1-2	1-2	T
II (8.0-15.3)	30	30	5	20	V	S/M	1	1-2	T
III (15.3-22.1)	40	50	20	30	P	S/M	1-2	2	M
Gumjuwac (0.0-0.2)	20	10	20	20	V	S/M	1-2	2	T

LEGEND:

Total: % of total habitat area dependent on LWD  
 HQ: % of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; P = perpendicular, V = variable  
 #: Number of logs/structure; s = single log, m = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL

<u>Reach (R.M.)</u> <u>(Ft.)</u>	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>Q</u>	<u>W</u>	<u>D</u>	
I (5.0-8.0)	15	.5	.8	5	30	2	130
II (8.0-15.3)	7	.5	1.1	4	28	1.7	70
III (15.3-22.1)	14	.8	1.3	15	20	1.8	40
Gumjuwac (0.0-0.2)	3	.8	1.5	4	12	2	151

w,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 V: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

Badger Creek

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ORIENTATION</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>		
					A/W	A/W	
I (5.0-8.0)	9/15/83	5	30	E	65/5	- 72/65	1300-1630
II (8.0-15.3)	9/1, 9, 12, 14/83	4	60	E	57/4	- 68/58	1200-1900
III (15.3-22.1)	8/29-31/83	14	80	SE	53/51	- 59/53	1500-1730
Gumjuwac (0.0-0.2)	8/29/83	4	80	s	53/48		1700

TABLE IX - RIPARIAN HABITAT SUMMARY

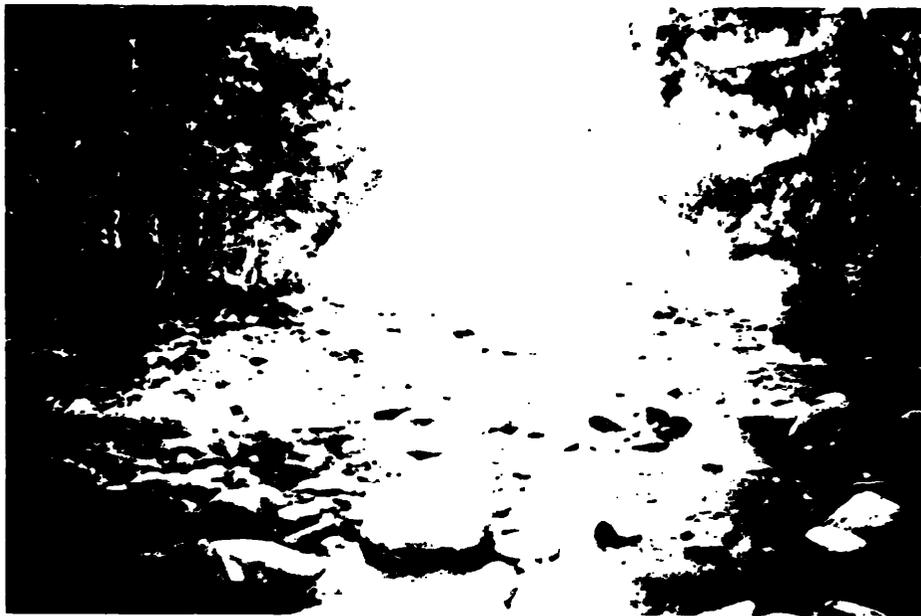
<u>REACH RM</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>		<u>AQUATIC</u>				
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special</u>	
				<u>Con.</u>	<u>Dec.</u>			<u>Habitat</u>	
I (5.0-8.0)	7.3	130	4	3	2	I	L	S	2
II (8.0-15.3)	7.4	70	4	4	2	I	L	L-S	2
III (15.3-22.1)	5.6	40	4	5	0	I	L	L-S	1
Gumjuwac Cr. (0.0-0.2)	4.4	15	4	4	0	II			0

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain width  
 H.U.: Habitat Units H  $\geq$  4; M 2-3; L  $\leq$  1  
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands;  
 H >50%; M 25-50%; L (25%  
 Size: Size of Wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5274N)



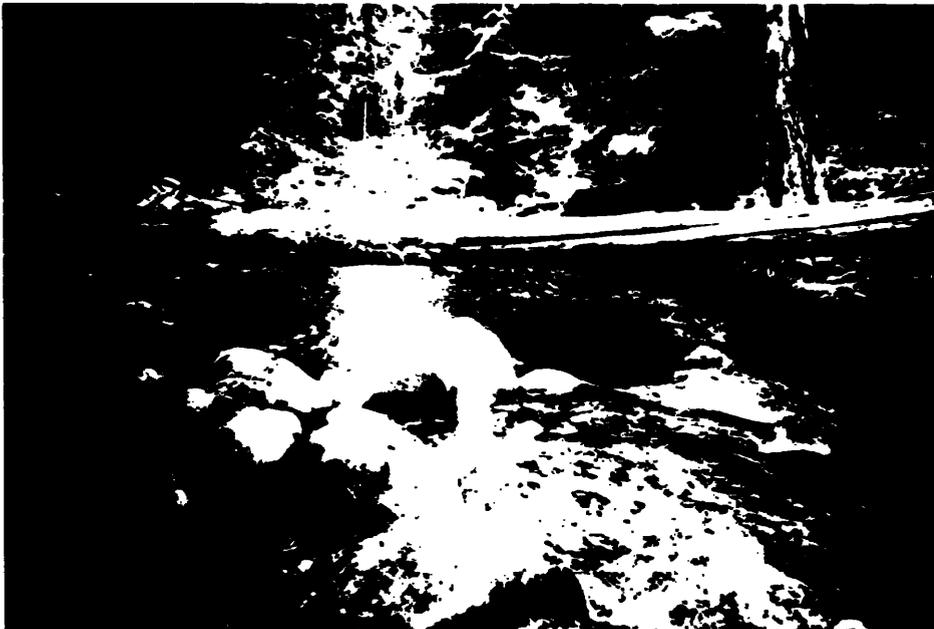
Large pools (20-40 sq. yds.) are created in Reach I where the streamflow is directed against bedrock sidewalls. These pools generally have moderate depths (1-2 ft.) and low to moderate effective cover. These pools provide **good** rearing habitat and some are suitable as holding areas for large fish. **P00** quality could be improved in these areas, however, by increasing effective cover and/or low flow discharge.



Lou flow pool quality in Reaches I and II is greatly reduced by the water withdrawal at RM 15.3. Long sections (0.1-0.2 mi.) in these reaches also lack large channel structural components for pool development. Pool enhancement, possibly using large boulder clusters, or berms, could greatly improve rearing habitat in these reaches. This view at RM 11.5 shows a relatively high priority site for enhancement **adjacent** to the Bonney Crossing Campground.



The diversion dam at RM 15.3 presents a total passage barrier to salmonid migration. The dam is 2.5 feet high with a four foot long cement apron which eliminates jump pool development. If anadromous fish are introduced to this stream, improvement of passage at this structure appears to be a high priority to access up to 7.2 miles of high quality chinook and steelhead habitat. Screening of the ditch Inlet would also be necessary to prevent smolt loss.



Exceptionally high quality pools associated with large boulders and bedrock outcrops are common in Reach III. These pools are typically large and deep (3+ ft.) with high effective cover. They could provide excellent holding and rearing habitat for chinook salmon and steelhead trout.



Reach III contains many potential barriers to anadromous fish migration from RM 18.2 to 19.3, including this waterfall (F2, 15 ft. high) at RM 18.9. Three miles of mainstem and tributary habitat are present above this site. Due to the number of these barriers and the apparent high degree of planning and investment needed for passage enhancement at some sites, modification of these barriers would appear to be a low priority.



Badger Creek heads in Badger Lake (35 acres), 22.1 miles above the stream's confluence with Tygh Creek. A small dam has been installed at the lake outlet which has increased storage capacity and allows regulation of the stream for supply to the irrigation diversion downstream. As a result, the stream from the lake to RM 15.3 has a good baseflow and excellent habitat conditions during summer periods. The lake appears to be suitable for rearing juvenile anadromous fish (chinook, coho, steelhead, and sockeye).

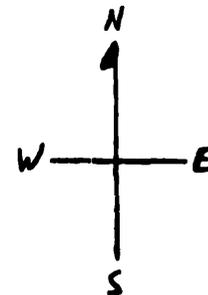


This pond/wetland area (RM 8.2) provides excellent wildlife habitat and could be utilized as an off-channel rearing area by anadromous species (especially coho). Opportunities exist for creating further off-channel rearing areas and increasing wetland wildlife habitat on the wide valley bottom terraces of Reaches I and II. Riparian habitat was rated high overall (RCR-6.7) on Badger Creek, with Reach II providing the highest quality and broadest spectrum of habitats observed (RCR-7.4).

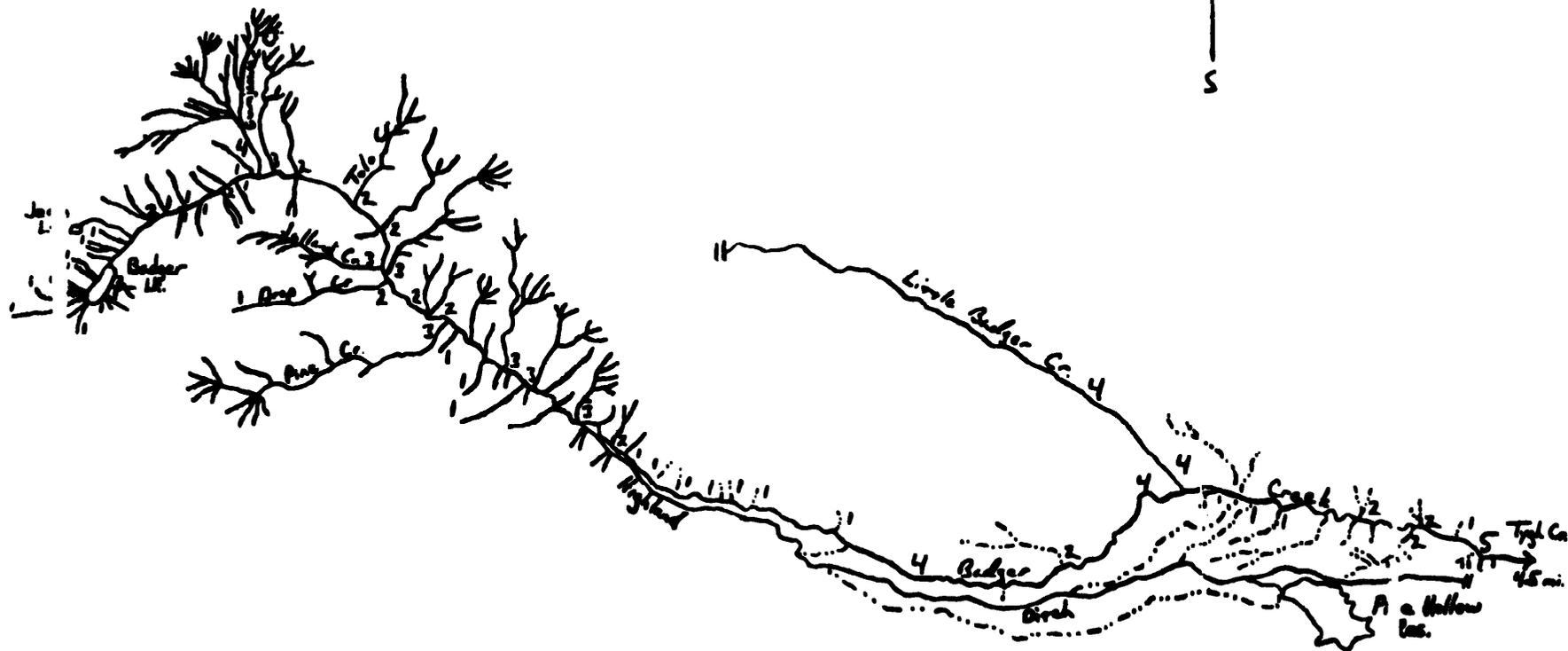


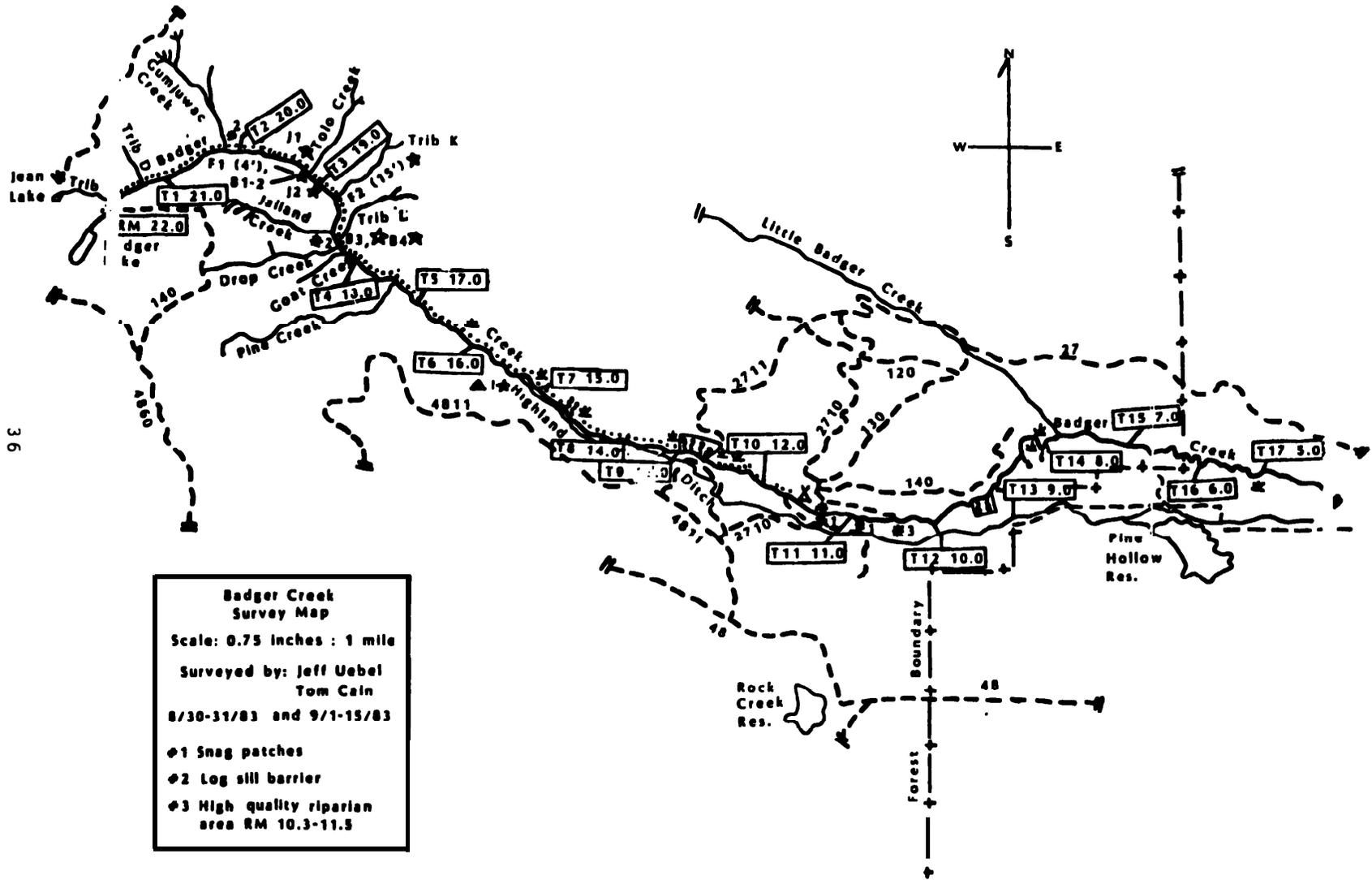
Numerous tributaries occur along Badger Creek but only two, Gumjawac Creek (pictured here) and Little Badger Creek (see survey), appear to contain **potential anadromous** habitat. A four foot high log sill at RM 0.1 **(background) is a potential** migration barrier on Gumjawac Creek. An estimated 0.4 miles of potential steelhead habitat occurs above the barrier. The HCR for Gumjawac is 4.9 (poor to fair); Badger Creek habitat conditions are similar above their confluence (RM 20.0 of Badger Creek).

**Badger Creek  
Stream Order: 5th**



35

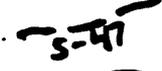




**Badger Creek Survey Map**  
 Scale: 0.75 inches : 1 mile  
 Surveyed by: Jeff Uebel  
 Tom Cain  
 8/30-31/83 and 9/1-15/83

- ♣1 Snag patches
- ♣2 Log sill barrier
- ♣3 High quality riparian area RM 10.3-11.5

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
<b>R<sub>1,II,III</sub></b>	REACH # and SECTION
<b>T<sub>1</sub> 1.0</b>	TRANSECT # and RIVERMILE
 OBSTRUCTION	 BARRIER
<b>J<sub>1,2,3</sub></b>	JAM and #
<b>F( )<sub>1,2,3</sub></b>	FALLS, HEIGHT, and #
<b>C<sub>1,2,3</sub></b>	CULVERT and #
<b>B<sub>1,2,3</sub></b>	CHUTE and #
	DIVERSIN STRUCTURE (I - water. is used for irrigation purposes)
	MINE or ROCK PIT SITE
	<b>BRIDGE</b>
	LANDSLIDE, SLUMP
	DEBRIS TORRENT TRACK
	SPRING
	UPPER LIMIT OF FISH PRESENT (A - limit of potential anadromous fish habitat)
	BANK EROSION (EXTENSIVE/SEVERE)
	1,2,3, MISCELLANEOUS
	WERLAND HABITAT
	ROAD AND ID NUMBER
	EARTHFLOW

LITTLE BADGER CREEK - BARLOW RANGER DISTRICT

SURVEYORS: Kevin Godbout COUNTY: Wasco  
Jeff Uebel

DATES SURVEYED: 8/31/02-9/1/82 MOUTH LOCATION: T3S, R12E, Sec. 32

TRIBUTARY TO: Badger Creek WATERSHED AREA: 16 square miles  
10,000 acres

DRAINAGE: Deschutes STREAM LENGTH: 9.0 miles

TRI COMPARTMENT: Ball, Pine AVERAGE WIDTH: 10 ft.  
1404, 1407

STREAM ORDER: IV

GAME FISH: Rainbow trout  
(winter steelhead)

Average Fish Habitat Condition Rating: 4.9, Poor-fair

Average Stream Stability Rating: 4.4, moderately unstable

Average Riparian Quality Rating: 6.0, moderate

( ) habitat suitable, but major passage work needed for utilization.

## LITTLE BADGER CREEK

### STREAM SURVEY SUMMARY

Little Badger Creek is a major (fourth order) tributary to Badger Creek. This southeast oriented creek originates from Sunrise Spring near the summit of Flag Point and flows approximately 9 miles to its confluence with Badger Creek at RM 7.7 (T3S, R12E, Sec 32). A total of 5.5 miles, from RM 2.0-7.5, were surveyed on August 31 and September 1, 1982. The low flow at RM 2.0 was estimated at 2 cfs.

The majority of this 10,000 acre drainage lies within National Forest System land. The lower 2.0 miles (about 20 percent) of the drainage consist of discontinuous private land holdings. Access in the lower 2.5 miles is fair with road crossings (S-208) at RM 2.0 and 2.4. In the upper drainage access is poor, limited to a hiking trail that parallels the creek up to RM 6.0.

The surveyed reaches lie in a narrow to wide flat-bottomed "V" shaped canyon. This has resulted in variable floodplain development (70 to 200 ft.). Sideslopes are steep and often consist of vertical bedrock walls.

The drainage pattern is pinnate in the survey area and palmate in the lower mile. Most surveyed tributaries were intermittent, short, steep, first or second order and originate from the north bank. Two perennial tributaries (flowing less than one cfs) and several seeps/springs were observed. This

drainage network appears to respond rapidly to inputs of precipitation (snow, rain) and contributes to a flashy flow regime.

Three reaches were identified in the survey area: Reach I, RM 2.0-4.2; Reach II, RM 4.2-5.5; and Reach III; 5.5-7.5. Reach I contains: a wide floodplain (120 to 200 ft.); low stream gradient (5 percent); rubble dominated substrate; riffle dominated stream area (70 percent); good stream shading (80 percent); and high numbers of rainbow trout. Reach II exhibits: decreased floodplain (70 to 120 ft.); increased gradient (7 percent); small boulder-rubble substrate; and decreased shading (70 percent). Within Reach III the valley becomes steep-sided (70 percent slope) resulting in minimal floodplain development (less than 70 ft.); stream gradients are steep (9 to 12 percent); substrate is bedrock/large boulder; numerous waterfalls and chutes are present; and habitat is suitable for low numbers of fish.

Moderate to high numbers of resident rainbow trout occupy the lower 5.5 miles of this system. Potential habitat exists for winter steelhead up to that point as well. Low water temperatures and falls passage barriers appear to limit perennial fish populations above that point (in addition to poor habitat characteristics).

Fish habitat is rated poor to fair overall (4.9 HCR). Pools and spawning gravels are generally limited in quality and quantity. Large physical structural elements in channel (large boulder and bedrock outcrops) are generally scarce and gravel catchment and pool scour are minimal. The potential for fish habitat improvement is high throughout the surveyed

reaches. Spawning habitat development is heavily dependent on large woody debris (LWD) .

Rearing habitat is not well developed. Pool size is uniformly small throughout (averaging 4 sq. yards). Pool area composes 30 to 40 percent of the stream area in low flows, but appears to diminish to 10 to 20 percent in higher flows. Pool depth is low to moderate (6 to 29 inches) and effective cover is moderate. Reach II has the best pool development.

Spawning habitat development is very poor overall. Of the 350 sq. yards observed, 55 percent were considered marginal due to placement in channel. Only about 15 percent of the total were of a size class suitable for the resident trout population present. Potential spawning habitat for anadromous fish (if introduced) is better distributed, although one quarter of the total gravels lie above total passage barriers starting at RM 5.6. Gravel trapment is highly dependant on LWD: over 50 percent of the high quality spawning habitat observed was associated with log sills and small jams. Spawning gravel deposits were best developed in Reach II.

Passage obstructions may be limiting present and potential fish production in this drainage. Several logjams throughout the survey area present upstream migration barriers to trout, but do not appear to be significantly limiting production. They are all likely potentially passable to anadromous fish. However, a series of totally impassable falls (F1-F7) throughout Reach III may be limiting trout production in that reach and prevent potential usage by introduced anadromous fish. Low water temperatures and poor habitat development also act to limit fish production in this reach.

The introduction of anadromous fish to the Badger Creek system could occur if a major falls obstruction on White River was altered for passage. This project has been determined a high priority by the ODFW. Feasibility studies and preliminary evaluation are being planned. It appears that this project has a good likelihood for accomplishment. If anadromous fish are introduced to the Badger Creek system, their management will be complicated by the private ownership on the lower reaches of the drainage and the system of irrigation diversions present. The remote character of Little Badger on Forest lands could provide a spawning and rearing refuge for anadromous fish and appears to warrant efforts to provide migration passage to and from the Forest (especially the higher quality habitat of Reach II).

The stream is rated moderately unstable (SSR = 4.4). Factors responsible for this low rating include: a wide variation in seasonal flows indicating a flashy flow regime; 25 percent bank erosion resulting in unstable stream banks in Reach I; unstable channel bottom in Reach I (30 percent of the substrate detached during high flow periods); and low channel structure. Increased stream bank (Reach II and Reach III) and channel substrate stability and increased flow regulation in Reach III have a positive influence on the score. However, flows of a violent nature appear to be common and act to further reduce the stability rating.

The true zone of riparian vegetation is limited in development (70 ft.). The riparian area quality is rated moderate (RQR = 6.0). Factors which have a positive influence on the score include: moderate to wide floodplain development (70 to 200 ft. in Reach I and II); a perennial water supply

providing habitat for resident (and potentially anadromous) fish as well as wildlife; and moderate vegetative structural diversity consisting of a mixed deciduous and coniferous overstory, showing little variance in age/size classes and low ground cover. Factors which generally act to reduce the overall score include: lack of streamside wetlands throughout the survey and the decreased floodplain width in Reach III.

Snag pockets and areas of dead and dying conifers were noted at RM 4.3 and 5.3-5.5. The riparian area receives heavy use by elk and deer. Silver-gray squirrels were also observed. Riparian habitat could become high to very high quality through modification of the dense overstory to promote a greater distribution of age/size classes.

Rehabilitation and enhancement efforts offer great potential for aquatic and terrestrial habitat development and center on: increased spawning and rearing habitat in Reach I and II; enhancing fish passage in Reach II; consolidating stream flows in Reach I and II; construction of headwater storage impoundments in Reach III to increase base flows in low flow periods; and selective openings in the dense riparian canopy to encourage the development of a diversity of species and structural elements.

## LITTLE BADGER CREEK

### REACH SUMMARIES

#### Reach I (RM 2.0-4.2)

1. The valley configuration is a flat-bottomed "V" containing a wide floodplain (120 to 200 ft.).
2. The substrate is composed of rubble and cobble.
3. The stream is dominated by riffles (70 percent).
4. Gradient averages 5 percent.
5. Stream shading is high (80 percent).

#### Reach II (RM 4.2-5-S)

1. The floodplain decreases to a moderate width (70 to 120 ft.).
2. The substrate is composed of small rubble and boulders up to 3 ft. in diameter.
3. Gradient increases to 7 percent.

4. Stream shading is moderate (70 percent).

Reach III (RM 5.5-7.5)

1. The valley is V-notched with steep sideslopes, resulting in very little floodplain development (less than 70 ft.).
2. The substrate is composed of bedrock and large boulders with waterfalls and chutes common.
3. Steep stream gradients dominate (9 to 12 percent).

LITTLE BADGER CREEK

FISH HABITAT SUMMARY

Reach I (RM 2.0-4.2)

1. Habitat is rated poor (4.6 HCR). Moderate to high numbers of resident rainbow trout are present.
2. Rearing habitat is poor. Pools average 30 percent of the stream area during low flows; pool area decreases during high flows due to low channel structure. Pools average 4 sq. yards in area, 4 to 12 inches deep and have moderate effective cover.
3. Spawning habitat is very limited in quantity and quality. Only 113 sq. yards of gravels were observed, and 60 percent of these were rated marginal. Only 10 percent of the total were of a size class suitable for resident trout utilization. Forty percent of the total spawning habitat was associated with LWD.
4. Jams J1 (RM 2.6), J2 (RM 2.9), and J3 (RM 3.1) are barriers to trout migration, and may be potential barriers to anadromous fish. A log sill (3 ft. high) at RM 2.0 is also a trout barrier.

### Reach II (RM 4.2-5.5)

1. Habitat is rated fair (6.3 HCR). Moderate to high numbers of resident trout are present.
2. Rearing habitat is improved from the previous reach. Pools average 40 percent of the stream area. Pool size is still small (4 sq. yards), but depth and effective cover are increased (6 to 29 inches deep, moderate EC).
3. Spawning habitat is also improved. Of the 135 sq. yards observed, 55 percent were rated marginal. "Trout sized" gravels are also increased (20 percent of the total). Fifty percent of the total gravels were associated with LWD.
4. A 3 foot high falls at RM 4.8 is a trout barrier and a potential anadromous fish migration obstruction. A small debris jam at RM 5.2 is also a trout migration barrier.

### Reach III (RM 5.5-7.5)

1. Habitat is rated poor (4.3 HCR). Habitat is suitable for low to moderate numbers of resident trout; none were observed.

2. Rearing habitat is poor. Pools again compose only 30 percent of the stream area. Pool size and depth are similar to Reach II, but effective cover is reduced (low).
  
3. Spawning habitat is very poor. Sixty-five percent of the 95 sq. yards observed were of marginal quality. Only 20 percent were usable by resident trout. Over 70 percent of the total gravels were associated with LWD.
  
4. Several falls (F1 - F7) are barriers to resident trout and potentially to anadrowus fish. Debris jams are numerous and form numerous obstacles to fish migration in low flows. Low water temperature and passage may be limiting fish production in this reach (combined with poor habitat characteristics).

## LITTLE BADGER CREEK

### RIPARIAN QUALITY SUMMARY

The riparian area quality is moderate (RQR=6.0). Factors which have a positive influence on this score include: the flat-bottomed "V" shaped valley configuration resulting in moderate-wide floodplain development (70 to 200 ft.) in Reach I and II; a perennial water supply providing habitat for resident rainbow trout and potentially anadromous fish (steelhead) as well as wildlife; moderate vegetative structure and composition consisting of a mixed coniferous (fir, pine, cedar) and deciduous (cottonwood, maple, alder) overstory composed of similar age/size class (pole and small sawtimber). Additionally, ground cover is low-moderate (50 percent), composed of a shrub (Oregon grape, wildrose) habitat unit.

The decreased valley width in Reach III and the lack of streamside wetlands generally act to reduce the overall score. Management of this area could increase the riparian quality through: increasing the aquatic diversity by creating headwater impoundment areas to increase the base flows; and increasing the vegetative structural diversity by creating canopy openings to encourage the development of more habitat units and a greater diversity of understory and groundcover species.

Reach I (RM 2.0-4.2)

1. The RQR is 6.1, high.
2. The vegetative structural diversity is low due to the presence of two habitat units (pole, small sawtimber) and 40 percent ground cover factor. The overstory composition of three conifers and a deciduous species increases the diversity.
3. The valley bottom is wide, 120 to 200 ft.
4. The aquatic habitat is rated moderate due to the presence of a resident trout fishery and importance of the scattered wetland areas in this semi-arid climate.

Reach II (RM 4.2-5.5)

1. The RQR is 6.0, moderate-high quality.
2. The vegetative structural diversity increases with the addition of a habitat unit (grass/forb), increased canopy diversity (three conifers, two deciduous), and increased ground cover factor (60 percent).
3. The valley width decreases, 70 to 120 ft.

4. The aquatic habitat remains similar, moderate.
5. Snag pockets and many dead and dying conifers are present at RM 4.3 and 5.3-5.5.

Reach III (RM 5.5-7.5)

1. The RQR is 5.8, moderate.
2. The vegetative structural diversity increases with an additional habitat unit (shrub).
3. The valley width continues to decrease (70 ft. wide), and sideslopes gradients are greater than 70 percent.
4. The aquatic habitat remains moderate.

## LITTLE BADGER CREEK

### REHABILITATION AND ENHANCEMENT SUMMARY

#### Pool Development and Spawning Gravel Recruitment: RM 2.5-5.6

Throughout the survey area, pool development is very low and 70 to 80 percent of the stream area is composed of riffles. Construction of notched log sills and/or "V" shaped boulder berms could be used to create more (and deeper) pool area, with better dispersion of spawning habitat. Highest priority is Reach I. Numerous sites are present in the first mile and materials are readily available throughout the stream. Access is limited to the adjacent hiking trail.

#### Stream Channelization; RM 2.5-5.6

Within Reaches I and II, unstable stream banks coupled with a flashy flow regime have produced braided stream channels. Pool and spawning gravel improvement structures mentioned above (notched log sills, V-shaped boulder berms) plus alternating single wing deflector<sup>6</sup> could be designed to channelize and focus stream flows and increase channel stability. Due to moderately steep stream gradient<sup>6</sup> in Reach II (5 to 9 percent), use of large boulders and single wing deflector<sup>6</sup> may be advisable. Lateral cutting around instream large woody debris is high in Reach II and indicate<sup>6</sup> that log sills could fail in areas where gradient<sup>6</sup> exceed 5 percent.

#### Stream Bank Stabilization; RM 2.0-4.5

Stream banks show moderate amounts of bank erosion (25 percent). These banks are dependent upon streamside vegetation and rootwads for stability.

Currently, vegetative cover is low (40 percent). Stream banks are generally composed of sandy soils and have a low bank rock content (40 percent).

Through pool development and stream channelization violent flows could be directed away from unstable banks. Concurrently, seeding or planting these areas could increase the bank stability and help revegetate the raw exposed banks. Effective cover for fish would also increase from overhanging vegetation.

#### Passage Enhancement; RM 5.5-7.5

A 10 ft. waterfall at RM 5.7, and a series of falls and chute<sup>6</sup> at RM 5.9, 6.3, 6.8, and 7.0 preclude potential resident trout and anadromous migration into the upper reach. The substrate in this area is typically bedrock. Blasting of holding pools in the chutes and modification of the falls are options to enhance passage. Access is limited to the trail.

#### Pool Enhancement; RM 5.5-7.5

Throughout Reach III pool development is low (20 to 30 percent of the area). Blasting of pools in this bedrock area could increase the potential rearing area available. Likewise, construction of sills or berms in the tailouts of these pool<sup>6</sup> could act as gravel Catchments.

### Headwater Storage Impoundments

Very low summer flows are limiting the rearing area available to resident trout. Channel scour is resulting from the occasionally violent fluctuation in flows following periods of rapid runoff or snowmelt. Construction of storage impoundments in the upper reaches could help provide a better regulated streamflow, improving both fisheries habitat and stream stability. Access is limited to the trail, and all work would have to be accomplished with hand tools using materials on site.

### Log Jam Modification; RM 2.6-4.3

If anadromous fish passage is provided into the Badger Creek system and the lower reaches of Little Badger Creek, modification of barrier logjam J1-53 and several other debris jam in this section should be a high priority. Partial removal of these jam would provide passage into the higher quality spawning and rearing areas of Reach II. Care should be taken to preserve the high quality spawning habitat usually associated with these structures. Access is limited to the trail throughout this area.

### Trail Maintenance; RM 4.6

Several sections of the Little Badger Trail adjacent to the creek have recently washed out. Rerouting the trail onto the valley sideslopes in some areas could avoid continuing degradation of the trail.

## Riparian Habitat Enhancement; RM 2.0-7.5

Riparian vegetative species and structural diversity is relatively low. The dense conifer-dominated canopy limits development of understory and deciduous canopy elements. Selective opening, through cutting or burning, may increase habitat diversity along the stream. Care should be taken to protect stream shading and bank stability in stream adjacent sites.

## LITTLE BADGER CREEK

### STREAM STABILITY SUMMARY

The stream stability rating is 6.4, moderately unstable. Factors which influence the score include: a flashy flow regime; Sandy soil (low rock content) and low vegetative cover (40 percent) resulting in unstable stream banks in Reach I (30 percent bank erosion); a moderate amount of channel Substrate scour due to the relatively high substrate detachment factor (30 percent) of rubble sized material in Reach I and II; and low overall channel structure due to the lack of a large structural element to create large pools.

Factors which generally increase the rating include: increased stream bank stability in Reach II and III due to increased rock content (frequent sections of bedrocks) and vegetative cover (70 percent); increased channel substrate stability, Reach II and III, due to decreased detachment (20 percent) of the bottom material; and a decrease in the flashy nature of the stream flow in Reach III due to the proximity to the head waters (loss of volume).

It appears that this stream may have a difficult time adjusting to large increases in flow and sediment production, particularly in Reach I and II. Rehabilitation opportunities are numerous in Reach I and II and should likely center on increasing bank stability through mechanical armouring and deflecting flow away from unstable stream banks.

### Reach I: RM 2.0-4.2

1. The SSR is 3.6, unstable.
2. There is a wide variation between seasonal flows resulting in a flashy flow regime. Instream LWD has a parallel orientation (80 percent) and lateral cutting around jams is common (90 percent).
3. The bank stability is moderate with 25 percent erosion observed. Bank rock content is moderate (40 percent) and vegetative cover is low (40 percent).
4. Channel substrate stability is moderate with 35 percent of the substrate being detached.
5. Channel structure is low as only 5 percent of the area consists of long pools.

### Reach II; RM 4.2-5.5

1. The SSR is 3.8, unstable.
2. The flow regime remains flashy.
3. Bank stability increases with 10 percent less bank erosion due to an increase in bank rock content (60 percent) and vegetative cover (60 percent).

4. The channel substrate stability increases slightly.
5. Channel structure remain6 low.
6. Cultural resources are present at RM 5.7-5.8: the Kineel Mine and homestead are located on the north bank in this area.

Reach III; RM 5.5-7.5

1. The SSR increases to 5.7, moderately stable.
2. The flow regime is moderately flashy with instream LWD maintaining a 65 percent parallel orientation.
3. Stream banks are stable with 10 percent observable bank erosion. The vegetative cover (70 percent) and rock content (70 percent) is high.
4. The channel substrate is stable with 20 percent of the substrate being detached.
5. Channel structure remains low.

LITTLE BADGER CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH</u> (R.M.)	<u>STREAM</u>					<u>POOLS</u>					<u>RIFFLES (%)</u>				
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>	
I (2.0-4.2)	4.6	80	3:7	5	L	4	M	*	45	40	10	*	*	0.3	
II (4.2-5.5)	6.3	70	4:6	7	L-M	4	M	0	30	40	25	*	*	0.4	
III (5.5-7.5)	4.3	75	3:7	11	L-M	4	L	30	25	20	20	*	0	0.2	

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth. (L <12", M = 12 - 29", H ≥30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L <40%, M = 40-60%, H ≥60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (feet)  
\*: Present, but less than 5 percent

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>			<u>TRIBUTARIES</u>
	<u>I</u>	<u>II</u>	<u>III</u>	
Rainbow - j	M	M	*	
Rainbow - a	M	M	*	
Crayfish (Steelhead, winter)	*	M	*	

LEGEND: L =Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile  
\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

LITTLE BADGER CREEK

**TABLE III - SPAWNING GRAVEL (SQUARE YARDS)**

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (2.0-4.2)	113	48	65
II (4.2-5.5)	135	60	75
III (5.5-7.5)	<u>95</u>	<u>45</u>	<b><u>50</u></b>
TOTAL	343	153	190

**TABLE IV - FISH MIGRATION OBSTRUCTIONS**

<u>smw (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATION*</u>
(RM 2.4)	Culvert	C1	P	Velocity barrier at high flow. Low priority.
(2.5-4.2)	Logjams	J1-J3 Many unnamed	P-N	Modify to enhance
(4.9)	Falls (3')	F	P*	Modify to enhance passage.
5.8-7.0	Falls (4'-20')	F1-F6	N	Modify to enhance passage, low priority.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Trout migration barrier only; anadromous fish could pass obstacle.

LITTLE BADGER CREEK

TABLE V - LWD HABITAT QUALITY INFLUENCE

<u>Reach (R.M.)</u>	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>OR</u>	<u>LWD CHARACTERISTICS</u>			
	<u>Total (%)</u>	<u>HQ (%)</u>	<u>Total (%)</u>	<u>HQ (%)</u>		<u>#</u>	<u>L</u>	<u>Dia</u>	<u>Source</u>
I (2.0-4.2)	40	60	5	25	Perp	S&M	1-2	<b>2+</b>	M
II (4.2-5.5)	55	55	1	5	Perp	S&M	1-2	1-2	M
III ( <b>5.5-7.5</b> )	75	75	15	5	Perp	M	1-2	1-2	T

LEGEND: Total = % of total habitat area dependant on LWD  
 HQ = % of high quality habitat area dependent on LWD  
 OR = angle of orientation to flow; perp = perpendicular, var = variable  
**#** = number of logs/structure; s = single log, m = multi-log  
 L = average length of logs, expressed in channel widths  
 Dia = diameter of average logs in feet.  
 Source: L = local  
 T - transported  
 M = mixture of local and transported

TABLE VI - HABITAT AND HYDROLOGICAL FEATURES FOR  
 SUMMER AND BANEFULL CONDITIONS

<u>Reach (R.M.)</u>	<u>SUMMER</u>				<u>BANEFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>q</u>	<u>W</u>	<u>D</u>	
I <b>2.0-4.2</b>	5	3"	1	2	11	2.5	120-200
II 4.2-5.5	4	4"	1	1	10	2.0	120
III 5.5-7.5	3	2"	2	1	9	1.0	70

LEGEND: W,w - Stream width (ft)  
**D,d** - Stream depth (ft)  
 V - Velocity (feet/second)  
 Q - Average reach flow in cubic feet/second

LITTLE BADGER CREEK

TABLE VII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (CFS)</u>	<u>5 SHADE</u>	<u>ORIENTATION</u>	<u>TEMP. °F</u>	<u>AIR/WATER TIME</u>
I 2.0-4.2	8/31	2	80	East	64/56	1000-1400
II 4.2-5.5	8/31	1	70	East	65/54	1400-1800
III 5.5-7.5	9/1	1	75	East	65/49	1230

TABLE VIII - RIPARIAN HABITAT SUMMARY

			Understory		Overstory		Streamclass	Wetland%	Size	
			F.P. (ft.)	H.U.	G.C.%	Con.				Dec.
I	2.0-4.2	6.1	120-200	L	40	3	1	I	2	S
II	4.2-5.5	6.0	120	M	60	3	2	II	20	S
III	5.5-7.5	5.8	70	M	70	3	2	II	0	--

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: Habitat Units H **≥5**; M 3-5; L **≤3**  
 G.C.: Ground Cover %  
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H >50%; M 25-50%; L <25%  
 Size: Size of Wetland  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

LITTLE BADGER CREEK

TABLE IX - STREAM STABILITY SUMMARY

<u>REACH (R.M.)</u>	<u>SSR</u>	<u>FLOW REGIME</u>			<u>STREAM BANKS</u>			<u>CHANNEL SUBSTRATE</u>			
		<u>Ratio MF:LF</u>	<u>LWD Ornt</u>	<u>LAT CUT</u>	<u>ER</u>	<u>RC</u>	<u>VEG</u>	<u>DTCH</u>	<u>STONE</u>	<u>IMBRC</u>	<u>VEG</u>
I 2-0-4.2	3.6	2:1	11	H	M	M	M	M	MB	L	N
II 4.2-5.5	3.8	2:1	11	H	L	H	M	MB	M		N
III 5.5-7.5	5.7	1.75:1	11	M	L	H	M	M	MD	H	YRP

**LEGEND:**

**SSR:** Stream stability rating

**Ratio MF:LF:** Ratio between mean annual flow width and the seasonal low flow width

**LWD ORNT:** Large woody debris orientation (11 parallel:R Random)

**LAT CUT:** Lateral cutting (H >80%, M = 20-80%, L <20%)

**ER:** Bank erosion (H >50%, M = 20-50%, L <20%)

**RC:** Rock content (Diameter 1 ft.) (H >65%, M = 30-65%, L <30%)

**VEG:** Vegetative cover (Ground cover & root matrix) (H >80%, M = 50-80%, L <50%)

**DTCH:** Percent detached (H >50%, M 20-50%, L <20%)

**STONE:** B-(Bright), MB-(Moderately bright), MD-(Moderately dull), D-(Dull)

**IMBRC:** Imbrication (degree of substrate packing) (Low = two size classes or less; Moderate = three to five size classes; High = five size classes)

**VEG:** Vegetation: Y (Yes), N (No), R (Riffles), P (Pools)

\*Data on channel structure not included due to modification of data collection & evaluation procedures

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In Reach I (RM 2.0-4.2) stream stability is rated poor (SSR 3.6). Flashy stream flows promoting channel scour, have reduced pool development and consequently degrading fish habitat (HCR 4.6). Rehabilitation and enhancement activities could center on channelization of stream flows through boulder berm or gabion placement. This would develop pools, recruit spawning gravels, and reduce bank erosion.



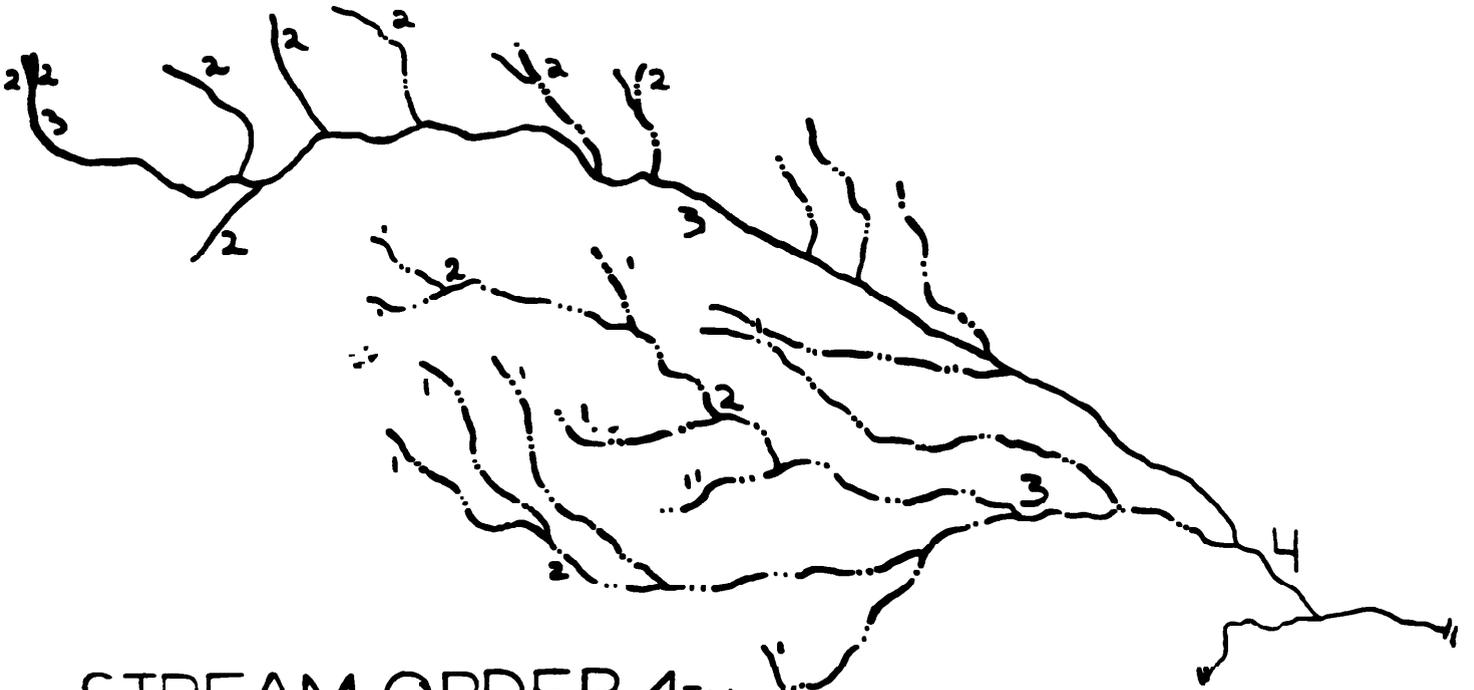
In Reach II (RM 4.5) stream flows of a violent nature appear to be frequent and consequently "blow out" or lateral cut most log sills. The use of large boulders, gabion wing deflectors, or keyed in log sills appears to be desirable in enhancement work.



Reach II (RM 4.2-5.5) contains fair to good fish habitat (HCR 6.3) for resident trout and the potential for anadromous species, particularly steelhead. Enhancement activities could likely center on increasing pool area and spawning gravel recruitment as in Reach I.



This 10 ft. water fall at RM 5.7 and a series of falls and chutes throughout Reach III (RM 5.5-7.5) preclude anadromous and resident trout migration into the upper reach. Passage enhancement would involve bedrock blasting and would access an additional 4 miles of habitat. Access is poor.



BADGER CREEK

STREAM ORDER 4TH  
LITTLE BADGER CREEK

SCALE 1in=1mi



- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

**R<sub>I,II,III</sub>** REACH # and SECTION

**T<sub>1</sub> 1.0** TRANSECT # and RIVERMILE

**★ OBSTRUCTION**

**★ BARRIER**

**J<sub>1,2,3</sub>** JAM and #  
**F( )<sub>1,2,3</sub>** FALLS, HEIGHT, and #  
**C<sub>1,2,3</sub>** CULVERT and #  
**B<sub>1,2,3</sub>** CHUTE and #



DIVERSION STRUCTURE (1 - water is used for irrigation purposes)



MINE or ROCK PIT SITE



BRIDGE



LANDSLIDE, SLUMP



DEBRIS TORRENT TRACK



SPRING



UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fishhabitat)



BANK EROSION (EXTENSIVE/SEVERE)



1.2.3, :MISCELLANEOUS



WETLAND HABITAT



ROAD AND ID NUMBER



EARTHFLOW

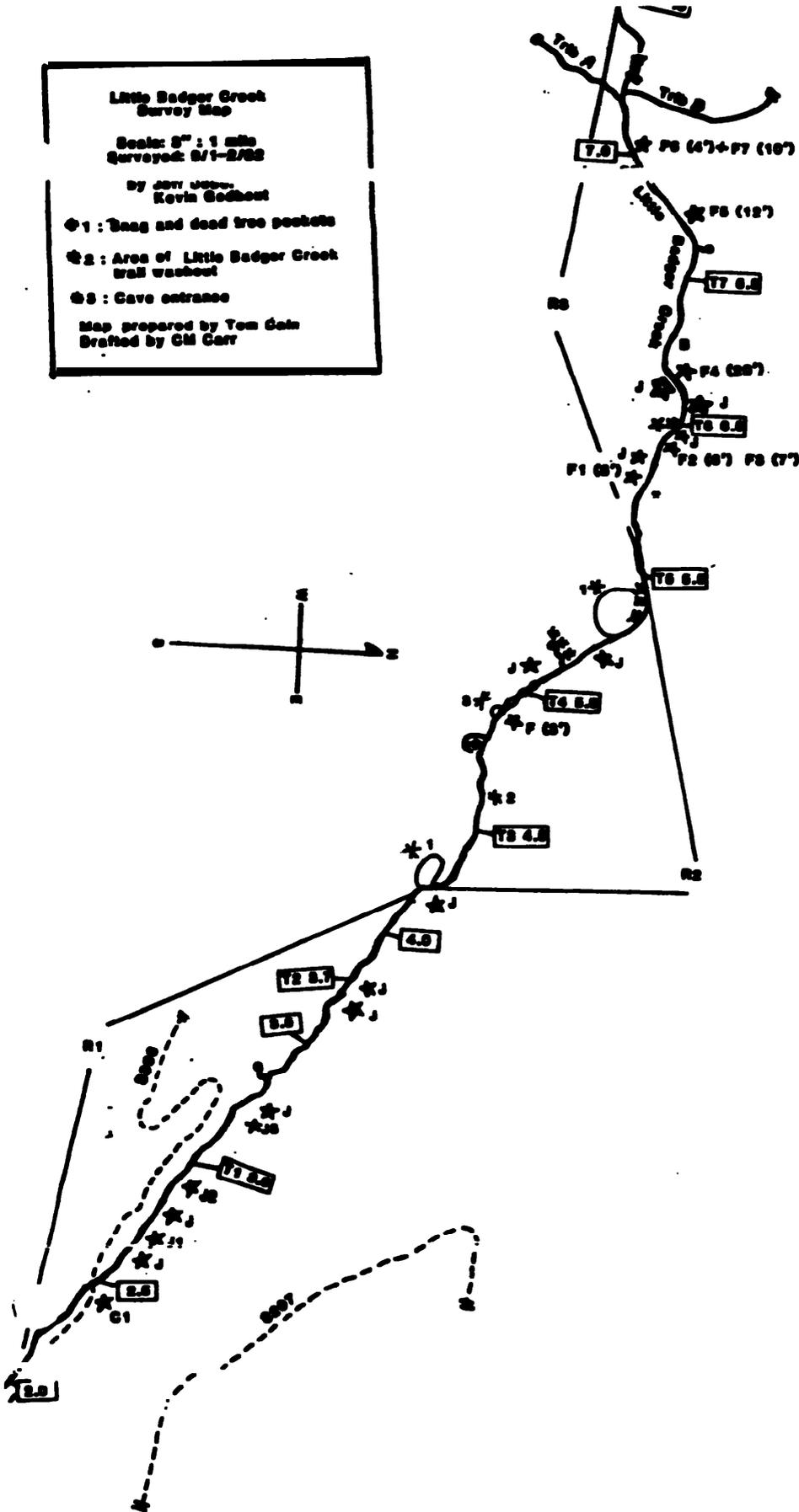
**Little Badger Creek  
Survey Map**

Scale: 2" = 1 mile  
 Surveyed: 8/1-2/82

By John Wynn  
 Kevin Godbout

⊙ 1 : Bag and food tree pockets  
 ⊙ 2 : Area of Little Badger Creek  
 trail washout  
 ⊙ 3 : Cave entrance

Map prepared by Tom Goin  
 Drafted by GM Carr



LITTLE BADGER CREEK

barlow RANGER DISTRICT

Surveyors:	David Wiswar Doug Kinzey	County: Wasco
Dates Surveyed:	August 24-25, 1983	Mouth Location: T.3S., R.12E., Sec. 32
Tributary To:	Badger Creek	Watershed Area: 10,000 acres 16 square miles
TRI Compartments:	Pine 1407	Stream Length: 9.0 miles
Gamefish:	Rainbow trout	Distance Surveyed: 2.4 miles, RM 0.0 - 2.4
Potential Anadromous Species:	Steelhead trout	Low Flow Width (Avg.): 6 feet
		Stream Order: IV
Average Fish Habitat Condition:		5.8 (Fair)
Average Riparian Condition Rating:		5.8 (Moderate)

## LITTLE BADGER CREEK

### Survey Summary

#### A. Stream Summary

Little Badger Creek is a major fourth order tributary of Badger Creek. This survey was conducted between the mouth (RM 0.0) and RM 2.4. Approximately 10 percent of the survey length (1/4 mile) is on private land. The upper reaches of the stream were surveyed in 1982. The report on RM 2.4 - 7.5 is presented as an addendum to this survey. Forest Service Road 2710 crosses the stream at RM 2.4 and is the site of Upper Little Badger Campground. Lower Little Badger Campground is located at RM 1.75 where the North-South Road crosses the creek. Rainbow trout were observed throughout the surveyed section.

#### B. Watershed Characteristics and Geomorphology

Little Badger Creek below RM 2.4 flows in a narrow, V-notched valley with steep (70-90 percent gradient) to very steep (90+ percent) sideslopes. Rock outcrops and talus slopes are common. The floodplain is narrow, 40-60 feet wide, over most of the surveyed length. The stream gradient is moderate (5 percent) and flows over a boulder and rubble substrate. Little Badger Creek provides about 30 percent of the flow (3 cfs) to Badger Creek at their confluence (RM 7.8). A major tributary system of Little Badger Creek enters

at RM 0.7. This system is intermittent, was dry at the time of this survey, and appears to have a flashy flow regime.

c. Reach Description

The 2.4 miles surveyed are classified as one reach. Valley shape, gradient, and substrate as described above are consistent.

D. Fisheries

The fisheries habitat rating is fair (HCR=5.8). Rainbow trout were observed throughout the survey. Spawning habitat is very limited. Spawning gravels totalling 35 square yards occur in small pockets of 1-2 square yards. Thirty-five percent (12 square yards) are high quality. Seventy percent (25 square yards) of the total gravels are in the 1.5-3 inch size class. The remainder are in the 0.5-1.5 inch size class. Rearing habitat is only fair. Pools are 2-3 square yards with shallow depths (<12 inches). Effective cover provided by instream boulders is moderate. Boulders are the dominant structural control of the stream. A bedrock falls at RM 1.9 and chute with a 12 percent gradient at RM 2.0 are migration barriers. Two logjams at RM 0.3 and 0.6 are partial low flow barriers. A culvert is present where Forest Service Road 2710 crosses the stream at RM 2.4. The habitat appears suitable for steelhead trout.

Water temperatures were high for the relatively low ambient temperatures experienced this summer (see Table VIII). During a normal hotter, drier summer, air temperatures would usually be higher and this would likely be associated with increased water temperatures. As Little Badger Creek provides about 1/3 of flows to Badger Creek, the effects of high water temperatures may be cumulative for the Badger Creek system, and high temperatures could present a major limiting factor.

#### E. Riparian Area

The riparian habitat is rated moderate (RCR=5.8) with an overstory canopy dominated by Douglas-fir. Positive factors influencing the rating are the high number of habitat units, presence of deciduous species, and special habitat units (rock outcropping, talus slopes, and a snag patch). Negative factors affecting the rating include a narrow floodplain and absence of wetlands.

#### F. Rehabilitation and Enhancement

Rehabilitation and enhancement opportunities should center on three concerns: (1) improving passage at the bedrock falls and chute (RM 1.9) which currently blocks an additional 5.6 miles of the stream. Spawning habitat above RM 2.4 is fair to good (see 1982 survey report); (2) increasing gravel retention in Reach I (RM 0.0 - 2.4); and (3) improving pool quality in the lower two reaches (RM 0.0 - 4.2) by increasing pool depth and size.

LITTLE BADGER CREEK

Reach Summary

Reach I; RM 0.0 - 2.4:

1. Valley configuration is narrow and V-notched, with steep (70-90 percent gradient) to very steep (90+ percent) sideslopes. The floodplain is narrow (40-60 feet wide). The flow regime is flashy.
2. Stream gradient is moderate (5 percent).
3. Substrate is primarily boulders and rubble.
4. The pool-to-riffle ratio is even (P:R=S:S). Riffles are short cascades over rubble. Pools average two square yards.
5. Stream shading is high, averaging 85 percent.

LITTLE BADGER CREEK

Fish Habitat Summary

Reach I; RM 0.0 - 2.4:

1. The fish habitat is rated fair (HCR=5.8).
2. Although pool-to-riffle ratio is excellent (5:5), rearing habitat is only fair due to poor depth (generally less than 12 inches), small size (2-3 square yards), and moderate cover.
3. Spawning habitat is very limited with a total of 35 square yards counted (12 good and 23 marginal). Thirty-five percent of these are in the 0.5-1.0 inch size class. The remainder are in the 1.5-3.0 inch class.
4. A 5-foot high falls followed immediately by a 10-foot long bedrock chute (RM 1.9) and a 20-foot long, 12 percent gradient bedrock chute (RM 2.0) appear to be complete barriers to fish passage. Approximately 5.6 miles of potential anadromous habitat is blocked by these barriers. Partial barrier log jams exist at RM 0.3 and 0.6.

LITTLE BADGER CREEK

Riparian Habitat Summary

Reach I; RM 0.0 - 2.4:

1. The riparian habitat is rated moderate (RCR=5.8).
2. The floodplain width is narrow (40-60 feet), forming a flat bottom V-shaped valley.
3. Habitat units present are variable, with an average of four per transect noted.
4. The coniferous overstory is dominated by Douglas-fir, with grand fir and western red cedar also common. Red alder is the most common deciduous species, with lesser amounts of oak and big leaf maple.
5. Special habitats include: rock bluffs on upland slopes, particularly west of the stream; a talus slope down nearly to the water's edge at RM 0.75; and a snag patch at RM 0.4 (more than 10 trees at two feet DBH and tops broken above 50 feet).

## LITTLE BADGER CREEK

### Rehabilitation/EnhancementSummary

#### Passage Enhancement; RM 1.9, 0.3, 0.6:

Providing passage past the falls and chutes between RM 1.9 and 2.0 is a high priority if use of potential spawning habitat in the upper reaches (see 1982 Riparian Area Resource Assessment) by anadromous fish is desired. These obstructions presently appear to be full migration barriers. The general area is accessible from Forest Service Road 2710. The upper chute (RM 2.0) is on private land.

Logjams at RM 0.3 and 0.6 are considered partial barriers, but are presently providing some rearing habitat and retaining some spawning gravels so should be monitored to document passage problems if removal is considered.

#### Spawning and Rearing Habitat; RM 0.0 - 1.9:

Only 35 square yards of spawning gravel were counted over the 2.4 miles of the survey. These occur in small, scattered pockets. The addition of gravel retention structures could enhance the overall fish production capabilities of the Badger Creek System.

Although pools are numerous (P:R = 5:5), shallow depths (<12 inches) and small size (3 square yards) limit rearing habitat. Structures such as boulder berms or log sills placed to increase these habitat elements could enhance this stream's fish-rearing capabilities.

Access from RM 0.0 to 1.5 is poor and work here would likely have to be done by hand and small portable equipment. Above RM 1.5, access by Forest Service Road 2710 is good.

LITTLE BADGER CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM					POOLS				RIFFLES (%)				
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	EC	BR	1'+- 6-12"	1-6"	.1-1"	SD	D	
<u>1983</u>														
I (0.0-2.4)	5.5	80	5:5	5	L	3	M	*	25	35	20	10	10	3
<u>1982</u>														
I (2.4-4.2)	4.6	80	3:7	5	L	4	M	*	45	40	10	*	*	4
II (4.2-5.5)	6.3	70	4:6	7	L-M	4	M	0	30	40	25	*	*	5
III (5.5-7.5)	4.3	75	3:7	11	L-M	4	L	30	25	20	20	*	0	2

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq 12"$ , M = 12 - 29", H  $> 30"$ )  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq 40\%$ , M = 40-60%, H  $\geq 60\%$ )  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

SPECIES  
Rainbow trout

REACH I  
L

LEGEND: L = Low (0-5), M = Moderate (6-50), H = High (50+)  
a = adult, j = juvenile  
\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

LITTLE BADGER CREEK

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
<u>1983</u>			
I (0.0-2.4)	35	12	23
<u>1982</u>			
I (2.4-4.2)	113	48	65
II (4.2-5.5)	135	60	75
III (5.5-7.5)	<u>95</u>	<u>45</u>	<u>50</u>
TOTAL	378	165	213

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
<u>1983</u>				
0.3	Logjam	J1	P	Low priority.
0.6	Logjam	J2	P	Low priority.
1.9	Falls	F1 (5')	N	Modify for passage. Alaskan steep-pass and/or increase pool depth.
2.0	Bedrock chute	B1	N	On private land.
2.4	Culvert	C1	F	Low priority.
<u>1982</u>				
2.5-4.2	Logjams	J1-J3	P-N	Modify for passage.
4.9	Falls (3')		P	Modify for passage.
5.8-7.0	Falls (4'-20')	F1-F6	N	Low priority.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

LITTLE BADGER CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
<u>1983</u>								
I (0.0-2.4)	1.9	0.5	5:5	3	1	35	0	
<u>1982</u>								
I (2.4-4.2)	0	1.8	3:7	4	1	75	41	
II (4.2-5.5)	0	1.3	4:6	4	1-2	60	34	
III (5.5-7.5)	<u>0</u>	2.0	3:7	4	1-2	<u>48</u>	16	
TOTAL	1.9	5.6				208	91	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R: Ratio of pool length:riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

**LITTLE BADGER CREEK**

**TABLE VI - LWD HABITAT QUALITY INFLUENCE**

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
<u>1983</u>									
I (0.0-2.4)	10	10	10	20	Perp	S	1-2	1-2	L
<u>1982</u>									
I (2.4-4.2)	40	60	5	25	Perp	S-M	1-2	2+	M
II (4.2-5.5)	55	55	1	5	Perp	S-M	1-2	1-2	M
III (5.5-7.5)	75	75	15	5	Perp	M	1-2	1-2	T

**LEGEND:** Total: % of total habitat area dependant on LWD  
 HQ: % of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

**TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS**

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	q	W	D	
<u>1983</u>							
I (0.0-2.4)	7	0.3	1	2	13	1.0	40-60
<u>1982</u>							
I (2.4-4.2)	5	0.3	1	2	11	2.5	120-200
II (4.2-5.5)	4	0.3	1	1	10	2.0	120
III (5.5-7.5)	3	0.2	2	1	9	1.0	70

**LEGEND:** W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q= Average reach flow in cubic feet/second

LITTLE BADGER CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH</u> ( R . <u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
				<u>TEMP. °F</u> A/W	A/W	
<u>1983</u>						
I (0.0-2.4)	8/24-25/83	2.5	80	SE	64/55-69/59	1030-1700
<u>1982</u>						
I (0.0-4.2)	8/31/82	2.0	80	E	64/56	1000-1400
II (4.2-5.5)	8/31/82	1.0	70	E	65/54	1400-1800
III (5.5-7.5)	9/1/82	1.0	75	E	65/49	1230

TABLE IX - RIPARIAN HABITAT SUMMARY

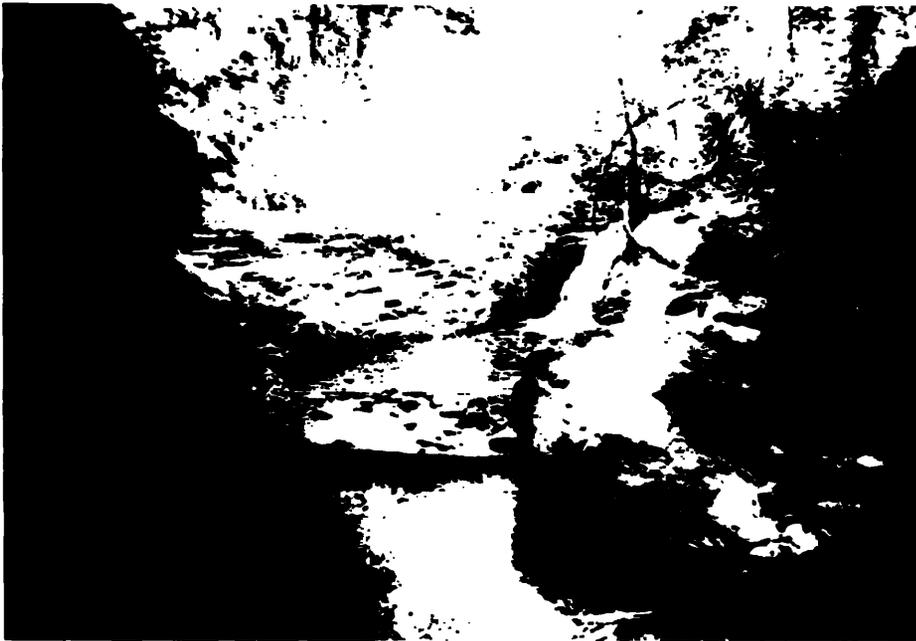
<u>REACH (R.M.)</u>	<u>RCR</u>	<u>VALLEY</u>		<u>VEGETATION</u>		<u>AQUATIC</u>				
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Con. Dec.</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>	
<u>1983</u>										
I (0.0-2.4)	5.8	50	4	3	1	I				3
<u>1982</u>										
I (2.0-4.2)	6.1	120-200	3	3	1	I	L	s		-
II (4.2-5.5)	6.0	120	4	3	2	II	L	s		-
III (5.5-7.5)	5.8	70	4	3	2	II	0	-		-

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: Habitat units H  $\geq 4$ , M 2-3., L  $\leq 1$   
 Con: % Conifer species  
 DecL # Deciduous species  
 Wetland: % stream length with adjacent wetlands; H  $>50\%$ ; M 25-50%; L  $<25\%$   
 Size: Size of wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5222N)



The pool-to-riffle ratio in Reach I is even (P:R-5:5). The stream gradient is moderate (5%) over a small boulder and rubble substrate. Pools average 3 square yards and have shallow depths. Enhancement opportunities exist for increasing pool size and depth, possibly by constructing boulder berms with substrate materials. (RM 0.1 shown.)



The bedrock falls at RM 1.9 is a complete barrier to fish migration. The falls is 5 feet high and has a 10 foot long chute immediately above it. There are 5.4 miles of habitat beyond the falls which includes a section (RM 4.2 - 5.5) with good spawning habitat (250 sq. yds.).



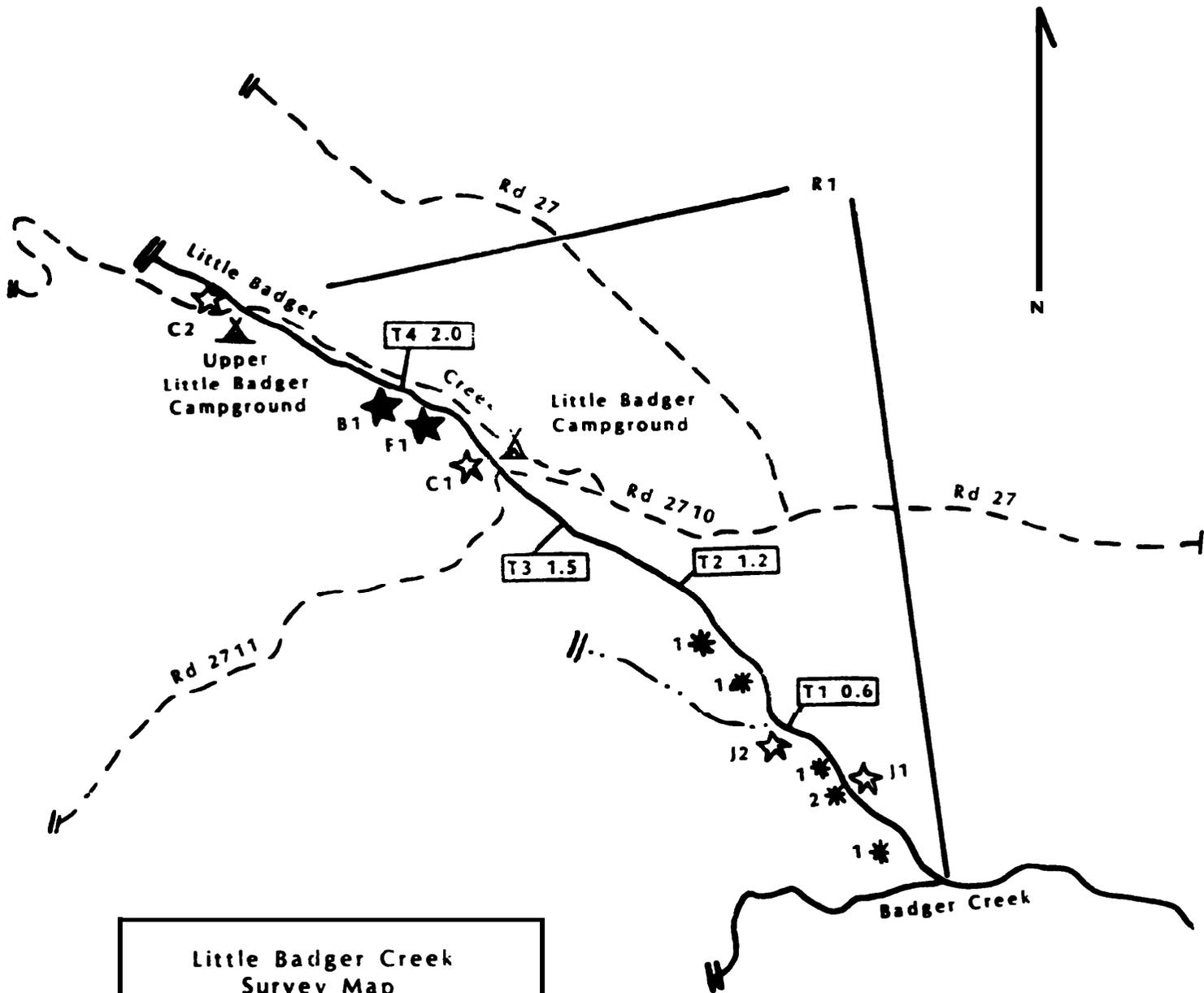
STREAM ORDER 4<sup>TH</sup>

BADGER CREEK

LITTLE BADGER CREEK

SCALE 1in=1mi





Little Badger Creek  
 Survey Map  
  
 Scale: 2.6" : 1 mile  
  
 Surveyed  
 8/24, 25/83  
  
 by: David Wiswar  
 Doug Kinzey  
  
**Legend**  
 #1 Rock Outcrop/Talus  
 #2 Snag Patch

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
R <sub>I,II,III</sub>	REACH # and SECTION
T <sub>1</sub> 1.0	TRANSECT # and RIVERMILE
★	OBSTRUCTION
★	BARRIER
J <sub>1,2,3</sub>	JAM and #
F( ) <sub>1,2,3</sub>	FALLS, HEIGHT, and #
C <sub>1,2,3</sub>	CULVERT and #
B <sub>1,2,3</sub>	CHUTE and #
▲	DIVERSION STRUCTURE (I = water is used for irrigation purposes)
✂	MINE or ROCK PIT SITE
— —	BRIDGE
↪	LANDSLIDE, SLUMP
~>	DEBRIS TORRENT TRACK
~●	SPRING
◇	UPPER LIMIT OF FISH PRESENT (A . limit of potential anadromous fish habitat)
▲▲▲▲	BANK EROSION (EXTENSIVE/SEVERE)
*	1,2,3. :MISCELLANEOUS
☁	WETLAND HABITAT
—5-47	ROAD AND ID NUMBER
☞	EARTHFLOW

Falls/Chute # F1 Screen Little Badger Date 8/25/83

Location: T. \_\_\_ S. \_\_\_ W. \_\_\_ Screen Survey Mile 1.9

Size: W 3, H 5, L 10. Gradient \_\_\_ Barrier: Yes X No \_\_\_

Is pool present below the falls? Yes X No \_\_\_

Length 10 ', width 6 ', depth 5 '.

Other comments: 4-5' bedrock falls, then 10' chute.

Good jump pool, easy place at tail to increase depth with a log or boulder berm.

Falls/Chute # B1 Screen Little Badger Date 8/25/83

Location: T. \_\_\_ S. \_\_\_ W. \_\_\_ Screen Survey Mile 2.0

Size: W 4, H 10, L 30. Gradient 12% Barrier: Yes X No \_\_\_

Is pool present below the falls? Yes X No \_\_\_

Length 20 ', width 8 ', depth 4 '.

Other comments: Bedrock

Falls/Chute # \_\_\_ Screen \_\_\_ Date \_\_\_

Location: T. \_\_\_ S. \_\_\_ W. \_\_\_ Screen Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

Falls/Chute # \_\_\_ Screen \_\_\_ Date \_\_\_

Location: T. \_\_\_ S. \_\_\_ W. \_\_\_ Screen Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

Falls/Chute # \_\_\_ Screen \_\_\_ Date \_\_\_

Location: T. \_\_\_ S. \_\_\_ W. \_\_\_ Screen Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

Falls/Chute # \_\_\_ Screen \_\_\_ Date \_\_\_

Location: T. \_\_\_ S. \_\_\_ W. \_\_\_ Screen Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

RM 107  
 Culvert # 1 Stream Little Badger Date 8/25/83  
 Gradient greater than 1%: Yes        No X

Type of structure (check)  
 Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure 40 ft. Diameter of structure 4' 3" ft.

Are baffles present? Yes        No ✓

Jumping distance into culvert from pool: Height 0.2

Pool present below culvert: Length 10', width 8', depth 0.8'

Stream above culvert: Width 8', gradient 4%

Stream flowing water: Yes X No       

Other comments: No passage problem. One trout seen in culvert.

Culvert # 2 Stream Little Badger Date 8/25/83  
 Gradient greater than 1%: Yes 4% No       

Type of structure (check)  
 Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure 80 ft. Diameter of structure 4 ft.

Are baffles present? Yes        No ✓

Jumping distance into culvert from pool: Height 4"

Pool present below culvert: Length 20', width 20', depth 2'

Stream above culvert: Width 4', gradient 3%

Stream flowing water: Yes ✓ No       

Other comments: Partial Barrier

Culvert #        Stream        Date         
 Gradient greater than 1%: Yes        No       

Type of structure (check)  
 Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure        ft. Diameter of structure        ft.

Are baffles present? Yes        No       

Jumping distance into culvert from pool: Height       

Pool present below culvert: Length       ', width       ', depth       '

Stream above culvert: Width       ', gradient       '

Stream flowing water: Yes        No       

Other comments:       

Culvert #        Stream        Date         
 Gradient greater than 1%: Yes        No       

Type of structure (check)  
 Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure        ft. Diameter of structure        ft.

Are baffles present? Yes        No       

Jumping distance into culvert from pool: Height       

Pool present below culvert: Length       ', width       ', depth       '

Stream above culvert: Width       ', gradient       '

Stream flowing water: Yes        No       

Other comments:

JORDAN CREEK - BARLOW

SURVEYORS:	Kevin Godbout Jeff Uebel	COUNTY:	wasco
DATES SURVEYED:	8/23-24/82	MOUTH LOCATION:	T3S, R12E, Sec. 26
TRIBUTARY TO:	Tygh Creek	WATERSHED AREA:	23 sq. mi. 15,000 acre6
DRAINAGE:	Deschutes	STREAMLENGTH:	15.3 mile6
TRI COMPARTMENT:	Friend, Jordan, Sunset (1430), (1431). (1402)	DISTANCE SURVEYED:	7.0-11.5 mainstem.
GAME FISH:	Rainbow/Cutthroat hybrid6 (winter steelhead) (coho salmon)	AVERAGE WIDTH:	13 ft.
		STREAM ORDER:	IV order

Average Fish Habitat Condition Rating: 6.3, Fair

Average Stream Stability Rating: 4.1, Moderately Unstable

Average Riparian Quality Rating: 5.6, Moderate Quality

( ) habitat suitable but major passage work needed for utilization.

JORDAN CREEK  
Stream Survey Summary

Jordan Creek is a major (fourth order) tributary to Tygh Creek containing 40 percent of the Tygh Creek drainage area. This east-west oriented creek originates from a spring line near Flag Point and flows east 15 miles to its confluence with Tygh Creek at River Mile (RM) 9.0 (T3S, R12E, Sec. 26). A total of 5.5 miles, from RM 7.0-11.5, were surveyed on August 23 and 24, 1982. On August 23, the flow at RM 7.0 was estimated at 3 cfs.

The lower 8 miles, or 40 percent, of the Jordan Creek drainage is located on private land. National Forest System Lands extend upstream from RM 8.2 to its headwaters. In the upper drainage, access is fair, with Forest roads S-205 and S-209 paralleling the creek on the north and south slope respectively. Road crossings are found at RM 7.6, 3.0, and 2.0.

The surveyed reach lies in a sharply incised, narrow, "V" shaped canyon. This has resulted in minimal floodplain development (70 ft.). Sideslopes are steep, often with vertical bedrock walls and terraces interspersed with shallow soil depositional areas. The general land form indicates that erosional stream processes have dominated in the past and are still active.

The drainage pattern is a mixture of palmate and pinnate branching. In the survey area, long first and second order intermittent tributaries dominate. These tributaries appear to respond rapidly to inputs of precipitation (i.e., snow, rain) and apparently contribute to a flashy flow regime in the mainstem.

One reach was identified in the survey area. Characteristically, this stream flows at a 6 percent gradient over a small-boulder rubble substrate. Riffles dominate the stream area (70 percent) and stream shading is moderate from both vegetative and topographic sources. Resident rainbow/redband trout are found in moderate to high numbers throughout the reach.

The fish habitat is rated moderate (HCR 6.3) in the survey area. The boulder/rubble dominated substrate (70 percent), low pool development, low stream stability and low base flows all tend to reduce the rating. High amounts of spawning habitat in some areas and moderate fish numbers raise the rating.

Pool rearing habitat is limited in quality and quantity. Pools average only 30 percent of the stream area and are generally small to moderate in size (10 sq. yards) as well as shallow (6 to 29 inches deep). Effective cover is moderate. The overall lack of high quality pool habitat is likely limiting production of salmonids, particularly native stocks.

Spawning habitat is abundant overall, but distribution is very patchy. Of the total 1,000 sq. yards observed in the survey area, over 50 percent were in three small (0.1-0.2 mile long) sections, representing only 10 percent of the total survey area. Sixty percent of the gravels observed were marginal due to poor placement in the channel. Seventy percent are of a size class suitable only for anadromous fish utilization.

Passage is obstructed by a culvert (C1) at RM 7.7, a 4 foot falls at RM 7.6, and numerous small to large logjams throughout the reach. Passage does not appear to be limiting resident trout production in this area.

Physical structural components in the channel, such as bedrock and large boulders, create excellent habitat development (spawning and rearing) but are generally scarce and point-related in function. Large woody debris (LWD) is commonly incorporated as single logs (sills) or in jams and frequently contributes to pool and spawning gravel development. Over 50 percent of the high quality spawning and rearing habitat observed was associated with LWD. Significant channel scour and habitat degradation was observed in areas where incorporated LWD was removed. Maintenance of beneficial in-channel LWD would therefore appear to be a priority. The role of large streamside trees is evident, both as a source of materials for channel structure, and as contributors to stream shading and bank stability.

The stream is rated as moderately unstable. The stream stability rating (SSR) is 4.1. This low score is due to the combination of: a flashy flow regime; moderately unstable stream banks (25 percent bank erosion); low channel structure resulting in small pool development; heavy grazing pressure; and excessive instream debris removal accompanying past harvest activities. The moderate amount of channel substrate detachment (25 percent) increases the overall rating. However, seasonal flows of a violent nature appear to be common and could act to further reduce the stability rating.

The riparian area is rated as moderate quality. The riparian quality rating (RQR) is 5.6. Positive factors include: the perennial flow and habitat to support resident salmonid and potentially anadromous fisheries; and the high wildlife use of this area. Factors which reduce the rating center on: the narrow valley bottom width resulting in minimal floodplain and true riparian vegetation development; the low to moderate vegetative structural diversity consisting of a coniferous overstory, similar age/size class, and moderate ground cover; and the lack of wetland areas, reducing the aquatic diversity.

Wildlife diversity and densities are apparently quite high along Jordan Creek. Abundant sign of deer and elk were observed. Bear, beaver, porcupine, coyote, woodrat and Cooper's hawk sign were also noted in the survey. Caves and overhangs in the cliffs along the stream adjacent slopes of the lower section (RM 7.0-9.0) appeared to increase habitat diversity.

Rehabilitation and enhancement opportunities are diverse and could be implemented in such areas as: improving fish habitat through increasing quality rearing and spawning area; modification of logjams, falls and a culvert to enhance fish passage; supplementing summer flows through construction of headwater storage impoundments; protection and improvement of stream bank stability in areas receiving heavy grazing pressure; and selective

removal of canopy cover in heavily timbered areas to increase riparian vegetational species and structural diversity.

NOTE: The Oregon Dept. of Fish and Wildlife has established provision of anadromous fish passage into the White River system as a high priority project. Potential anadromous fish habitat exists throughout the surveyed reach of Jordan Creek. However, if anadromous fish runs are established in the White River basin, management for anadromous production from Jordan Creek on National Forest System Lands will be complicated by the presence of irrigation diversions and three impassable falls (6 to 25 feet high) located on private land below the survey area.

JORDAN CREEK  
REACH SUMMARY

Reach I - RM 7.0-11.5

1. Stream shading is moderate (70 percent) and is provided by the coniferous overstory and local topography.
2. Valley configuration is steep and V notched, with a narrow valley bottom, resulting in minimal floodplain development.
3. Substrate is composed of small boulders (60 percent) and rubble.
4. The stream is dominated by riffles (70 percent).
5. Resident trout are found in high numbers.
6. Stream gradient averages 6 percent.

NOTE: This stream survey assessed only the mid to upper drainage area of Jordan Creek, which displayed fairly uniform physical and biological characteristics. Stream reconnaissance conducted above or below this section of stream, would likely yield considerable variance for these reach characteristics. One or more additional reach areas are likely present in the drainage.

JORDAN CREEK  
FISH HABITAT SUMMARY

Reach I - RM 7.0-11.5

1. The habitat rates fair (6.3 HCR).
2. Pool rearing habitat is limited in quality and quantity. Limited pool area (30 percent) favors riffle adapted species (i.e., rainbow trout). Pools are small (10 sq. yards) and shallow (6 to 29 inches deep) with moderate effective cover from LWD and the boulder/rubble substrate.
3. Spawning habitat is plentiful, but very patchy in distribution. Over 1,000 sq. yards total were observed, but 50 percent of these gravels were limited to three small depositional plain areas at RM 9.1, 9.3-3.4 and 10.4-10.5. Sixty percent of all gravels observed were rated marginal due to poor placement. Seventy percent of the gravels were of a size class suitable for anadromous fish utilization.
4. Both pool formation and spawning gravel accumulation are dependent on LWD input. Over 50 percent of the high quality spawning and rearing habitat observed was associated with LWD. LWD generally accumulated as both single log (sills) or small multiple log deposits. The logs were most often 5 to 20 feet long and of the 12 to 24 inch size class. Habitat degradation and channel scour were noted in areas where stream clean-out had removed all incorporated LWD.

5. Fish passage is obstructed at numerous points in the reach, but does not appear to be significantly affecting resident trout production. Culvert C1 (RM 7.7), a 4 foot falls (RM 7.6) and many small jams block fish migration.

JORDAN CREEK  
RIPARIAN AREA SUMMARY

The riparian area quality is moderate (RQR = 5.6). Major factors which contribute to this rating include: a perennial water supply and stream habitat suitable for resident trout (and potentially suitable for anadromous fish populations); and an apparently high value wildlife area in this arid region utilized intensively as a valley travel corridor and perennial water supply. Two small (1 to 2 acre) sediment depositional areas at RM 9.1 and 9.3 present exceptionally high habitat diversity for both fish and wildlife, and likewise raise the rating.

Factors which generally act to reduce the rating include: the poorly developed floodplain (valley bottom width less than 70 ft.); and limited vegetative structural diversity due a coniferous overstory (fir, cedar, pine) of a small sawtimber age/size class. Additionally, groundcover is low (55 percent) and composed of grass/forb (sedge, fern), shrub (Oregon grape, vine maple) habitat units.

Through management, the true zone of riparian vegetation could be increased from its present limited levels of diversity to moderate or high levels. Removal of individual or patches of riparian conifers could encourage development of deciduous elements in the understory and canopy.

JORDAN CREEK  
REHABILITATION AND ENRANCEMENT SUMMARY

Passage Enhancement; RM 7.6, 7.7, 8.3, 10.2

Currently, a 4 foot falls (RM 7.6) (with an associated debris jam), two large logjams (RM 8.2 and 10.2) and numerous (13) small debris jams throughout the survey area are barriers to trout and would present potential anadromous fish obstructions. A culvert (C1) at RM 7.7 is a trout barrier and would present a potential velocity barrier to anadromous fish at high flows. Partial removal of logjams, debris jams and modification of the falls and culvert could enhance fish passage. Should an anadromous fishery be introduced to the White River Drainage, increasing fish passage in this area would open 6 or more miles of potential anadromous habitat.

Pool and Spawning Habitat Enhancement; RM 9.0-11.5

Pool development throughout the surveyed reach is low (70 percent of the stream composed of riffles) and spawning habitat is patchy. Construction of sill structures would create more pool area and better disperse of spawning habitat from RM 9.0-11.5. Boulder berms and/or log sills appear well-suited to this area. Several good sites are found from RM 9.0-10.0. Access to the creek is very good in the Frailey Timber Sale area from a logging spur at RM 9.4, but may be difficult elsewhere. These projects could be coordinated with passage enhancement; gravels accumulated behind jam obstructions could be used to seed in catchment structures.

### Pool Enhancement; RM 8.5-9.0

Within this half-mile section, bedrock dominates the channel substrate. Pool development is low, resulting in low quality fish habitat. Pool quality in this area could be increased through blasting and/or anchoring structures to the bedrock substrate. Project design incorporating gravel catchment could produce multiple benefits.

### Stream Bank Stabilization; RM 9.0-10.5

Streambanks show moderate amounts of bank erosion (25 percent). These banks are dependent upon streamside vegetation and rootwads for stability. Currently, cattle are compacting and eroding bank soils, and reducing the vegetation present. Rehabilitation could involve creating grazing exclosures, coupled with seeding and/or planting these areas to increase bank stability and reduce the impacts of heavy grazing.

At RM 9.65, 200 sq. yd. of raw exposed streambank is present. Bank armoring, possibly utilizing juniper or cedar tree riprap, could deflect flows from this bank and enable vegetative stabilization to occur.

### Headwater Storage Improvements

Construction of storage impoundments could be utilized to supplement summer low flows. This could also temper the occasional violent fluctuation of

seasonal peak flows (reducing channel scour) and provide a source for stock and wildlife watering.

#### Riparian Vegetation Manipulation; RM 7.0-11.5

Riparian vegetative species and structural diversity is relatively low. The uniformly dense coniferous canopy deters understory development or deciduous overstory regeneration. Selective removal of individual or small patches of riparian conifers could enhance riparian habitat diversity. Care should be taken to preserve stream shading and maintain low stream water temperatures.

## JORDAN CREEK

### STREAM STABILITY SUMMARY

This stream is moderately unstable-unstable, (SSR = 4.1). Major factors contributing to this rating include: the wide variation between seasonal flows and the quick response time to inputs of precipitation, resulting in a flashy flow regime; streambanks which are composed of loosely packed sand and small rocks and dependent upon rootwads and streamside vegetation (50 percent ground cover) for stability, resulting in moderately unstable banks (25 percent erosion); low channel structure due to a scarcity the primary structural element (LWD), resulting in riffle dominated stream area; heavy grazing pressure resulting in soils and vegetative compaction and erosion; and excessive in-stream debris removal following timber harvest, which removed incorporated and beneficial LWD and triggered accelerated channel downcutting.

Factors which generally act to increase the stability center on: a low substrate detachment (25 percent) factor resulting in moderate channel substrate stability; and point-related bedrock outcrops providing channel structure.

This drainage appears to produce flow of a violent nature. The presence of streamside vegetation is important in maintaining long-term bank and channel stability. Removal of the streamside overstory or ground cover may contribute to further instability. Rehabilitation activities to increase stream stability could center on increasing bank stability through fencing and planting, armoring with rip/rap or large woody debris, and especially redirecting flows away from raw exposed banks at RM 9.65.

JORDAN CREEK

TABLE I - HABITAT DATA SUMMARY

EACH (R.M.)	STREAM			POOLS						RIFFLES (%)				
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D
I (7.0-11.5)	6.3	65	3:7	6	L-M	10	M	0	35	35	20	5	5	0.3

**LEGEND:** HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L < 12", M = 12 - 29", H > 30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L < 40%, M = 40-60%, H > 60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (feet)  
\*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FEET

<u>Species</u>	<u>REACH</u> <u>I</u>	<u>TRIBUTARIES</u>
Rb/ct hybrid - a	M	<u>None observed</u>
Rb/ct hybrid - j	M	
stw	*	
co	*	

LEGEND: L = Low (0-5); M = Moderate (6-50), H = High (50+)  
a = adult, j = juvenile  
\* = habitat suitable; major passage work needed for utilization

Rb = Fainbow trout  
Ct = cutthroat trout  
stw = winter steelhead  
co = coho salmon

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (7.5-11.5)	1050	410	640
TOTAL	<u>1050</u>	410	<u>640</u>

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS</u>
(RM 7.6)	Fall6 (4')	F1	P-N*	Modify for passage; low priority at present
(7.7)	Culvert	C1	"	Modify for passage; low priority at present
(8.3)	Log Jam	J1	"	Modify for passage, low priority at present
(10.2)	Log Jam	J2	"	Modify for passage; low priority at present
(7.8-10.8)	Debris Jam	None	"	Modify for passage; low priority at present

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Trout migration barrier only, anadromous fish could pass obstacle.

TABLE V - LWD HABITAT QUALITY INFLUENCE

<u>Reach (R.M.)</u>	<u>SP . GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	<u>Total</u>	<u>HQ</u>	<u>Total</u>	<u>HQ</u>	<u>OR</u>	<u>#</u>	<u>L</u>	<u>Dia</u>	<u>Source</u>
I (7.0-11.5)	65	65	20	45	Perp	S+M	1-2	1-2	<b>M</b>

LEGEND: Total = % of total habitat area dependant on LWD  
HQ = % of high quality habitat area dependent on LWD  
OR = angle of orientation to flow, perp = perpendicular, var = variable  
# = number of logs/structure; s = single log, m = multilog  
L = average length of logs, expressed in channel widths  
Dia = diameter of average logs in feet.  
Source: L = local  
**T** - transported  
M = mixture of local and transported

JORDAN CREEK

TABLE A - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Mile6		P.R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (7.0-11.5)	0.6	3.9	3.7	10	1.5	526	183	Numerous small partial to full migration barriers (culverts, log <b>jams</b> , chutes lie above the 4' falls barrier at RM 7.6.
TOTAL	0.6	3.9				<u>526</u>	<u>183</u>	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R: Ratio of pool length:riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of Sq. Yards of gravels observed in the 1"-3' and 3"-6" size classes.

TABLE VI - HABITAT AND HYDROLOGICAL FEATURES  
FOR SUMMER AND BANKFULL CONDITIONS

<u>REACH (RM)</u>	<u>Summer</u>				<u>Bankfull</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>Q</u>	<u>W</u>	<u>D</u>	
I (7.0-11.5)	7.5	4"	1	3	18	2.5	70-120

w,w - Stream width (ft)  
D,d - Stream depth- (ft)  
v - Velocity (feet/second)  
Q - Average reach flow in cubic feet/second

TABLE VII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (RM)</u>	<u>Date</u>	<u>Flow (cfs)</u>	<u>% Shade</u>	<u>Orientation</u>	<u>Air/Water</u>	<u>Time</u>
					<u>Temp. °F</u>	
I (7.0-11.5)	8/23&24/82	3	65	SE	61/57	1100-1600

TABLE VIII - RIPARIAN HABITAT SUMMARY

<u>REACH RM</u>	RCR	VALLEY	<u>VEGETATION</u>				<u>AQUATIC</u>			
			F.P. (ft.)	H.U.	Understory G.C.%	Overstory Con. Dec.	Streamclass	Wetland%	Size	
I (7.0-11.5)	5.6	70-120	M		55	3	-	I	L	S

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: Habitat Units H  $\geq$  5; M=3-5; L  $\leq$  3  
 G.C. : Ground Cover %  
 Con: # Conifer Species  
 Dec. # Deciduous Species  
 Wetland: % stream length with adjacent wetlands;  
 H > 50%; M 25-50%; L < 25%  
 Size: Size of Wetlands  
 S " Small (less than 1 acre)  
 L = Large (greater than 1 acre)

TABLE IX - STREAM STABILITY SUMMARY

<u>REACH (R.M.)</u>	<u>SSR</u>	<u>FLOW REGIME</u>			<u>STREAMBANKS</u>			<u>CHANNEL SUBSTRATE</u>				
		<u>Ratio MF:LF</u>	<u>LWD Ornt</u>	<u>LAT CUT</u>	<u>ER</u>	<u>RC</u>	<u>VEG</u>	<u>DTCH</u>	<u>TONE</u>	<u>EMBRC</u>	<u>VEG</u>	
I (7.0-11.5)	4.1	2:1	11	H	M	M	L	M	MB	L-M	Y	P

LEGEND: SSR: Stream stability rating  
Ratio MF:LF: Ratio between mean annual flow width and the seasonal low flow width  
LWD ORNT. Large woody debris orientation (ll=parallel;R=Random)  
LAT CUT. Lateral cutting (H 80%; M = 20-80%; L 20%)  
ER: Bank erosion (H 50%; M = 20-50%; L 20%)  
RC: Rock content (Diameter 1 ft.)  
(H > 65%; M = 30-65%; L < 30%)  
VEG. Vegetative cover (Ground cover & root matrix)  
(H > 80%; M = 50-80%; L 50%)  
DTCH: Percent detached (H 50%; M 20-50%; L 20%)  
TONE: B-(Bright); MB-(Moderately bright); MD-(Moderately dull); D-(Dull)  
IMBRC. Imbrication (degree of substrate packing)  
(Low: two size classes or less  
Moderate: three to five size classes  
High: five size classes)  
VEG: Vegetation: Y (Yes); N (No); R (Riffles); P (Pools)

\*Data on channel structure not included due to modification of data collection & evaluation procedures

CLEAR CUT BOUNDARY

RI,II,III

REACH # AND SECTION

T1 1.0

TRANSECT # AND RIVERMILE

\* OBSTRUCTION

\* BARRIER

J1,2,3

JAM AND#

F( )1,2,3

FALLS, HEIGHT, AND #

C1,2,3

CULVERT AND #

B1,2,3

CHUTE AND #

DIVERSION STRUCTURE (I = water is used for irrigation purposes)

MINE OR ROCK PIT SITE

BRIDGE

LANDSLIDE, SLUMP

DEBRIS TORRENT TRACK

SPRING

UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)

BANK EROSION (EXTENSIVE/SEVERE)

1,2,3, : MISCELLANEOUS

WETLAND HABITAT

ROAD AND ID NUMBER

EARTHFLOW



Excessive stream cleanout R.M. 10.8 REMOVED beneficial LWD which served as a key channel structural element. This has triggered accelerated channel SOWNCUTTING resulting in reduced stream stability.



Stream flows of a violent nature appear to be cinnib, The presence of streamside vegetation is Important in maintaining long-term bank stability through mechanical binding with root matrices and deflection of seasonal high flows. The stream is rated moderately unstable (SSR 4.1).



At R.M. 10.0, high quality spawning gravels suitable for anadromous utilization are present. Enhancement activities (log sill construction) from R.M. 9.0-11.5 are an option. Several potential sites are found from R.M. 9.0-10.0. Access is good with a logging spur crossing at R.M. 9.4.



Log **Jam** two (R.M. 10.2) has created a large sediment plain. Partial removal would enhance fish passage and provide a source material to seed enhancement structures downstream. 24



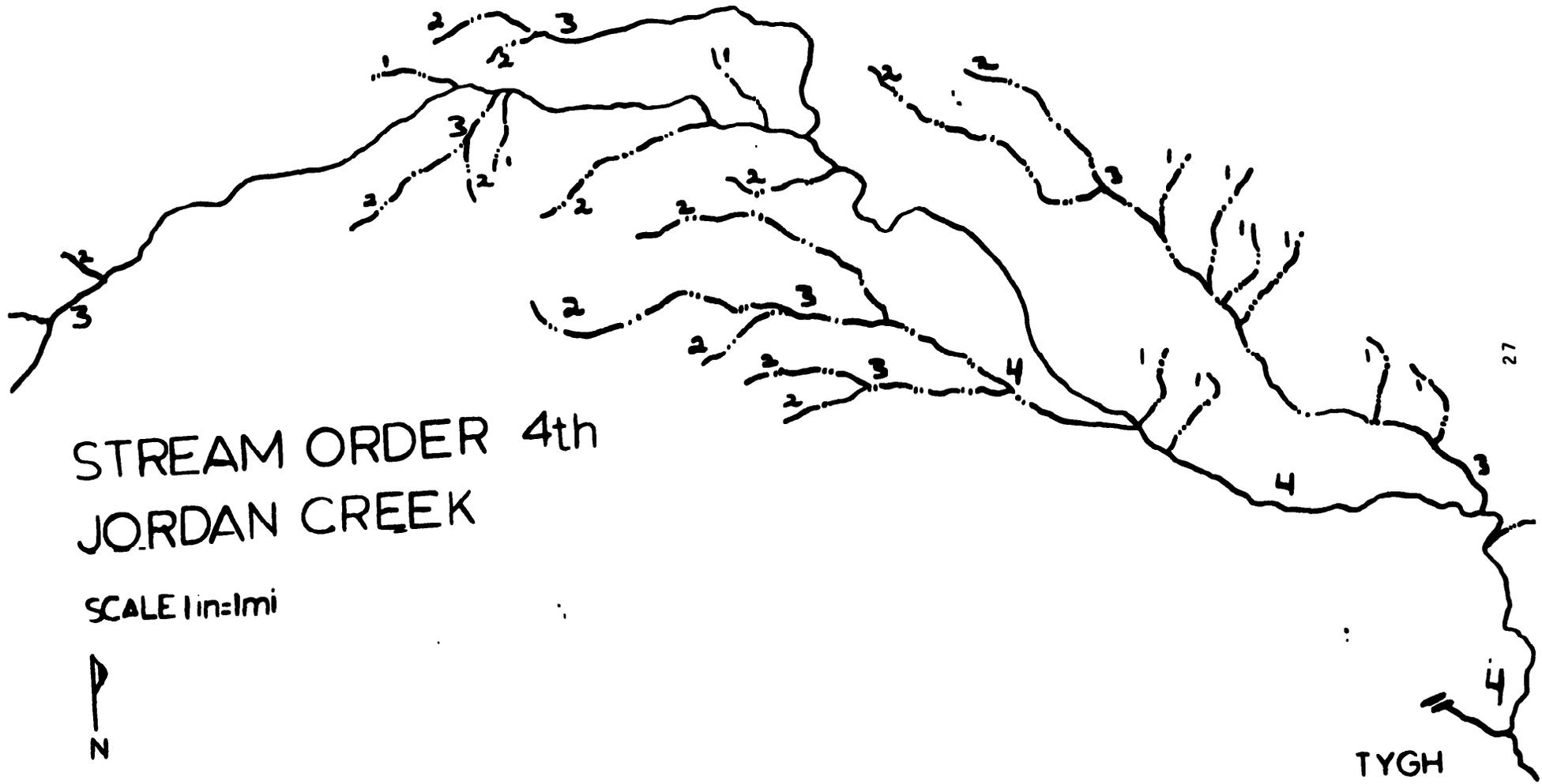
Over 50% of the high quality spawning and rearing habitat is associated with LWD. Maintenance of large trees will provide a future source material for continued habitat formation and stream stability.



Passage enhancement at R.M. 8.2 is an option. This jam and numerous small jams are barriers to resident rainbow trout and would present obstructions to anadromous fish. Modification should be considered on an individual basis and care should be taken not to remove the key structural components.



Large physical structural components such as bedrock and large boulders create excellent habitat (spawning and rearing) but are generally limited to the inside portion of stream meanders. Rearing habitat may be limiting fish production. Enhancement activities could be centered on pool development.



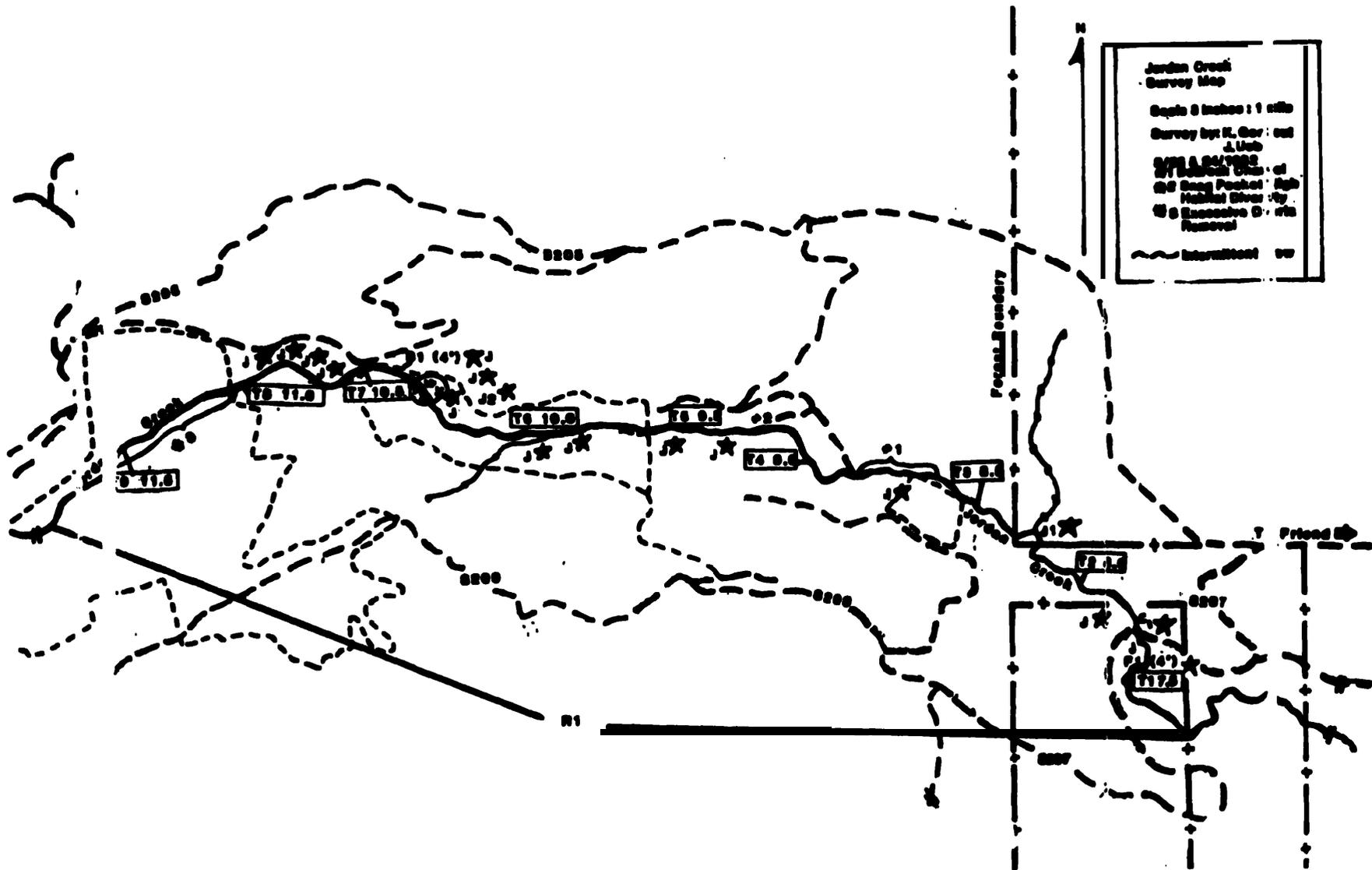
STREAM ORDER 4th  
JORDAN CREEK

SCALE 1in=1mi



TYGH  
CREEK

27



THREEMILECREEK

BARLOW RANGER DISTRICT

Surveyors: David Wiswar county: Hood River, Wasco  
Doug Kinzey

Dates Surveyed: August 29-31, 1983 Mouth Location:  
T4S, R13E, Sec. 16

Tributary To: White River Watershed Area: 24,800 acres  
38.7 square miles

TRI Compartments: Stream Length: 20.5 miles  
Stockton 1501  
Rocky 1502  
Bell 1503 Low Flow Width (Avg.): 9 feet

Gamefish: Rainbow trout Stream Order: III (on sec.  
surveyed)

Potential Anadromous Species: Distance Surveyed:  
Steelhead trout Mainstem: 7.3 miles  
Coho salmon (RM12.0-19.3)

Average Fish Habitat Condition Rating: 6.9 (good)

Average Riparian Condition Rating: 5.8 (moderate)

## THREEMILE CREEK

### SurveySUMMARY

#### A. StreamSummary

Threemile Creek is a fourth order stream, which ultimately drains into White River. The section of Threemile Creek surveyed is within the Mt. Hood National Forest boundary. This survey began immediately below Forest Service Road 4811 (RM 12.0) and continued to RM 19.3. Forest Service Road 4811 parallels the drainage on the north side and crosses the stream again at RM 17.5. The 1974 "Rocky Bum" extends from RM 12.0-13.7. A diversion structure is located near RM 11.5 on private land. It is reported that most of the summer streamflow is channelled into an irrigation ditch at this point. Rainbow trout were observed throughout most of the surveyed length.

#### B. Watershed Characteristics and Geomorphology

Threemile Creek flows in a broad, flat-bottom, V-shaped valley from RM 12.0-13.5. Valley sideslopes are moderate (30-50 percent). The stream gradient is low (4 percent) in a very wide floodplain (200+ feet). Above RM 13.5 the floodplain narrows to less than 100 feet wide. Stream gradient increases to 10 percent above RM 2.9 and maintains a high gradient over the remaining stream length. Several perennial tributaries contribute to the stream's discharge. The important ones are Tributary B, which provides

approximately 30 percent of the flow (2.5 cfs) at its confluence (RM 14.6), and Tributary D, which provides about half of the flow (1 cfs) at its confluence (RM 18.3). Tributary D drains through a wet meadow (10 acres). A smaller meadow (2 acres) is located at RM 19.2. Threemile Creek maintains a good base flow (4-7 cfs), with a moderately flashy flow regime. In the area of the "Rocky Burn" stream shading is low (10 percent), whereas upper reaches have moderate to high shading. A salvage sale conducted in the burn area greatly reduced the source of large woody debris, which is an important structural component in this section of stream. Loss of streamside riparian vegetation has decreased bank stability and cover.

c. Reach Descriptions

Four reaches were identified along the surveyed section of Threemile Creek. All reaches are riffle dominated. The stream gradient is low (4 percent) in Reaches I and II (RM 12.0-14.9) and high (>8 percent) in Reaches III and IV. Large woody debris is important in retention of greater than half the total spawning gravels and over 70 percent of the pool formation.

D. Fisheries

The overall rating of the fisheries habitat is good (HCR = 6.9). Rainbow trout were observed up to RM 17.4. Pool size is 3-6 square yards over 75 percent of the surveyed length. Depths are moderate and effective cover is moderate to high. High quality pools are common and are found on the outside

of meander turns and at the base of log sills. Large woody debris (LWD) is influential in 80 percent of all pool development and 90 percent of the high quality pools. Spawning gravels total 791 square yards with 85 percent suitable for anadromous salmonids. Gravel beds are 2-4 square yards in area over 75 percent of the surveyed length. The presence of LWD in the channel influences the retention of 75 percent of the total and high quality gravel beds. Debris accumulations are present at RM 13.2, 13.25, and 14.35. The lower two are partial barriers. There are two culverts present; Forest Service Road 4811 crosses the stream at RM 12.05 and RM 17.5. Water velocities measured in each were 3 ft/sec and 5 ft/sec, respectively. The upper culvert is a partial velocity barrier. The habitat in Threemile Creek appears highly suitable for steelhead trout and marginal for coho salmon.

#### E. Riparian

The overall riparian quality rates moderate (RCR = 5.8). Positive factors influencing the rating include a wide floodplain in Reach I, a high number of habitat units above RM 13.7, deciduous overstory species scattered in the floodplain between 14.9 and 17.4, and the presence of special habitats (talus slopes and wet meadows). Overstory canopy is absent from RM 12.0-13.7 due to the "Rocky Burn". Regeneration in this section is marginal. Western red cedar dominates the overstory above the burn area to RM 15.0, where hemlock becomes dominant. Four active clearcut units between RM 15.2 and 17.3 have had an impact on the riparian zone by decreasing stream shading and bank stability and increasing introduction of slash and sediment to the stream.

#### F. Rehabilitation and Enhancement

Rehabilitation efforts should center on re-establishing an overstory canopy in the area of the "Rocky Burn" (Reach I, RM 12.0-13.71) and within the units of the Slide Timber Sale that border the stream. Low stream shading and cover from the loss of riparian vegetation should be increased. Bank sloughing is also a problem in Reach I, which is compounded by the presence of livestock grazing. Maintenance of the livestock exclosures present in this area would improve their success, and allow revegetation of streambank areas.

#### G. Special Interest

The Threemile Creek Trail parallels the north side of the stream over most of the surveyed length. Units of the proposed Highland Timber Sale include sections of the trail. The sale proposes to divert the trail around these units. A rock pit is located on the south side of the drainage at RM 13.6.

## TEREMILE CREEK

### Reach Summary

#### Reach I; 12.0 - 13.7:

1. Valley configuration is a broad, flat-bottom V. Floodplain is greater than 200 feet wide.
2. Stream gradient is low (4 percent).
3. Substrate is primarily rubble and gravel (80 percent).
4. Riffles dominate the stream surface area (P:R = 3:7).
5. Stream shading is low (10 percent). The 1974 "Rocky Burn" extends through this section.

#### Reach II; 13.7 - 14.9:

1. Valley bottom width narrows. Floodplain width averages 100 feet.
2. Gradient remains low (4 percent).

3. Substrate is a rubble-gravel mixture (70 percent), with an increase in boulders (10 percent).
4. Pool-to-riffle ratio remains the same (P:R = 3:7).
5. Stream shading increases substantially to 85 percent.
6. Channel braiding is common. Braids average about 100 feet in length and have flows of 1-2 cfs.

Reach III; 14.9 - 17.4:

1. Valley configuration continues as a flat-bottom V, with a variable width. Floodplain width varies from 80 to 200 feet.
2. Gradient is high (10 percent). The stream has a stairstep profile. LWD and large boulders are the structural components creating the rise in the profile.
3. Riffle area is reduced by 10 percent (P:R = 4:6).
4. Shading is moderate (70 percent). Four clearcut/shelterwood units (Slide Timber Sale) are in this reach. Shading in these areas is low (15 percent). Timber was cut to the edge of the channel.

5. Channel braiding is still common. The braids have lower quality pool development than the mainstem and LWD has less influence.

Reach IV; 17.4 - 19.2:

1. Valley configuration is a narrow, flat-bottom V. Sideslope gradients are gentle to moderate (20-50 percent). Floodplain width is 60 feet wide and narrows to 30 feet at the upper end.
2. Gradient is high (8 percent).
3. Substrate composition is gravel and rubble (65 percent). Fine gravel and sand comprise 30 percent of the bottom composition. The flow regime is well-regulated.
4. Pool-to-riffle ratio remains 4:6.
5. Stream shading is moderate (60 percent).
6. Instream LWD is abundant.

Tributaries

Six perennial streams are tributaries to the surveyed section of Threemile Creek. Two of these, Tributaries B and D, are important because they

contribute more than 30 percent of the flow at their confluence with the main stem. The flow in the others is less than 0.5 cfs and fish habitat is very marginal.

Tributary B contributes approximately 30 percent of the flow (2.5 cfs) at its confluence with Threemile Creek (RM 14.6). The tributary was surveyed to RM 0.2. Habitat appears suitable for resident trout, although none were observed.

1. Valley configuration is V-notched with moderately steep sideslopes (30-50 percent sideslope gradient).
2. Stream gradient is high (11 percent) with a stairstep profile provided by LWD. Floodplain width is 20-40 feet.
3. Bottom composition is predominantly sand, gravel, and rubble.
4. Pools comprise approximately 40 percent of the stream surface area. The quality of the rearing habitat is low. Pools are 1-2 square yards, shallow (0.5 ft), and have low effective cover.
5. Shade is high (90 percent).
6. Channel braiding is common.

Tributary D provides about 50 percent of the low flow to Threemile (1 cfs) at its confluence (RM 18.3). The tributary is a single channel at the confluence and then braids into three channels through a wet meadow area. The stream gradient of the tributary below the meadow is 14 percent. Habitat appears marginal for resident trout. Pool quality is low. Pools are less than one square yard and shallow.

## THREEMILE CREEK

### Fish Habitat Summary

#### Reach I; RM 12.0 - 13.7:

1. The fish habitat quality is rated fair to good (HCR = 6.3).  
Electroshocking in August 1982 (Cain, T. and Smith, D. 1982. Resident Trout Population Assessment Program. Mt. Hood National Forest) gave a population estimate for rainbow trout that was relatively high (2374 fish/acre). No other game species were observed.
2. Spawning gravels total 217 square yards, with 60 percent (123 square yards) considered high quality. Approximately 40 percent (91 square yards) of the total are in the 1.5-3 inch size class and 50 percent (108 square yards) in the 3-6 inch size class. Spawning beds are typically 3-4 square yards in area. LWD influences formation of about 50 percent of the beds.
3. Riffles dominate the stream area (P:R = 3:7). Rearing pools of 5 square yards are moderate to high in quality. They are generally found on meanders. The high quality pools are associated with large, overhanging root wads. LWD influences 75 percent of all pool development and 95 percent of the high quality pools.

4. Double, 4-foot diameter culverts (64 feet in length) at Forest Service Road 4811 (RM 12.05) are likely partial barriers to fish migration, particularly juveniles. Low flow velocities of 3 ft/sec and water depths of 6 inches were observed in the culverts. Two debris accumulations at RM 13.2 and 13.25 are also partial barriers. Both are 4-feet high and have accumulated more debris behind them. The stream channel in the area of Logjam #2 (RM 13.25) has numerous braids. Jump pool development below the accumulations is shallow.

Reach II; RM 13.7 - 14.9:

1. The fish habitat condition rated excellent (HCR = 8.0). No fish were seen in this section', probably due to low light conditions at the time of survey.
2. Spawning gravels total 134 square yards; 45 percent (62 square yards) are of high quality. Seventy percent of the total (92 square yards) are in the 1.5-3 inch size class and the remaining are in the 3-6 inch size class. LWD is influential in formation of 90 percent of the gravel beds. Average gravel bed size is 2-3 square yards. Most of the LWD appears to be local origin.
3. Rearing habitat is good although riffles continue to dominate the stream surface area (P:R = 3:7). Pools are 4-6 square yards, are typically associated with meanders, and natural log sills. Depths are moderate to

deep (30+ inches). Effective cover is high and created by overhanging root wads, pool depth, and surface turbulence. LWD influences 85 percent of the pool development and 100 percent of the high quality pools.

4. Logjam #3 at RM 14.35 is 4-feet high and may be a low flow barrier due to poor pool development below the structure.

Reach III; RM 14.9 - 17.4:

1. The fish habitat condition is rated good (HCR = 7.5). Rainbow trout are present and were observed in low number.
2. Spawning gravels total 290 square yards. Forty-five percent (130 square yards) are of high quality. Seventy percent (200 square yards) of the total are in the 1.5-3 inch size class and 20 percent in the 3-6 inch size class. Spawning bed size averages 3 square yards. About 80 percent of the gravel retention is influenced by LWD.
3. Pool surface area increases slightly from the previous reaches (P:R = 4:6). Channel structure is provided by large boulders and LWD. Mid-channel pools are 2-5 square yards with moderate depths and moderate effective cover. The larger and higher quality pools are associated with LWD. Smaller pools (1 square yard) are found behind boulders along the stream margins. These are shallow and offer little effective cover.

4. No migration obstructions are in this reach. The overall high gradient (10 percent) has a stairstepped profile with the rise being comprised of a series of short cascades over boulders and LWD.

Reach IV; RM 17.4 - 19.3:

1. The fish habitat condition is rated fair (HCR = 5.4). No fish were observed in this section.
2. Spawning gravels total 150 square yards; 50 percent are high quality. The distribution by size category is as follows: 40 percent (60 square yards) are 0.5-1.5 inch; 40 percent are 1.5-3 inch; and 20 percent are 3-6 inch. The average gravel bed size is small (1-2 square yards) and almost totally dependent an instream LWD for its formation and retention.
3. Pools comprise 40 percent of the stream surface area (P:R = 4:6). Pool sizes are 1-2 square yards, shallow, and have low effective cover. LWD is influential in 90 percent of the pool development.
4. A 4-foot diameter, 50-foot long culvert is at RM 17.5, the Forest Service Road 4811 crossing. The gradient measured 2.5 percent and stream velocity through it was 5 ft/sec. This culvert is marginal for fish passage and should be considered a priority for passage improvement if anadromous fish are introduced or at time of replacement. The culvert would be a probable barrier at higher flows, with velocities over 7 ft/sec.

## TRREEMILE CREEK

### Riparian Summary

#### Reach I; RM 12.0 - 13.7:

1. The Riparian Condition Rating is moderate (RCR = 5.6). The 1974 "Rocky Burn" extends throughout this reach.
2. Positive factors influencing the rating include a very wide floodplain (greater than 200 feet), forming a broad, flat bottom, V-shaped valley. Small wetlands are present along 10 percent of the reach length. They are more frequent at the upper end of the reach (RM 13.5-13.7). Negative factors include the lack of an overstory as the result of fire and salvage logging.
3. Two habitat units (grass-forb and shrub-seedling-sapling) are abundant, along with a sparse overstory (western red cedar and Douglas fir) at either end of the reach. Small (30-40 feet) snags are scattered throughout.
4. The small wetlands present (see above) are a special habitat in this reach.
5. Livestock are presently excluded from approximately 50 percent of the reach length. In sections in which either access is permitted or occurs

due to down fenceline (RM 13.2), cattle trails crossing the stream and following the streambank are common.

Reach II; RM 13.7 - 14.9:

1. The Riparian Condition Rating increases to high (RCR = 6.3).
2. Floodplain width is moderate (100 feet). Numerous high-f low braids have resulted in small silt-bottomed skunk cabbage wetlands over 20 percent of the reach length.
3. All five habitat units (grass-forb, shrub-seedling-sapling, poles, small saw, and large sawtimber) are present.
4. The coniferous overstory is cedar dominated, with lesser amounts of fir and a few Douglas-fir. No deciduous overstory was noted.
5. The skunk-cabbage wetlands mentioned above are a special habitat in this reach.

Reach III; RM 14.9 - 17.4:

1. The riparian habitat rates moderate (RCR = 5.7).

2. The floodplain width is narrow (averaging 65 feet), forming a V-shaped valley.
3. Five habitat units continue to be present.
4. Coniferous diversity is the greatest of any reach, with an average of five species (hemlock, cedar, grand fir, Englemann spruce, white pine) commonly present. Lesser amounts of Douglas fir, western larch, and ponderosa pine are also present. The overstory changes from cedar-dominated (Reach II) to hemlock-dominated.

Deciduous overstory species present, although none are common, are quaking aspen (RM 16.1), cottonwood, and Scouler's willow.

5. Two special habitats occur at RM 15.9 and 16.1. Both are talus slopes. The first contains a very high coniferous diversity (seven species) including several dead and dying white pine snags. The second special habitat talus slope contains a small quaking aspen grove and is surrounded by large (150-200 feet) ponderosa pines.
6. Four recently logged units (Slide Timber Sale) occur in this reach (RM 15.1, 15.7, 16.7, 17.2). In each, upland slopes on both sides of the drainage have been clearcut, with a sparse shelterwood left on the lower slopes and floodplain. Shading is poor (15 percent). At the time of the survey, following two days of rain, several recent overland flow channels

from the unit into Threemile Creek were noted. The northeast facing slope of the first clearcut (RM 15.1) contained the heaviest of these (three channels estimated at 1/4 cfs total). Under heavier run-off events a potential for accelerated stream sediment loading exists at these locations.

7. New needle growth on Douglas-fir and grand fir trees at RM 14.6 and 15.5 has died back.

Reach IV; RM 17.4 - 19.3:

1. Riparian habitat continues to rate moderate (RCR = 5.5).
2. The floodplain width is narrow (45 feet), forming a V-shaped valley with gentle (40 percent) sideslopes.
3. All habitat units are present.
4. The coniferous overstory is composed of spruce and true fir (noble and Pacific silver) in the riparian zone and mountain hemlock on the upland slopes. No deciduous species were noted.
5. Special habitats include two wet meadows at RM 18.3 and 19.2. The first is a large (10 acres) sedge/alder meadow with a sparse overstory of

spruce, true fir, and numerous snags. It is presently included in the Hiland #8 Salvage Sale (see Rehabilitation/Enhancement Summary).

The second special habitat meadow is a small (1-2 acres), open wetland of sedges, grasses, and forbs.

## THREEMILE CREEK

### Rehabilitation/Enhancement Summary

#### Riparian Enhancement

Riparian enhancement efforts directed at reducing effects such as reduced stream shading, bank stability, and soil and water retention capabilities associated with the 1974 "Rocky Burn" and the Slide and Hiland Timber Sales could benefit this stream.

In the Rocky Burn area (Reach I), livestock are presently excluded from approximately 50 percent of the reach length by barbed-wire fencing. Exclusion areas have higher banks and greater shading (provided predominantly by willow) than sections accessible to cattle. Repair of downed fenceline at RM 13.2 would exclude an additional 20 percent of reach length. Fencing the entire length of the reach and establishing watering troughs outside the riparian zone would likely provide maximum benefits to the riparian area.

In the four recently logged (unburned at time of survey) Slide Timber Sale units spanning the Threemile mainstem at RM 15.1, 15.7, 16.7, and 17.2, upland slopes have been clearcut and lower streamside slopes are shelterwoods. Shading in these areas is low (15 percent). Planting a buffer of fast-growing deciduous species such as willow, alder, and cottonwood would increase shading and bank stability. Additionally, overland flows occurring after a two-day

rainstorm in these areas were noted at the time of the survey and may present eventual erosion problems. Monitoring these locations would determine whether erosion work such as grass-forb seeding or installation of check dams and waterbars will be necessary.

In the Hiland Sale (RM 17.5-18.41, uncut at the time surveyed, a low ground pressure skidder salvage unit (Hiland #8) surrounds two smaller clearcuts (Hiland #4, 15) whose flagged boundaries presently extend into the Threemile floodplain (10-20 feet from stream edge). The salvage sale plan includes winching downed logs from the 10-acre special habitat wetland on Tributary D (RM 18.3). Re-establishing sale boundaries to provide a streamside protection strip and exclude wetlands from logging activity would help maintain fish and wildlife habitat in these areas.

#### Passage Enhancement

A diversion structure (RM 11.5) on private land, just below the area surveyed, diverts all summer discharge so that the stream immediately below this point is usually dry from July through November (information provided by local residents). Future increases in flow sufficient to allow passage during this period may be desirable. Approximately seven miles of upstream habitat would be made accessible in this manner.

Two culverts (RM 12.05 and 17.5) appear to be partial passage barriers. Baffling or some other modification may be required to enhance passage at these structures. The lower culvert (RM 12.05) has higher priority as it blocks access to 5.5 miles of fair to good habitat.

Three logjams (RM 13.2, 13.25, 14.35) may also partially reduce passage during low flows but are low priority. Passage during higher flows would probably be unobstructed.

THREEMILE CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>					<u>POOLS</u>				<u>RIFFLES (%)</u>				
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I(12.0-13.7)	6.3	10	3:7	4	M	5	M	-	*	40	40	15	5	3
II(13.7-14.9)	8.0	85	3:7	4	M	4	M-H	-	10	45	30	10	5	4
III(14.9-17.4)	7.5	70	4:6	10	L-M	3	M	-	20	35	30	10	5	4
IV(17.4-19.3)	5.4	60	4:6	8	L	2	L	-	5	30	35	15	15	2

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq$ 12", M = 12 - 29", H  $>$ 30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq$ 40%, M = 40-60%, H  $>$ 60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

THREEMILE CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

Species	<u>REACH</u>			
	I	II	III	IV
Rainbow Trout	L	( )	L	( )

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (12.0-13.7)	217	123	94
II (13.7-14.9)	134	62	72
III (14.9-17.4)	290	130	160
IV (17.4-19.3)	150	76	74
TOTAL	791	391	400

THREEMILE CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATION*</u>
12.05	Culvert	C1	P	Modify for passage, 64 ft long, 3 ft/sec velocity.
13.2	Logjam	J1	<b>P</b>	Low priority.
13.25	Logjam	J2	<b>P</b>	Low priority.
14.35	Logjam	J3	<b>F</b>	Low priority.
17.5	Culvert	c2	<b>P</b>	Modify for passage. Velocity barrier, 5 ft/sec, 40 ft long, 2.5% gradient. Low priority.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

THREEMILE CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH <b>(RM)</b>	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (12.0-13.7)	1.7	0.0	3:7	5	1	91	108	
II (13.7-14.9)	1.2	0.0	3:7	5	1.5	92	42	
III (14.9-17.4)	2.5	0.0	4:6	4	1	200	64	
IV (17.4-19.3)	1.9	0.0	4:6	2	0.5	60	30	
TOTAL	7.3	0.0				443	264	

LEGEND: Avail: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Miles of habitat potentially available with passage enhancement.  
 P:R: Ratio of pool length:riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3".6" size classes.

THREEMILE CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (12.0-13.7)	50	50	75	95	Var	S	1	1-2	L
II (13.7-14.9)	90	80	90	100	Perp	S+M	1-2	1-2	L+M
III (14.9-17.4)	80	80	70	80	Perp	S+M	1-2	1-2	L+M
IV (17.4-19.3)	100	100	90	100	Perp	S	1-2	1-2	L

LEGEND:

Total: % of total habitat area dependant on LWD  
 HQ: % of high quality habitat area dependent on LWD  
 OR: angle of orientation to flow, perp = perpendicular, var = variable  
 #: number of logs/structure; s = single log, m = multi-log  
 L: average length of logs, expressed in channel widths  
 Dia: diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	q	W	D	
I (12.0-13.7)	9	.4	1.5	5	14	1	200+
II (13.7-14.9)	14	.3	2	8	23	1.5	70
III (14.9-17.4)	7	.5	1.5	5	16	1.5	100
IV (17.4-19.3)	5	.2	1	1	9	.5	70

\* Data compiled from transect measurements.

LEGEND: W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 V: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

THREEMILE CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (12.0-13.7)	8/25/83	6.5	10	SE	65/54	75/57	1430-1700
II (13.7-14.9)	8/129/83	9-7.5	90	SE	60/50		1735-1845
III (14.9-17.4)	8/30/83	7-4	80	E	57/50	62/50	1100-1630
IV (17.4-19.3)	8/31/83	1-2	80	E	56/46	62/47	1100-1425

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>		<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Con.</u>	<u>Dec.</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>
I 12.0-13.7	5.6	200+	2	0	0	I	10	SM	1	
II 13.7-14.9	6.3	100	5	3	0	I	20	SM	1	
III 14.9-17.4	5.7	65	5	5	1	II			2	
IV 17.4-19.3	5.5	45	5	3	0	II	20	LG,SM	2	

LEGEND:

RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: Habitat Units H  $\geq$ 4; M 2-3, L  $\leq$ 1  
 Con: # Conifer Species  
 DecL # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H >50%; M 25-50%;  
 L <5%  
 Size: Size of Wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

XAnderson:paw(WP-PJS-5210N)



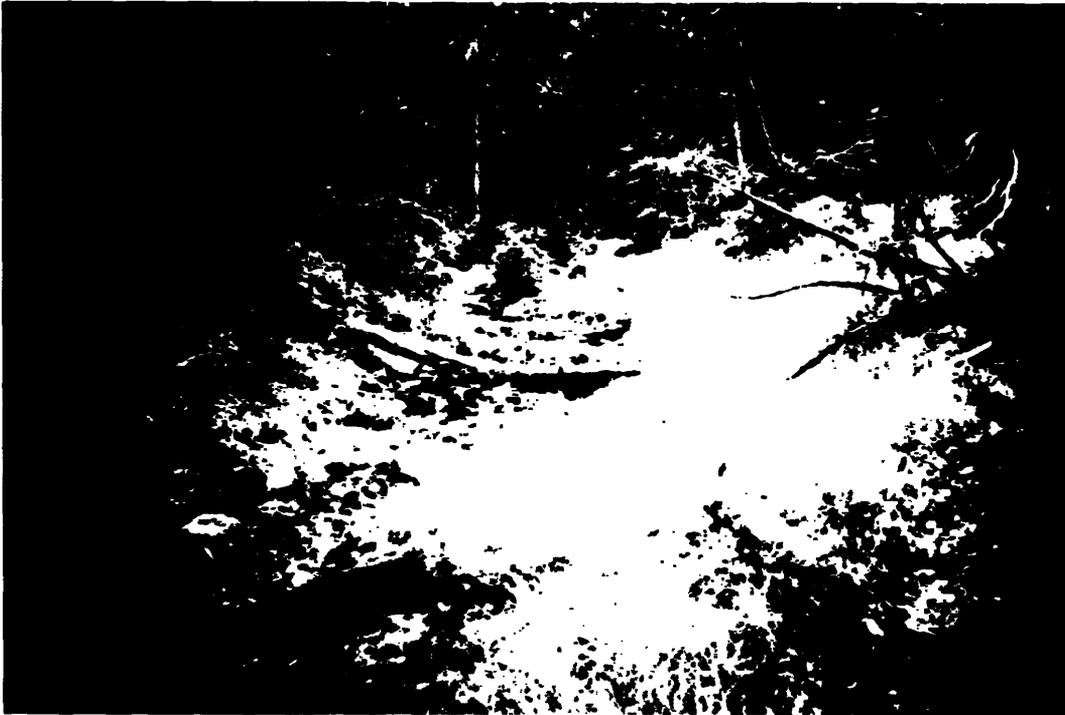
**View from the rockpit (RM 13.6) looking downstream through Reach I. The broad V-shaped valley of this reach lies within the 1974 "Rocky Burn" area. Small wetlands are present along 10% of the reach length, predominantly around the mouth of Tributary A (willow patch in left foreground of photo).**



Pool development is highly dependent on large woody debris throughout the stream length, with 95% of the high quality pools present associated with incorporated woody debris. Log sills and rootwads such as these pictured in Reach I are particularly common components in the stream channel, frequently creating pools with good depth (2-3 feet) and high effective cover.



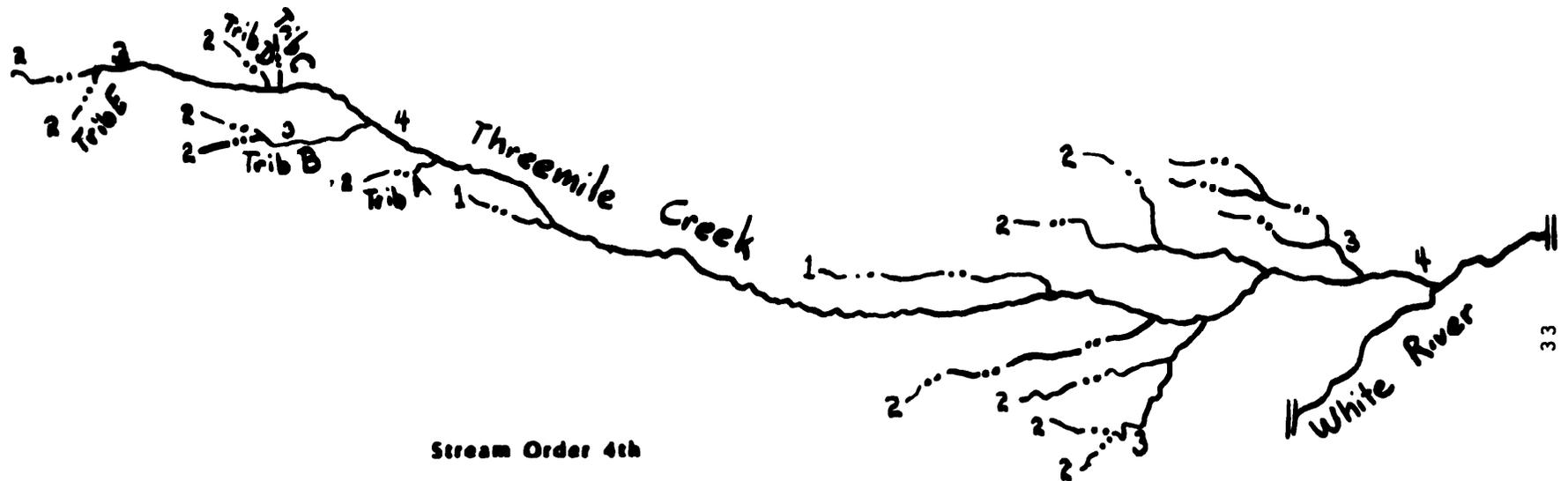
The fish habitat in Reach IV is only fair (HCR=5.4). The gradient is high (8%) over a gravel and rubble substrate. The flow regime is well-regulated. Riffles dominate the stream surface area slightly (P:R=4:6). Pools are small, with shallow depths and low effective cover. Spawning habitat is fair, there are 150 square yards of spawning gravels present, with approximately 60% suitable for anadromous salmonids. (Photo at RN **17.6.1**)



The two-acre grass meadow bordering Threemile Creek at RM 19.1 is one of the special habitats noted in the surveyed area. Other special habitats include small wetlands snag patches, and talus slopes. Riparian habitat conditions are rated moderate overall, largely limited by low species and structural diversity in the streamside plant communities. Existing special habitat units are therefore especially important in wildlife habitat quality on this stream.



Tributary D braids into three channels through this high quality sedge and tag alder meadow (10 acres). The overstory species within it are spruce and true fir. Standing and downed snags are abundant. The meadow is within the boundary of the Hiland #8 salvage sale. (Shown at RM **0.1.1**)



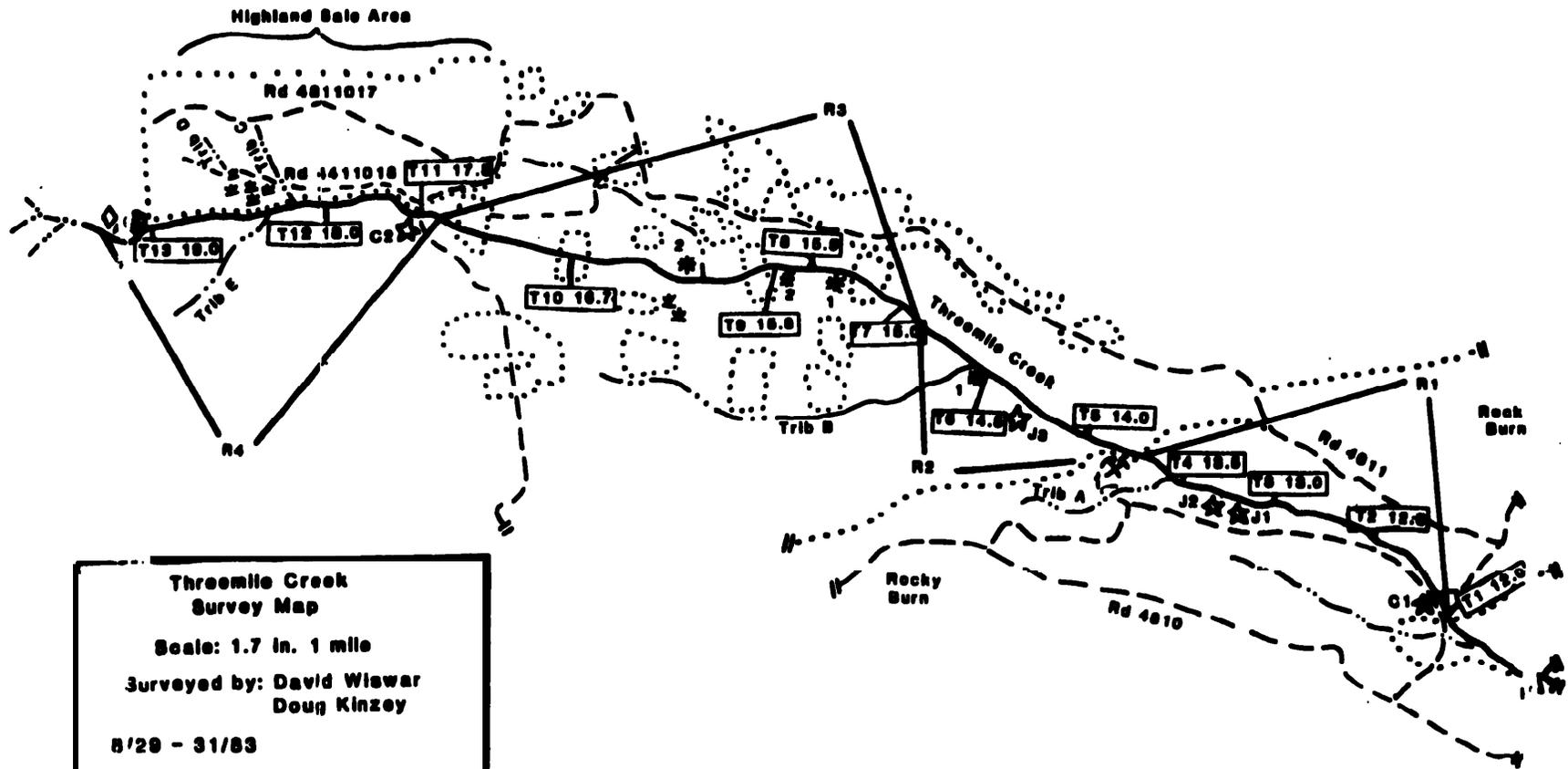
Stream Order 4th

THREEMILE CREEK

Scale 0.5 in; 1 mi

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
<b>R<sub>I,II,III</sub></b>	REACH # and SECTION
<b>T<sub>1</sub> 1.0</b>	TRANSECT # AND RIVERMIL
 OBSTRUCITON	 BARRIER
<b>J<sub>1,2,3</sub>, F( )<sub>1,2,3</sub> C<sub>1,2,3</sub> B<sub>1,2,3</sub></b>	<b>JAM and # FALLS, HEIGHT, and # CULVERT and # CHUTE and #</b>
	DIVERSION STRUCTURE ( <b>I</b> - water is used for irrigation purposes)
	MINE or ROCK PIT SITE
	BRIDGE
	LANDSLIDE, SLUMP
	DEBRIS TORRENT TRACK
	SPRING
	UPPER LIMIT OF FISH PRESENT (A - limit of potential anadromous fish habitat)
	BANK EROSION (EXTENSIVE/SEVERE)
	1.2.3, :MISCELLANEOUS
	WETLAND HABITAT
	ROAD AND ID NUMBER
	EARTHFLOW



**Threemile Creek  
Survey Map**

Scale: 1.7 in. 1 mile

Surveyed by: David Wiswar  
Doug Kinzey

8/28 - 31/83

**Legend**

- ♣-1 dead new growth on conifers
- ♣-2 talus slope

GATE CREEK

BARLOW RANGER DISTRICT

Surveyors: Jeff Uebel, Tom Cain, County: Wasco  
David Wiswar, Doug Kinzey

Dates Surveyed: October 5, 6, Mouth Location: T4S, R12E, Sec. 27  
& 11, 1983

Tributary To: Rock Creek Watershed Area: 23,700 acres  
37 square mile6

Drainage: Deschutes Stream Length. 13.5 miles

TRI Compartments: Gate 1505 Distance Surveyed: 8.0 miles,  
1.8 miles South Fork Gate Cr.

Gamefish: Rainbow trout Low Flow Width (Avg.): 5.5 feet

Potential Anadromous Species:  
Coho  
Steelhead trout Stream Order: IV

Average Fish Habitat Condition: 5.2 (Fair)

Average Riparian Condition Rating: 5.5 (Moderate)

## GATE CREEK

### Survey Summary

#### A. Stream Summary

Gate Creek is a fourth order tributary to Rock Creek, draining a watershed of approximately 23,700 acres (37 square miles). More than 80 percent of the drainage lies on National Forest System land (above RM 4.1). Seven miles of the mainstem (RM 5.0 to 13.0) were surveyed on October 5 to 11, 1983, along with 1.8 miles of a major tributary (South Fork Gate Creek). A diversion at RM 8.6 was withdrawing approximately half (1 cfs) of the total stream discharge at the time of the survey. The diverted water is stored in Rock Creek Reservoir for irrigation purposes.

The drainage is extensively roaded. Highway 48 crosses at RM 5.8. Easy access from RM 5.8 to 12.9 is possible from numerous spurs off of Road 4820. Road 4830 runs between the mainstem and the South Fork Gate Creek. Road 4811 crosses at RM 12.9 and Road 4813 at RM 13.7. The headwaters are crossed by Road 4812.

Rainbow trout were observed in low numbers throughout the survey length. A total of 9.8 miles of habitat potentially suitable for anadromous fish utilization (steelhead, coho) were identified in this survey.

## B. Watershed and Geomorphology

Gate Creek flows through a flat bottom, V-shaped valley with a floodplain ranging from 30 to more than 200 feet wide. Sideslope gradients are moderate, decreasing from 50 percent in the lower reaches to above 30 percent in Reach IV. The low topography of the drainage combined with relatively low mainstem gradient (maximum 8 percent) may be responsible for the generally well-regulated flow regime and for the apparent low stream power of the system. The resultant lack of scour may be as important as lack of structure in accounting for the relatively low pool quality evident in much of this stream. The stream has a low sediment flushing capability.

The major tributary system, South Fork Gate Creek (RM 7.11, delivers approximately half (1 cfs) of the mainstem discharge at their confluence.

### c. Reach Description

Four reaches were identified on the mainstem of Gate Creek. Reaches I and II are very low gradient (1 percent) with substrates dominated by fine gravels, sand, and silt in Reach I, and gravels in Reach II. Reach III has increased gradient (3 percent), and the highest boulder-rubble component of any reach (35 percent). Gradient increases throughout Reach IV (5-8 percent) over a gravel-dominated substrate.

Floodplain widths average 175 feet in Reach I, 55 feet in Reach II, and 30 feet in the South Fork Gate Creek. Floodplain widths vary considerably in Reaches III and IV between a maximum of greater than 200 feet and a minimum of 30 feet.

#### D. Fisheries

The overall rating of fish habitat is fair (HCR = 5.2). Approximately 9.8 miles of habitat on the Forest appear suitable for anadromous fish utilization. Rainbow trout are present but appear to be low in number. Pool size, depth, and cover are generally low and may be the major limiting factor to present and potential fish production. Of the high quality pools present, over 90 percent in Reaches II, III, and IV are LWD-dependent. Gravel quantity (averaging nearly 100 square yards/mile) appears good throughout the mainstem, but is scarce in the South Fork (33 square yards/mile). The amount of gravels dependent on LWD for retention increases from 10 percent in Reach I to 85 percent by Reach IV. Numerous debris jams through Reach II (RM 6.4-8.8) and the irrigation diversion structure (RM 8.6) appear to be partial obstructions to fish passage.

Fish habitat conditions appear suitable for coho salmon and steelhead trout in Reaches I, II, and III, and for steelhead trout in Reach IV.

#### E. Riparian Area

The overall Riparian Condition Rating is moderate (RCR = 5.5). Riparian habitat quality gradually decreases heading upstream. Extensive wetlands, dry meadows, and a wide valley bottom contribute to higher quality habitat in downstream reaches. Livestock grazing impacts (trampled streambanks, sedimentation at cattle crossings, heavily grazed riparian vegetation) are evident in the lower reaches and the South Fork. The 1974 Rocky Bum eliminated the canopy on the side-slopes and riparian area of RM 8.8 - 10.2, which makes up most of Reach III. Above the bum, logging corridors and streamside logging have removed the canopy in several localized areas.

#### F. Rehabilitation and Enhancement

Several partial and complete migration barriers throughout Reach II restrict access to the upper 6.6 miles of this stream. Partial removal of log jams (RM 6.4-8.8), modification of the diversion structure (RM 8.6), and alteration of the Road 4820 culvert-crossing (RM 9.3) could improve passage throughout the system.

Pool rearing habitat is generally poor above RM 6.0. Pools have small area, low depth and effective cover. Pool enhancement work such as log sill or boulder berm construction could greatly improve the fish-rearing capabilities of this stream.

Livestock impacts, such as bank and streambed trampling and overgrazing, are evident in the lower 4.0 miles surveyed, including the Rocky Burn. Above the Burn, logging corridors have been cut across the riparian corridor. The impact of canopy removal in both areas could be reduced and riparian diversity enhanced by revegetating streambanks in these areas with fast-growing deciduous species and protecting the riparian area from livestock overgrazing during the revegetation process.

#### G. Special Interests

The cultural resource value is high from RM 5.0-6.0, due to the presence of the Old Barlow Road Crossing (RM 5.3) the remains of an old shack (RM 5.4), and the well-maintained gravesite (RM 5.7) of Jarvis Biggs and son, who were killed in 1861. The diversion dam at RM 8.6 is a water supply to Rock Creek Reservoir, which is utilized as a water source for irrigation in summer months. A small private home development is located adjacent to the lake.

## GATE CREEK

### Reach Summary

#### Reach I; RM 5.0 - 6.4:

1. The valley configuration is a wide flat bottom V, with an average floodplain width of 175 feet. Stream braiding is common.
2. The gradient is very low (1 percent).
3. The riffle substrate is predominately fine gravel, sand, and silt (70 percent), apparently due to the well regulated flow regime, low gradient, and low summer flows. The stream has a low sediment flushing capability.
4. The stream area is pool dominated (P:R=6:41).
5. Stream shading is 60 percent.

#### Reach II; RM 6.4 - 8.8:

1. The floodplain width decreases (avg. = 55 ft) as the valley narrows. The stream is largely confined to a single channel.

2. The gradient is similar to Reach I.
3. The riffle substrate size increases to 55 percent gravel.
4. The pool to riffle ratio is similar to Reach I (P:R=6:4).
5. Shading increases to 90 percent.

Reach III; RM 8.8 - 10.9:

1. Valley configuration is a V-shaped valley with a floodplain width averaging 95 feet.
2. Gradient increases to 3 percent.
3. Substrates remain gravel-dominated (60 percent). The boulder-rubble component (35 percent) is the highest of any reach.
4. Riffles dominate the stream area (P:R=4:6).
5. Stream shading is moderate (50 percent). It is low (30 percent) throughout the Rocky Burn (RM 8.8-10.2) but increases to 90 percent in the upper end of the reach.

Reach IV; RM 10.9 - 13.0:

1. Floodplain width remains moderate (100 feet wide) and is contained in a flat bottom V-shaped valley.
2. Gradient increases from 5 percent at the lower end of the reach to 8 percent at the upper end.
3. Substrate remains gravel dominated (55 percent).
4. Pool to riffle ratio remains 4:6.
5. Stream shading remains high (80 percent).

South Fork Gate Creek; RM 0.0 - 1.6:

1. Valley configuration is a narrow bottom (30 feet wide) V-shaped valley.
2. Gradient is low (3 percent).
3. Gravel remains the predominant substrate size class (50 percent of all substrates).

4. Shallow pools (depth less than 12 inches) dominate the stream area (P:R=7:3). Pool cover is low to moderate.
  
5. Stream shading is moderate (70 percent).

## GATE CREEK

### Fish Habitat Summary

The overall fish habitat is rated fair (HCR=5.2). The highest rating, 5.9 (fair to good) is in Reach III (RM 8.8 to 10.9), while the lowest rating, 4.5 (poor), is in Reach II (RM 6.4 to 8.8). Low numbers of rainbow trout were observed throughout the survey section. A total of 9.8 miles of potential anadromous fish habitat is present, including 8.0 miles on the mainstem and 1.8 miles on South Fork Gate Creek. This habitat appears suitable for coho and winter steelhead production. Major limiting factors include the poor pool development throughout the stream, and the many small debris jams and diversion dam in Reach II, which form partial and total migration barriers.

#### Reach I; RM 5.0 - 6.4:

1. The fish habitat is rated fair (HCR=5.4).
2. The quantity of pool rearing habitat is good but the quality is generally marginal. Pools average 12 square yards in size but depths are predominately less than 12 inches. Effective cover is moderate and is provided by overhanging vegetation and LWD. A few high quality pools associated with beaver dams are present at RM 5.0-6.0. Channel braids in this reach also provide excellent off-channel rearing habitat.

3. Spawning habitat is fair with 45 percent of the 148 square yards of gravels rated as good quality. Seventy percent of the gravels are of a size class suitable for potential anadromous utilization.
4. No migration obstructions were observed.

Reach II; RM 6.4 - 8.8:

1. The habitat quality decreases to poor (HCR=4.5).
2. Pool rearing habitat quality decreases with a greater predominance of shallow (12 inch depth) pools. Effective cover is moderate and the average pool size is similar to Reach I. Ninety-five percent of the high quality low flow pools are dependent on LWD.
3. Spawning habitat is poor to fair as the relative abundance and quality of gravels decreases from the previous reach. Fifty-five percent of the 148 square yards of gravels are of a size class suitable for anadromous utilization.
4. Numerous small debris jams occur throughout the reach and act as partial to full migration barriers. A diversion dam (RM 8.6) also is an upstream migration barrier as well as a potential downstream smolt migration obstruction.

Reach III; RM 8.8 - 10.9:

1. The fish habitat condition is rated fair (HCR=5.9).
2. Riffles dominate the stream area (P:R=4:6). Pool depths (greater than 12 inches) and cover are moderate, with an average surface area of 3 square yards.
3. Spawning habitat quality is moderate, with 258 square yards (65 sq. yds./mile) of gravels counted. Eighty percent of these are in size classes suitable for anadromous utilization.
4. No barriers to potential anadromous migration were noted.
5. Negative factors lowering the Habitat Condition rating include the effects of recent logging activity throughout this reach. In the Rocky Bum (RM 8.8-10.21, salvage operations have reduced the potential for future LWD input into the channel. Above the Bum, in the Gator Sale area (1982), logging corridors cut across the stream were used to remove cedar from streamside areas and from the wetland special habitat (see Riparian summary) located in this reach. Clean-up operations resulted in the removal of some LWD previously incorporated in the stream channel.

Reach IV; RM 10.9 - 13.0:

1. Fish habitat is rated fair (HCR=5.1).
2. Pool habitat is similar to Reach III.
3. Spawning gravel quantity decreases from the previous reach. One hundred and thirty-one square yards (33 sq. yds./mile) were counted, approximately half of which are in size classes suitable for anadromous utilization.
4. No barriers to potential anadromous migration were noted.
5. Logging corridors and cedar removal continue from the previous reach. A corridor running down the length of Pup Creek (RM 12.3) has removed the overstory and bank vegetation from a 100 foot section at the confluence of this perennial tributary to Gate Creek. High stream gradient (33 percent) at this location greatly increases the potential for bank cutting and sediment loading.

South Fork Gate Creek; RM 0.0- 1.6:

1. The fish habitat is rated poor (HCR=4.1).

2. Pools dominate the stream area (P:R=7:3) but are generally low quality (12 inches deep with low cover). Average size is 3 square yards.
3. Spawning habitat is of moderate quality, with 99 square yards (33 sq. yds./mile) of gravels counted.
4. No obstructions to fish passage were noted.

## GATE CREEK

### Riparian Summary

#### Reach I; RM 5.0 - 6.4:

1. The Riparian Condition Rating is high (RCR=7.9).
2. The average floodplain width is 175 feet, in a wide, flat bottom V-shaped valley.
3. All five habitat units are present, although poles and saw timber are scarce where the stream passes through a large wet/dry meadow complex (RM 5.0-5.5).
4. The overstory is a variable mix of conifers and deciduous species including ponderosa pine, Douglas-fir, cedar, oak, red alder, and cottonwood.
5. Special habits include the abundant (80 percent of stream length) beaver-pond wetlands, and snag patches.
6. A reduction in riparian vegetation and bank stability due to livestock activity lowers the riparian habitat quality in isolated areas (RM 5.2 and 5.4).

Reach II; RM 6.4 - 8.8:

1. The riparian habitat is rated moderate to high quality (RCR=6.0).
2. The average floodplain width decreases to 55 feet in the narrow flat bottom V valley.
3. Four habitat units are present, with grass/forb habitat generally scarce.
4. The coniferous overstory diversity increases, with the inclusion of grand fir to the previous list. Red alder was the only deciduous species observed in the overstory.
5. The special habitats observed are similar to those in Reach I.
6. The effects of livestock are reduced in this reach.

Reach III; RM 8.8 - 10.9:

1. The riparian habitat is rated moderate (RCR=4.6).
2. The floodplain width is moderate (averaging 95 feet), ranging between 30 and 190 feet.

3. Most of this reach (RM 8.8-10.2) is located within the 1974 Rocky Burn. An average of three habitat units per transect are present, with grass/forb and shrub/seedling/saplings common. The third unit is variable.
4. The coniferous overstory, where it occurs, is cedar dominated with Douglas-fir and grand fir also common. Ponderosa pine, white pine, and western hemlock are present but uncommon. A deciduous overstory is generally lacking, although some cottonwood is present.
5. A special habitat is the wet grass/sedge meadow (1 acre) occurring at RM 10.4.

Reach IV; RM 10.9 - 13.0:

1. The riparian habitat remains moderate (RCR=4.3).
2. The floodplain configuration is similar to Reach III. Average width is moderate but continues to fluctuate between 30 feet and greater than 200 feet wide.
3. Habitat units increase to four, with all units except grass/forb generally present.

4. An average of four coniferous species per transect compose the overstory. Cedar, grand fir, and hemlock dominate, with lesser amounts of white pine, Douglas-fir, spruce, and ponderosa pine. Cottonwoods and red alder are deciduous species occasionally present, but not common
5. No special habitats were noted.

South Fork Gate Creek; RM 0.0 - 1.6:

1. The riparian habitat is moderate (RCR=5.2).
2. The floodplain width is narrow (30 feet).
3. All five habitat units are present.
4. The coniferous overstory averages three species per transect (cedar, grand fir, and Douglas-fir).
5. Three special habitats are a small (less than 1/2 acre) beaver meadow and elk wallow at RM 0.9, the Turkey Spring meadow area to the north and upslope of this point, and a small (less than 1 acre) quaking aspen grove at RM 1.6.

6. Cattle grazing impacts include bank trampling and vegetation grazing. Grass height at the time surveyed was less than 6 inches in areas accessible to grazing and 3 feet in areas protected by down logs and branches.

## GATE CREEK

### Rehabilitation and Enhancement Summary

#### Passage Enhancement; RM 6.4-9.5, 7.45, 8.6, and 9.3:

At least 10 debris jams in Reach II and particularly logjam J2 (RM 7.45) present partial and total migration barriers to salmonids. Partial removal of these debris accumulations could enhance passage. A diversion dam (RM 8.6) would likely present both up- and downstream passage problems to anadromous fish. The dam is 2 feet high with a cement apron 8 feet long and 15 feet wide with no jump pool. Modification for upstream passage appears relatively easy. Screening of the intake ditch will be required to facilitate downstream passage. Culverts C2 (RM 9.3) and C3 (RM 12.9) are velocity barriers to salmonids which could apparently be rectified by the addition of baffles. Culvert C3 is above the extent of potential anadromous habitat and, therefore, is a low priority project to benefit resident trout. Heavy equipment access is good along most of Gate Creek, with numerous roads paralleling and crossing the stream course.

#### Pool Rearing Habitat Enhancement; RM 6.0-13.0:

Pool quality and quantity during summer low flows is poor through 90 percent of the area surveyed. Pool depths are predominantly shallow (12 inches) with moderate effective cover (RM 6.0-13.0). Riffles dominate above RM 8.5.

Enlarging existing pools, improving pool scour, and recruiting more flow past the diversion dam could increase low flow pool rearing habitat. Access is good throughout this area.

Bank Rehabilitation; RM 5.2, 5.4, 9.3-12.4; S.F. Gate 0.0-0.2:

Bank instability due primarily to livestock trampling of banks and reduction of riparian vegetation occurs at RM 5.2, 5.4, 7.1, and 9.3-10.2 of the mainstem and RM 0.0-0.2 on South Fork Gate Creek. Additional areas of bank instability (RM 10.3-12.4) are associated with logging corridors.

Revegetating these areas could improve bank stability and increase the riparian diversity. Protection of banks and bankside vegetation by restricting cattle access to sensitive areas could prevent the reoccurrence of these problems.

Riparian Overstory Rehabilitation and Enhancement; RM 6.5-7.5 and 8.8-12.4:

A predominantly coniferous overstory exists from RM 6.5-7.5 and RM 10.2-12.4. To increase riparian overstory diversity, deciduous species could be introduced, especially in the areas of logging corridors where the riparian vegetation has been reduced and greater light penetration occurs. Recovery of the riparian overstory in the area of the 1974 Rocky Burn (RM 8.8-10.2) has been very slow. Cattle grazing and frost pockets have kept regeneration to a minimum. Planting the area and protecting the seedlings could increase the rate of recovery, and improve stream shading and bank stability.

GATE CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM					POOLS					RIFFLES (%)				
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D	
I(5.0-6.4)	5.4	60	6:4	1	L	12	M	--	*	5	20	30	40	3	
II(6.4-8.8)	4.5	90	6:4	1	L	10	M	--	5	20	35	20	20	2	
III(8.8-10.9)	5.9	55	4:6	3	M	3	M	--	10	25	40	20	5	3	
IV(10.9-13.0)	5.1	90	4:6	7	M	3	M	--	--	15	55	20	10	3	
South Fork (0.0-1.8)	4.1	70	7:3	3	L	3	L	--	*	15	50	20	15	3	

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq 12"$ , M = 12 - 29", H  $\geq 30"$ )  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq 40\%$ , M = 40-60%, H  $\geq 60\%$ )  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

GATE CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>S. Fork</u>
Rainbow Trout-a	L	L	L	L	L
Rainbow Trout-j	M	L	L	L	L

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+).  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( 1 = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (5.0-6.4)	148	69	79
II (6.4-8.8)	187	68	119
III (8.8-10.9)	258	124	134
IV (10.9-13.0)	131	49	82
South Fork (0.0-1.8)	99	15	84
<b>TOTAL</b>	<b><u>823</u></b>	<b><u>325</u></b>	498

GATE CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
6.4-9.0	Debris jams	None	N-P	Partial removal, especially at total barriers RM 7.0, 8.4, and 9.2.
7.45	Log jam	J2	N	Partial removal.
8.6	Diversion dam	DI	N	Develop jump pool.
9.3	Culvert	c2	N	Velocity barrier-add baffles.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

<u>REACH (RM)</u>	<u>Miles</u>		<u>P:R</u>	<u>Rearing</u>		<u>Spawning</u>		<u>Comments</u>
	<u>Avail.</u>	<u>Pot.</u>		<u>Area</u>	<u>Depth</u>	<u>1"-3"</u>	<u>3"-6"</u>	
I (5.0-6.4)	1.4	0	6:4	12	1	89	15	
II (6.4-8.8)	0.6	1.8	6:4	10	1	92	13	Small debris jams reduce available habitat in R II.
III (8.8-10.9)	0	2.1	4:6	3	2	190	13	
IV (10.9-13.0)	0	2.1	4:6	3	2	48	13	
South Fork (0.0-1.8)	0	1.8	7:3	3	1	83	5	
<b>TOTAL</b>	<b>2.0</b>	<b>7.8</b>				<b>502</b>	<b>59</b>	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length:riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

GATE CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I(5.0-6.4)	10	10	25	45	Var	S-M	1-2	1	M
II(6.4.8.8)	30	35	40	95	Var	S-M	1-2	1	T-M
III(8.8.10.9)	50	50	70	90	Perp	S-M	1	1	L-T-M
IV(10.9-13.0)	75	85	80	90	Perp	S-M	1-2	1	L-M
South Fork (0.0-1.8)	30	15	65	30	Perp	S-M	2	1	L-M

LEGEND: Total: Percent of total habitat area dependant on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Vat = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
 SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	q	W	D	
1(5.0-6.4)	5.5	.3	.5	.8	10	1.2	175
II(6.4.8.8)	5	.2	1	1	8	.9	55
III(8.8.10.9)	6	.4	1	2.4	9	.8	95
IV(10.9-13.0)	6	.3	1	1.8	9	.9	100
South Fork (0.0-1.8)	5	.3	0.8	1.2	7	.8	30

LEGEND: W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 q= Average reach flow in cubic feet/second

GATE CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>R E A C H</u>	<u>(D.M.)</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (5.0-6.4)	10/5/83	0.8	60	E	58/46	62/48	1320-1500
II (6.4-8.8)	10/5-6/83	1	90	SE	54/45	61/47	1130-1700
III (8.8-10.9)	10/6/83	2.4	50	SE	51/44	64/52	1215-1545
IV (10.9-13.0)	10/6, 11/83	1.8	90	SE	51/42	64/44	1315-1600
South Fork (0.0-1.8)	10/5/83	1.2	70	E	55/44	57/46	1440-1725

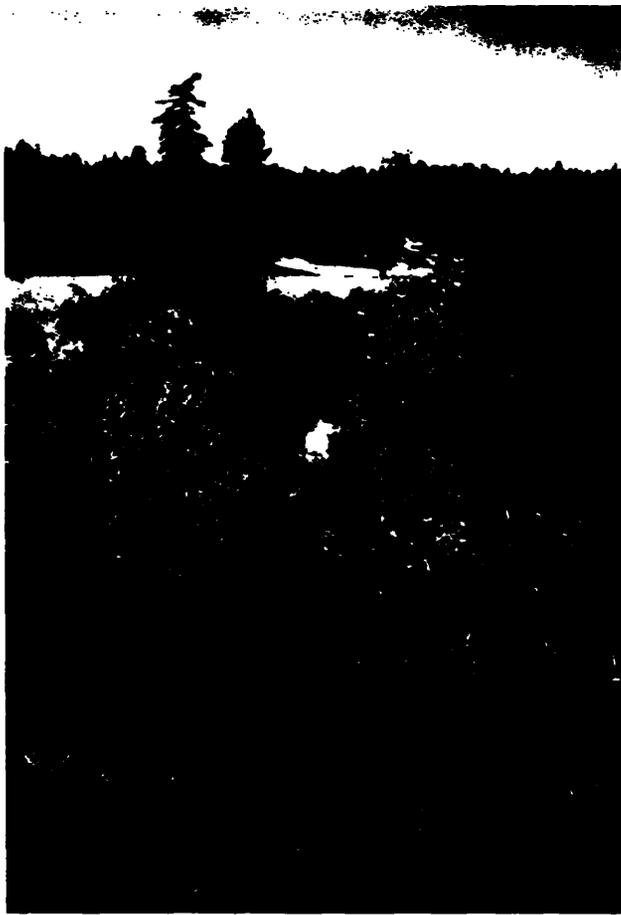
GATE CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>		<u>VEGETATION</u>		<u>AQUATIC</u>			
		F.P. (ft.)	H.U.	Overstory Con. Dec.	Streamclass	Wetland%	Size	Special Habitat	
I(5.0-6.4)	7.9	175	5	2	1	I	80	s	2
11(6.4-8.8)	6.0	55	4	4	1	I	30	S-L	1
111(8.8-10.9)	4.6	95	3	3	0	I	1	S	1
IV(10.9-13.0)	4.3	100	4	4	1	I	1	S	0
South Fork (0.0-1.8)	4.9	30	5	3	0	II	10	S	3

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain width in feet  
 H.U.: # Habitat units (H  $\geq 4$ ; M = 2-3; L  $\leq 1$ )  
 Con: # Conifer species  
 DecL # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands; (H 50%;  
 M = 25-50%; L 25%)  
 Size: Size of wetlands  
 S = small (less than 1 acre)  
 L = large (greater than 1 acre)

KAnderson:paw (WP-PJS-5240N)



The riparian habitat in Reach I is rated high quality (RCR-7.9) and includes the large wetland/dry meadow complex shown here (RM 5.0-5.5). The presence of all five habitat units, a good mix of coniferous and deciduous species in the overstory, and an abundance of small wetlands created by beaver ponds typifies the reach. This meadow has very high value as habitat for game and nongame wildlife, as well as its cultural resource values, such as the Old Barlow Road transversing it at RM 5.3 (background).



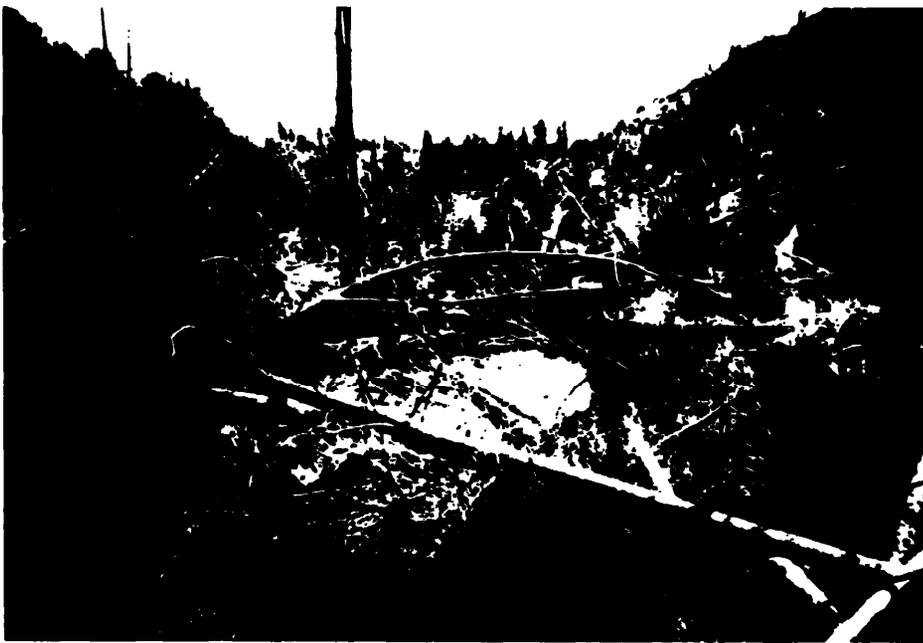
Pool quality is generally low in over 90% of the survey area. Pools in low flow periods are typically shallow (12") with moderate effective cover. Enlarging and deepening existing pools is a high priority for enhancing summer low flow rearing habitat.



The diversion dam at RM 8.6 presents a potential migration barrier to anadromous fish if they are introduced into Gate Creek. Modification for passage appears easy and would access an additional 4.1 miles of habitat (400 sq. yards of gravel). Numerous debris jams, especially in Reach II, also are partial to total migration barriers and alteration (partial removal) would be needed if utilization of all the potential habitat is desired.



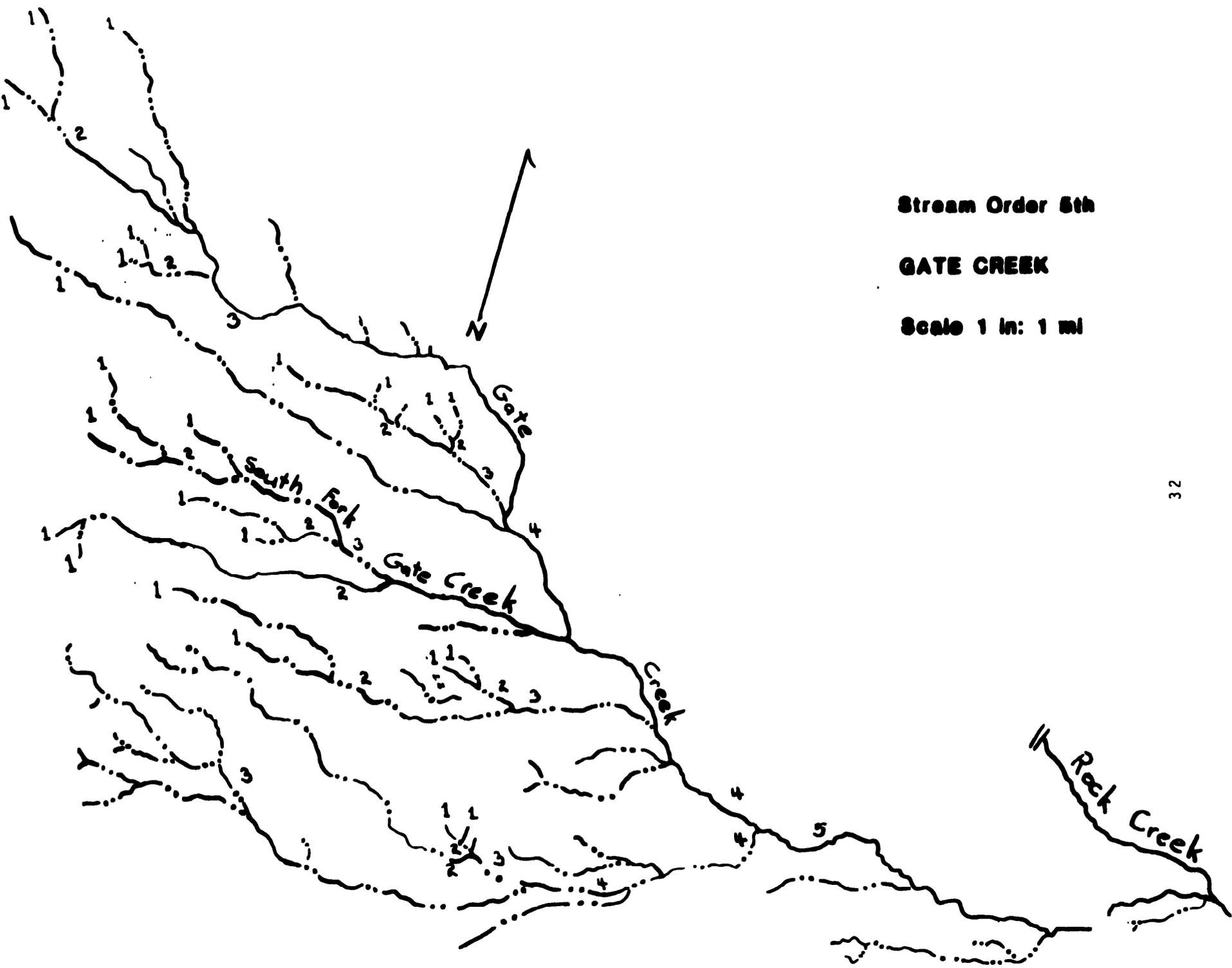
Logging corridors are common across Gate Creek from RM 10.3 to 12.4. Rehabilitation/enhancement opportunities, such as streamside deciduous plantings to increase bank stability and decrease stream sediment loading, exist at these locations.



Gate Creek passes through the 1074 "Rocky Burn" from RM 8.8 to 10.2. Shading and streamside cover are low. A 5° water temperature increase was observed through the burn during the survey on October 6. Reestablishment of stream cover appears to be a high priority for rehabilitation efforts in this area-



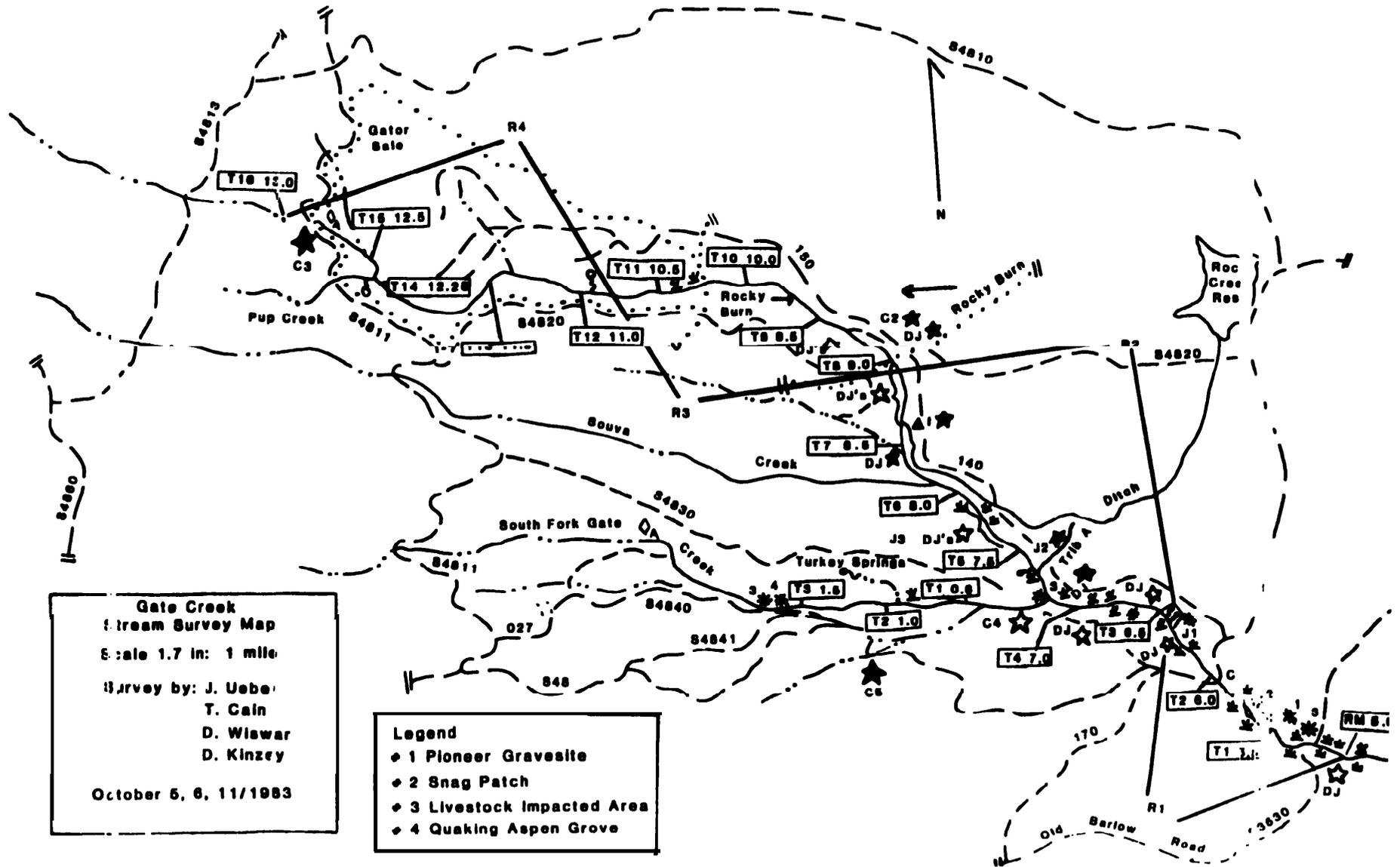
A "typical" view of Reach IV (RM 11.1). Ninety percent of the high-quality pools in this reach are dependent on LWD for their formation. LWD also appears to be an important component in bank stability. A logging corridor crosses the stream in the background.



**Stream Order 5th**

**GATE CREEK**

**Scale 1 in: 1 mi**





## BOULDER CREEK

### Survey Summary

#### A. StreamSummary

Boulder Creek, previously known as Crane Creek, is a fourth order tributary of the White River providing approximately 15 percent (13 cfs) of low flows at their confluence (RM 29.0 of White River). The headwater basin is located between Bonney Meadows and Badger Butte. A 470 acre tract of private land lies between RM 5.1 and 6.2. This represents three percent of the total drainage acreage. Forest Service Road 48 crosses the creek at RM 2.9. Associated spur roads 4800 and 4870 run parallel along the west and east slopes of the drainage. Crane Creek and Boulder Creek trails also provide access to the drainage. A total of 11.6 miles were surveyed, including 11.0 miles of mainstem, and 0.6 miles of tributary habitat. The survey was conducted on June 21-28, 1983.

#### B. Watershed Characteristics

The basin is oriented in a north-south direction. Drainage characteristics have been heavily influenced by glacial activity. Forest and Lost creeks are the major perennial tributaries in the lower basin. Numerous first and second order perennial and intermittent tributaries enter the mainstem throughout its length. The gradient of the mainstem

averages 3 to 4 percent. The flow regime appears to be well-regulated in the upper third of the drainage, becoming flashy towards the mouth. Boulder, Spinning, and Little Boulder Lakes are located on the northwest side of the drainage. The outlet streams of these lakes drain into Boulder Creek at RM 8.5. Numerous wetlands are found along the floodplain throughout the drainage. Large wetlands (5 acres) are common in the upper third of the drainage.

C. Geomorphology

The floodplain below RM 2.3 is less than 70 feet wide. Above RM 2.3 to RM 8.3 it is wide (120-200 ft.) with a flat-bottom V configuration. From RM 8.5 to 10.3, the stream meanders through a broad (500 - 1000 ft.) glacial formed U-shaped valley. The floodplain narrows to less than 20 feet wide above RM 10.3, and also in the Lost Creek drainage. Side slopes of the mainstem are steep (70 percent) and generally stable. Scattered sections have exposed talus along the east slope adjacent to the floodplain.

D. Reach Description

Five reaches were identified in the survey. All are riffle dominated. Reaches I, II, and III have moderate (2-4 percent) gradient. Substrates are dominated by boulder/rubble in Reaches I and III and by coarse gravels in Reach II. The valley bottom width gradually increases from 70 feet in

Reach I to about 1000 feet by Reach IV. The size and number of wetlands increases through Reach III to a maximum in Reach IV, where extensive meadows, springlines, and channel braiding occur. Reach IV also has the lowest gradient (2 percent) of any reach, with the substrate dominated by coarse gravels. In the headwater Reach V, gradient increases to 15 percent, small wetlands remain common, and the valley width narrows to 20 feet.

E. Fisheries

Rainbow trout and brook trout were observed throughout the stream length. Fish habitat also appears to be potentially suitable for chinook salmon, coho salmon, and steelhead trout. Fish habitat is rated good overall (HCR = 7.8). Riffles dominate the stream area (P:R=3:7). Pools are generally small, ranging from one to ten square yards, with moderate depth (30 inches) and good effective cover. High quality pool development is associated with LWD (60 percent) and boulders (40 percent). Off channel rearing area is abundant in Reaches II and IV. Spawning gravels are abundant, totalling 3235 square yards. Over 50 percent were rated high quality. Reach II (RM 2.3-3.2) has the highest concentration of spawning habitat (650 square yards of spawning gravels/mile). Fish passage may be a limiting factor to potential anadromous fish production. On the mainstem, there are three logjams considered to be complete barriers (RM 1.0, 5.2, and 9.0). Several partial barriers include a road culvert (RM 2.9), numerous log and debris jams (see Table IV), and the Crane Creek

Ditch diversion structure (RM 3.1). This latter obstacle to fish migration was diverting approximately 70 percent (25 cfs) of the Boulder Creek discharge at the time of the survey.

The Oregon Department of Fish and Wildlife annually stocks Big and Little Boulder Lakes with juvenile brook trout. These lakes appear to be suitable for rearing juvenile anadromous fish.

G. Riparian Zone

The overall Riparian Condition Rating is high (RCR = 7.8). Positive factors include the high number of habitat units (4-5), high coniferous species diversity, extensive wetland development, snag patches, and the generally wide floodplain (120-200 feet). Negative factors are the low levels of deciduous trees in the overstory and the diversion ditch at RM 3.2. Exceptionally high quality wetland habitat development is found throughout Reach IV, covering virtually the entire width of the valley floor (500 - 1,000 feet).

## H. Rehabilitation and Enhancement

Rehabilitation and enhancement opportunities center on modifying migration barriers, increasing high quality rearing pool area (especially in Reach III), and increasing riparian habitat diversity through canopy manipulation and introduction of deciduous species. The Forest Creek Campground offers a location for introducing interpretive and educational displays on fish and wildlife habitat management in the basin.

## BOULDER CREEK

### Reach Summary

#### Reach I; RM 0.0 - 2.3:

1. Valley configuration is a narrow, flat bottom "V" with a floodplain less than 70 feet wide.
2. Gradient is low (4 percent).
3. The substrate is primarily large boulder/rubble (80 percent).
4. Riffles dominate the stream area (P:R = 4:6).
5. Stream shading is moderate (50 percent).

#### Reach II; RM 2.3 - 3.2:

1. Valley configuration broadens to a wide, flat bottom "V", with the floodplain increasing to 160 feet.
2. Gradient decreases to 3 percent.

3. Substrate materials decrease in size class to primarily coarse gravels (45 percent) and rubble (30 percent).
4. Pool area decreases from levels observed below (3:7).
5. Stream shading increases to 70 percent.

Reach III; RM 3.2 - 8.5:

1. Valley configuration continues to be a wide, flat-bottom "V", with a floodplain ranging between 120 and 200 feet.
2. Gradient continues to average 3 percent.
3. Substrate is predominately boulder (30 percent) and rubble (30 percent).
4. Riffles continue to predominate (70 percent).
5. Stream shading is low (35 percent).
6. Small-sized (1 acre) stream adjacent wetlands were found along 25 percent of the reach.

Reach IV; RM 8.5 - 10.3:

1. Valley configuration widens to a broad U-shape with a floodplain greater than 200 feet.
2. Gradient is the lowest of any reach (2 percent).
3. Substrate size class decreases to 60 percent coarse gravel.
4. Pool area increases to 50 percent of the total stream area.
5. Stream shading is moderate (60 percent).
6. Extensive large (1+ acre) and small (1 acre) wetlands are found along 80 percent of the stream length. Channel braiding is common, usually associated with debris jam accumulations.

Reach V; RM 10.3 - 11.0:

1. The valley becomes more constricted in this headwall reach, with the stream entrenched in a narrow (70 ft. wide) V-notch channel approximately 20 ft. deep.
2. Gradient increases to 15 percent.

3. Substrate is an even mix of rubble and gravel (40 - 45 percent).
4. P:R decreases to 1:9, the lowest pool development observed in the system.
5. Stream shading increases to very high (95 percent).
6. Resident and anadromous fish habitat is marginal in lower end of the reach (RM 10.3 - 10.6), non-existent above.

Lost Creek; RM 0.0 - 0.3:

1. Valley configuration quickly changes from a very wide, U-shaped valley near its confluence with Boulder Creek (RM 0.0 - 0.2) to narrow V-notch above (10 ft. wide valley floor RM 0.2 - 0.3).
2. Gradient correspondingly changes from very low (1 percent, RM 0.0 - 0.2) to moderate (6 percent, RM 0.2 - 0.3).
3. The substrate also changes from heavily silted gravel (RM 0.0 - 0.2) to gravel/rubble dominated (70 percent) above.
4. Pool area decreases from 50 percent near the mouth to 30 percent at RM 0.3.
5. Stream shading is high throughout (90 percent).

6. Boulder Ditch removes virtually all of the flow at RM 0.2; groundwater and seepage from the diversion gradually increase flow to 1 cfs at the mouth. Wetland development is extensive in this area (RM 0.0 - 0.2) and the channel is poorly defined.

Trib. K; RM 0.0 - 0.4:

1. Valley configuration, gradient, substrate composition, pool:riffle ratio and stream shading change dramatically in the 0.4 miles observed. RM 0.0 - 0.3 is very similar to Lost Creek RM 0.0 - 0.3 in the transition from the Boulder Creek floodplain to the tributary channel. Above RM 0.3, the stream has all the characteristics of Reach V of Boulder Creek.

## BOULDER CREEK

### Fish Habitat Summary

The mainstem of Boulder Creek contains approximately 10.6 miles of very high quality potential anadromous fish habitat. Additional habitat is provided in numerous channel braids and tributary systems (see Forest Creek Survey). A wide diversity of habitats are present, apparently suitable for utilization by coho (primarily Reaches II and IV), chinook (I through IV), and steelhead (Reaches I, III, and IV). Boulder Lake (14 acres) appears to be suitable for rearing juvenile anadromous fish, possibly including sockeye salmon. The lake is annually stocked with juvenile brook trout by the ODFW. Upstream passage to the lake is blocked by the very high tributary stream gradient, which forms a continuous series of small cascades throughout the length of the outlet stream (0.7 miles.).

#### Reach I; RM 0.0 - 2.3:

1. The fish habitat is rated excellent, HCR = 9.0.
2. Rearing habitat is good although the stream is riffle dominated (60 percent). The pools are high quality, with an average size of 10 square yards and depth ranging from 2-4 ft. High effective cover is provided by the large boulder substrate and water turbulence. Low flow

anadromous holding habitat is available in the isolated very large pools (50 square yards area and 3 feet deep).

3. Spawning habitat is good; 80 percent of the 690 square yards of gravels are of a size class suitable for anadromous fish. Fifty-five percent were rated good quality.
4. One complete passage barrier (J2, RM 1.0) and numerous partial barriers including six jams, four chutes, and three small falls obstruct passage throughout the reach. Please refer to stream survey map for locations and descriptions.

Reach II; RM 2.3 - 3.2:

1. The fish habitat rates 8.1, excellent. Positive factors include: the gravel-rubble dominated substrate, abundant high quality spawning gravel, and the dominance of riffle habitat preferred by the resident rainbow trout.
2. Pool rearing area decreases in the mainstem as riffle area increases to 70 percent. Pools are smaller (4 square yards) and more shallow than in the previous reach. Effective cover remains high and is largely a result of accumulated LWD. High quality off-channel rearing area is found in the numerous channel braids of this reach.

3. Spawning habitat is excellent with 20 percent (650 square yards) of the total gravel in the system found in this relatively short reach. About 70 percent of the gravels are suitable for anadromous fish. Sixty percent were rated good quality.
4. A culvert (C1, RM 2.9) is likely a passage barrier (velocity) during spring high water passage flows.

Reach III; RM 3.2 - 8.5:

1. The habitat condition rating is 7.8 (good).
2. Pool rearing habitat is limited (30 percent of stream area). Rearing habitat is best suited for riffle-adapted species. Pool sizes average 4 square yards, are of shallow to moderate depths, and have moderate amounts of effective cover.
3. Spawning gravels are abundant but patchy in distribution, totalling 1096 square yards. About 50 percent are considered to be high quality, and 75 percent are suitable for anadromous utilization.
4. Several migration obstructions occur between RM 3.3 and 6.4. Logjam J7, at RM 5.2, is likely a complete barrier. Five other logjams observed are rated as partial barriers (see Table 4 and Special Case Forms). The Boulder Ditch diversion structure (RM 3.2) is likely a low flow barrier.

Reach IV; RM 8.5 - 10.3:

1. The habitat rates excellent (HCR = 8.3).
2. Pool rearing habitat composes 50 percent of stream area, with moderate levels of effective cover. Pools are shallow (90 percent are less than 12" in depth), averaging 8 square yards in area. Approximately 80 percent of the high quality pool development is dependent on large woody debris.
3. Spawning habitat is abundant. Nearly 700 square yards of spawning gravel were counted, of which approximately half is high quality. About 40 percent are of a size class suitable for anadromous fish. Spawning habitat quality is highly dependent on LWD (75 percent of high quality habitat).
4. Fish passage appears to be fully blocked at river mile 9.0 by logjam J9. Partial barriers (logjams) exist at river miles 8.6, 9.2, and 9.3.
5. Channel braiding provides abundant high quality rearing habitat.

Reach V; RM 10.3 - 11.4:

1. Fish habitat rates fair (5.7 HCR). The quality of anadromous fish habitat is marginal from RM 10.3 - 10.7. No fish habitat is present above RM 10.7, due to the high gradient and low pool development.

2. Pool rearing habitat is very limited (10 percent of the stream area). Pools are small (1 square yard) and shallow (1 ft. max. depth), but have high effective cover.
3. Spawning habitat is limited, with 80 sq. yards of gravels observed. Fifty-five percent are of high quality and 60 percent are suitable for anadromous utilization.

Lost Creek; RM 0.0 - 0.3:

1. Fish habitat quality varies widely in this area. Habitat quality is rated poor overall (HCR 4.7). Virtually the entire flow is diverted into Boulder Ditch at RM 0.25. Reduced stream flow below that point, coupled with heavy sedimentation and tributary gutting as a result of past breaching of the ditchline, have severely reduced habitat quality in the lower quarter mile. Above RM 0.3, the stream appears very stable, and habitat quality is fair for resident trout.
2. Pool rearing area is limited (30 percent of the stream area). Pools are small (1 sq. yard) and shallow (1 ft. max depth), but have high effective cover.
3. Spawning habitat is very limited, with only 10 sq. yards each of marginal and high quality gravels observed.

4. Boulder Ditch forms a full migration barrier at RM 0.25. Limited habitat above (apparently less than 1/2 mile of fair quality habitat) makes passage enhancement a low priority.

Trib. K; RM 0.0 - 0.4:

1. Fish habitat quality rates fair (5.8 HCR). Habitat quality varies widely in this area. RN 0.0 - 0.2 is very similar to Reach IV Boulder Creek, but the habitat is suitable for resident trout only. Above RM 0.4, fish habitat is very marginal.
2. Pool rearing habitat is most abundant RM 0.0 - 0.2, (80 percent of the stream area). Pools are moderate in size (5 square yards), but shallow (1 ft. max. depth).
3. Spawning habitat is very limited (10 sq. yards total), with only 3 square yards good gravel observed.

## BOULDER CREEK

### Riparian Habitat Summary

Riparian habitat on Boulder Creek is rated high quality. Wetland development, particularly in the upper basin (Reaches III - V) is some of the most extensive found on the Forest. Wildlife use of the drainage appears very high, which may be due to both the very high habitat diversity as well as the limited road access to most of the stream's length (no road access above RM 2.9).

#### Reach I; RM 0.0 - 2.3:

1. The riparian habitat is rated moderate (RCR = 4.3).
2. The floodplain width is moderate (70-120 ft) in a flat-bottom V-shaped valley. Wetlands are present along 5 percent of the reach length.
3. An average of three habitat units were observed with shrub-seedling-sapling, poles, and small saw timber predominant.
4. The coniferous overstory includes cedar, Douglas-fir, grand fir, and hemlock. No deciduous species were observed in the overstory.

5. Special habitat units observed were small wetlands and talus slopes. Active clear-cut units have removed streamside vegetation and reduced shading at RM 0.7-0.8 and 1.6-1.7.

Reach II; RM 2.3 - 3.2:

1. The riparian habitat rating increases to 7.5, high.
2. The floodplain widens (120-200 ft) and wetland occurrence increases to 20 percent of the reach length. Channel braiding is frequent.
3. Habitat units increase to four and include grass-forb, shrub-seedling-sapling, small and large saw timber.
4. The overstory composition is similar to Reach I.
5. Special habitat units present are wetlands, ponds, and snag pockets.

Reach III; RM 3.2 - 8.5:

1. Riparian quality is rated high, RCR = 7.2.
2. Floodplain is wide (120 - 200 ft.), with moderate wetland development.
3. Five habitat units were frequently observed throughout the reach.

4. Overstory species includes Douglas-fir, grand fir, noble fir, silver fir, Englemann spruce, western-red cedar, and hemlock.
5. Special habitat units include talus slopes, snag pockets and small wetlands.

Reach IV: Rm 8.5 - 10.3:

1. Riparian quality is rated very high (RCR = 8.3).
2. The floodplain is wide (greater than 200 feet); extensive large wetland development (80 percent of stream length) is found throughout the very wide flat valley bottom (500-1000 ft.) of this glacial U-shaped valley.
3. All habitat units (5) were observed.
4. The overstory is composed of spruce, hemlock, noble fir, silver fir, larch, lodgepole, white pine, and some cottonwood. The primary factor lowering the RCR is the scarcity of deciduous canopy species in the area. Isolated very large cottonwoods are found along wet meadow margins.
5. Three special habitats are present: wetlands, ponds, and snag pockets.

Reach V; RM 10.3 - 11.4:

1. Riparian quality is rated moderate (RCR = 5.0).
2. Floodplain width is very limited (20 feet.).
3. Habitat units decrease to grass-forb, small and large saw timber.
4. The overstory is composed of three coniferous species: Douglas-fir, silver fir, and spruce.
5. Small seeps and springs are almost continuous along both sides of channel.

Lost Creek; RM 0.0 - 0.3:

1. Riparian quality rates high overall (RCR = 6.1). Habitat diversity is much higher between RM 0.0 - 0.2, where channel braiding and seepage have created a large wetland/swamp complex (5 - 10 acres).
2. Floodplain width is narrow (6 ft.) above RM 0.3, and very wide (200+ ft.) RM 0.0 - 0.2.
3. All five habitat units were observed.
4. The overstory is composed of Douglas and grand fir at RM 0.3. Spruce, cedar, and hemlock are prevalent RM 0.0 - 0.2.

5. Large and small wetlands are virtually continuous along the stream length. A small pond is present at RM 0.1.
6. Wildlife use of this area (big game, fur bearers, primary cavity excavators) appears heavy.

Trib. K; RM 0.0 - 0.4:

1. The riparian quality of this area rates very high (RCR, 8.2).
2. Floodplain development is very wide, RM 0.0 - 0.2 (200 feet). The stream is more entrenched and floodplain development is lower from RM 0.2 to 0.4.
3. All habitat units, but poles, (4 total) are common.
4. The overstory is composed of spruce, silver, grand, and noble fir.
5. Large and small wetlands are abundant along the stream length.

## BOULDER CREEK

### Rehabilitation/Enhancement Summary

#### Passage Enhancement; RM 0.1-0.6; 1.0; 2.2; 3.2; 5.1-6.1; 9.0:

Numerous passage obstructions on Boulder Creek would likely limit potential anadromous fish production in this stream.

Complete passage barriers exist at logjams J2 (RM 1.0), J7 (RM 5.2), and J9 (RM 9.0). All could be enhanced through partial removal coupled with side channel development. The main jam structures at J2 and J7 should be preserved due to the high quality spawning and rearing habitat associated with them. Logjam J7 lies on private land (RM 5.1) adjacent to a walk-in campground area. Numerous partial barriers exist throughout the system. Debris and logjams are the most common (RM 0.8 - 10.1). Partial removal and side channel development could enhance passage. Passage at several small chutes (B1-2, RM 0.1 - 0.4) and falls (F1-3 RM 0.4 - 0.6) could be enhanced by developing jump pools. Debris removal is necessary at the head of chutes 83-4 (RM 2.2). The culvert C1 (RM 2.9), and diversion dam D1 (RM 3.2), are high and low flow barriers, respectively. The addition of baffles and the development of an inlet resting pool may improve passage at C1. The diversion dam create6 two problems; the passage of adult fish during their spawning migration and passage of the emigrating smolts. The development of a jump pool could

improve chinook and coho (fall run) adult passage during low flow conditions. Screening of the diversion ditch entrance will likely be necessary to prevent the loss of emigrating smolts.

Rearing Pool and Spawning Habitat Development; RM 3.2-8.5; 8.8-9.0; 10.3-10.6:

Pool rearing habitat quality and quantity is low and could be enhanced in Reach III (RM 3.2 - 8.5), and also RM 8.8 - 9.0 and 10.3 - 10.6. Spawning habitat is limited from RM 3.5 to 5.0 and 10.3 to 10.6. Boulder berm and/or log sills could likely be used to increase pool size and trap gravels in these areas. Placement of individual boulders, boulder clusters, and/or logs could also promote pool scour, especially RM 8.8 - 9.0.

Riparian Area Development; RM 5.0-6.0; 10.4-10.7:

Riparian diversity could be increased by selective small patch cutting (1-2 acres) to open the canopy along RM 5.0 - 6.0 and 10.4 - 10.7, encouraging establishment of deciduous species in the overstory.

Erosion Control: RM 5.8:

Erosion along an old road crossing and landing (RM 5.8) could apparently be controlled by utilizing water bars and seeding exposed soil areas.

BOULDER CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM				POOLS				RIFFLES (%)					
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
<b>Reach I (RM 0.0-2.3)</b>	<b>9.0</b>	<b>50</b>	<b>4:6</b>	<b>4</b>	<b>M</b>	<b>10</b>	<b>H</b>	<b>*</b>	50	25	20	*	*	7
Reach II (RM 2.3-3.2)	8.1	70	3:7	3	L	4	H	0	15	30	45	10	*	5
Reach III (RM 3.2-8.5)	7.8	35	3:7	3	L-M	4	M	0	30	30	25	10	5	7
Reach IV (RM 8.5-10.3)	8.3	60	5:5	2	L	8	M	0	*	15	55	20	10	7
Reach V (RM 10.3-11.0)	5.7	95	1:9	15	L	1	H	0	10	40	45	5	0	4
<u>Tribs</u>														
Lost Cr. (0.0-0.3)	4.7	90	3:7	6	L	1	H	0	15	30	40	10	5	2
Trib K (0.0-0.4)	5.8	90	8:2	1-2	L	5	M	0	0	0	60	20	20	4

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L 1. 12", M = 12 - 29", H > 30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L > 40%, M = 40-60%, H ≥ 60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

BOULDER CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>					<u>TRIBUTARIES</u>	
	I	II	III	IV	v	Lost	K
Rb	<b>H</b>	<b>H</b>	<b>M</b>	M	L	( )	M
BT	( )	( )	( )	L	0	( )	M

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0-2.3)	690	386	304
II (2.3-3.2)	650	375	275
III (3.2-8.5)	1,096	559	537
IV (8.5-10.3)	689	362	327
v (10.3-11.0)	80	45	35
<u>Trib</u>			
Lost Cr (0.0-0.3)	20	10	10
K (0.0-0.4)	<u>10</u>	<u>3</u>	<u>7</u>
Total	<u>3,235</u>	<u>1,740</u>	<u>1,495</u>

## BOULDER CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS</u>
0.1	Boulder chute	B1	P	Improve for passage, pool dev.
0.4	Boulder chute	B2	P	Improve for passage, pool dev.
0.4-0.6	Falls	FL-3	P	Develop jump pools
0.8	Logjam	J1	P	Partial removal
1.0	Logjam	J2	N	Partial removal
1.1	Debris jam	DJ	P	Remove boulders in jump pool
2.2	Boulder chutes	B3-4	P	Remove debris at head of chutes
2.4-2.8	Debris jam	DJ	P	Partial removal
2.9	Culvert	C1	P	Install baffles
3.1	Diversion dam	D1	P	Develop jump pool
3.3	Logjam	J3-6	P	Partial removal
5.2	Logjam	J7	N	Develop side channel
6.4	Logjam	J8	P	Partial removal
8.6	Debris jam	DJ	P	Partial removal
9.0	Logjam	J9	N	Partial removal
9.2	Logjam	J10	P	Partial removal
9.3	Debris jam	DJ	P	Partial removal

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Trout migration barrier only; anadromous fish could pass obstacle.

BOULDER CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot		Area	Depth	1-3"	3-6"	
I(0.0-2.3)	1.0	1.3	4:6	10	2	345	241	4 chutes, 3 jams and 3 small falls are partial barriers
11(2.3-3.2)	0	0.9	3:7	4	1	325	130	several debris jams, a culvert and a diversion dam are partial barriers.
III(3.2-8.5)	0	5.3	3:7	4	2	548	328	6 jams are partial to full barriers.
IV(8.5-10.3)	0	1.8	5:5	8	1	345	0	4 jams are partial to full barriers.
v(10.3-11.0)	<u>0.0</u> 1.0	0.4 9.7	1:9	1	1	<u>40</u> 1,603	<u>8</u> 707	Anadromous habitat ends at RM 10.7

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R: Ratio of pool length: riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of Sq. Yards of gravels observed in the 1"-3" and 3"-6" size classes.

BOULDER CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.) <u>Source</u>	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	
<b>I (0.0-2.3)</b>	30	15	30	5	Perp	S/M	2	1-2	T
II (2.3-3.2)	60	60	55	60	Perp	S/M	2	1-2	L
III (3.2-8.5)	40	55	25	75	Perp	S/M	1-2	1-2	M
IV (8.5-10.3)	70	75	60	80	Perp	S/M	1-2	1-2	L
v (10.3-11.0)	70	80	60	90	Perp	S/M	2	1-2	M
<u>Tribs</u>									
Lost (0.0-0.3)	30	90	20	50	Perp	S	2	1	L
K (0.0-0.4)	70	75	90	95	Perp	S/M	1-2	1-2	L

LEGEND: Total = % of total habitat area dependant on LWD  
 HQ = % of high quality habitat area dependent on LWD  
 OR = angle of orientation to flow; perp = perpendicular, var = variable  
 # = number of logs/structure; s = single log, m = multi-log  
 L = average length of logs, expressed in channel widths  
 Dia = diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = 'mixture of local and transported

BOULDER CREEK

TABLE VII HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITION

<u>Reach (R.M.)</u>	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>0</u>	<u>W</u>	<u>D</u>	
I (0.0-2.3)	15	.9	1.2	16	28	2	70
II (2.3-3.2)	12	.5	1.3	8	20	1.4	120-200
III (3.2-8.5)	18	.8	1.5	20	25	1.5	120-200
IV (8.5-10.3)	14	.6	1.2	10	20	1.3	200+
v (10.3-11.0)	6	.5	2	6	12	1	20
<u>Tribs</u>							
Lost Cr. (0.0-0.3)	3	.2	1.5	1	4	0.75	6
K (0.0-0-4)	L0	.5	1	5	15	1	270

LEGEND: W,w: Stream width (ft)  
D,d: Stream depth (ft)  
v: Velocity (feet/second)  
0: Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH</u>	<u>( R . DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>	<u>A/W</u>	
I (0.0-2.3)	6/21-22/83	16	50	S	54/48-61/50		1100-1700
II (2.3-3.2)	6/22-23/83	8	80	S	55/47-61/49		1500-1820
III (3.2-8.5)	6/23-6/28/83	20	35	S	55/45-61/49		1100-1700
IV (8.5-10.3)	6/24/83	10	60	S	57/46		1345-1530
v (10.3-11.0)	6/28/83	6	95	E	57/49		1530
<u>Tribs.</u>							
Lost Cr (0.0-0.3)	6/22/83	1	90	W	55/48		1630
K (0.0-0.4)	6/28/83	5	90	E	58/48		1500

BOULDER CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH (RM)	RCR	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>				
		F.P. (ft.)	H.U.	Overstory	Con.	Dec.	Streamclass	Wetland%	Size	Special Habitat
I (0.0-2.3)	4.3	70	3	3	0	II	L	S	1	
II (2.3-3.2)	7.5	120-200	4	4	0	II	L	S	2	
III (3.2-8.5)	7.2	120-200	4	4	0	II	M	S	3	
IV (8.5-10.3)	8.5	200+	5	5	0	II	H	L	3	
v (10.3-11.0)	5.0	20	3	3	0	III	H	S	1	
<u>Tribs</u>										
Lost Cr. (0.0-0.3)	6.1	6	5	2	0	II	H	S/L	2	
K (0.0-0.4)	8.2	200+	4	4	0	II	H	S/L	2	

LEGEND: RCR: Riparian Condition Rating  
 F.P. : Floodplain  
 H.U.: # Habitat Units H  $\geq$  4; M 2-3; L  $\leq$  1  
 Con: # Conifer Species  
 DecL # Deciduous Species  
 Wetland: Percent stream length with adjacent wetlands;  
 (H >30%; M 11-29%; L <10%)  
 Size: Size of Wetlands -  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5272N)



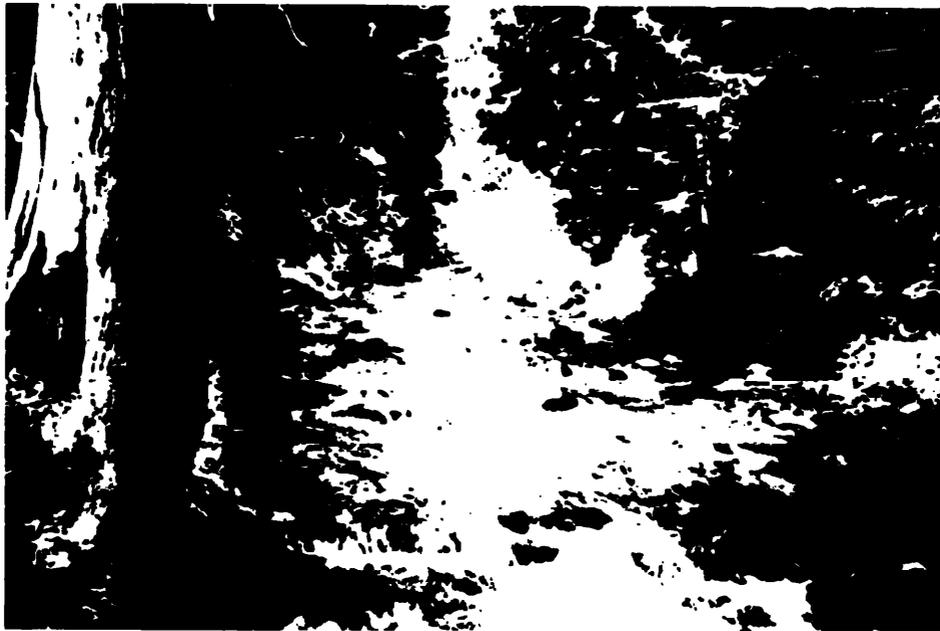
Exceptionally high quality pool development (3-7 ft. deep) is present throughout Reach I (RM 0.0 -2.3). primarily associated with large boulder channel structure. Several small chutes, falls and logjams in this reach are partial to full migration barriers and would be a high priority for passage improvement if anadromous fish are introduced. (Approximately 3000 sq. yds. of excellent spawning habitat lie above this point.) Photo at RM 0.4.



Reach II (RM 2.3 - 3.2) contains the highest concentration 7(+00 sq. yds./mile) of spawning gravels observed. Large gravel beds of 20+ so. yds. are common. Rearing habitat conditions are very good, with moderate pool volume and high effective cover from LWD. Channel braiding is prevalent in this area (RM 2.8 shown).



The Crane Creek ditch crosses the stream at RM 3.1, diverting 70% (25 cfs) of the streamflow at that point. Riparian and fish habitat quality is affected for two miles downstream by the water withdrawal. The diversion dam presents a partial barrier to fish migration; passage enhancement would likely require jump pool development. Diverted water is utilized for irrigation of the White River State Wildlife Management Area.



Reach III composes 50% of the Boulder Creek mainstem. low flow fish habitat is riffle dominated (70%). Pools are generally of moderate size (4 sq. yds.) and depth (1-2 ft.). Numerous high quality pools are distributed throughout, usually associated with logjams. Spawning habitat is very patchy in distribution, averaging 200 sq. yds./mile



This is a typical view (Rm 9.2\ of the very high quality fish habitat available throughout Reach IV (RM 8.5 - 10.3). Both pool and spawning habitat development are highly dependent on LWD structure (80 - 90%) in this reach. In the headwater area above {Reach V, RM 10.3 - 11.01, the gradient increases substantially and fish habitat becomes marginal.



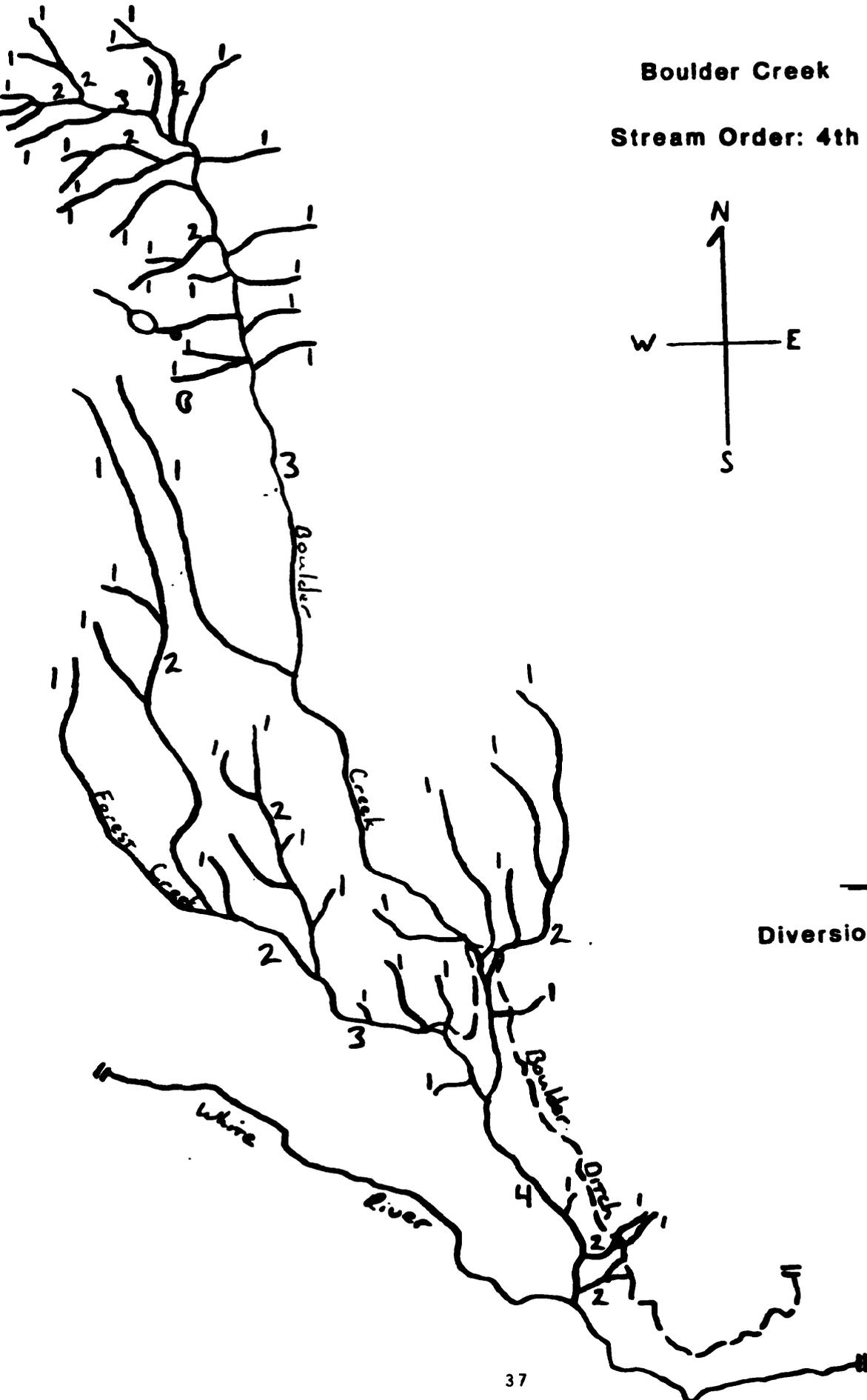
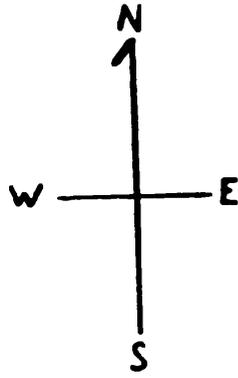
Large wetland development is exceptionally high in the 1000 foot wide valley bottom of Reach IV. Riparian habitat conditions are rated very good (RcR=8.5) in this reach. wildlife use, especially big game, appears to be very heavy. Open meadows of 10-20 acres such as this one at RM 10.0 (shown) are common in this upper third of the drainage.



Channel braiding and active meandering are common in Reach TV and are highly influenced by LWD. Excellent spawning and rearing conditions are present in most off-channel areas. Small and large ~~springlines~~ are also common in the reach.

**Boulder Creek**

**Stream Order: 4th**



**Legend**

**Diversion ditch: - - -**

FOREST CREEK  
BARLOW RANGER DISTRICT

Surveyors:	Jeff Uebel Tommy Cain	County: Wasco
		Mouth Location: T.4S., R.10E., Sec. 35
Dates Surveyed:	July 7-8, 1983	Watershed Area: 5.6 sq. miles 3,614 acres
Tributary to:	Boulder Creek	Stream Length: 2.9 miles
Drainage:	Deschutes	Distance Surveyed: 2.9 miles mainstem 0.2 miles Trib. B 0.4 miles Trib. C
TRI Compartments:	Echo, 1601 Forest, 1602 Immigrant, 1603	Low Flow Width (Avg.): 8.0 ft.
Game Fish:	Rainbow Trout	Stream Order: 3rd
Potential Anadromous Species:	Coho Steelhead	
Average Fish Habitat Condition Rating:	6.0 (Fair)	
Average Riparian Condition Rating:	6.2 (High)	

## FOREST CREEK

### Survey Summary

#### A. Stream Summary

Forest Creek (previously known as Cedar Creek) is the largest tributary system of Boulder Creek, contributing approximately 20 percent (2 cfs) of the flow at their confluence (RM 1.7 of Boulder Cr.). Over 90 percent of Forest Creek's flow (6 cfs) is diverted at RM 1.6 and runs in a ditchline to Boulder Creek, where 25 cfs of their combined flow is diverted for irrigation purposes.

The entire drainage area lies within National Forest System land. A small portion (approx. 160 ac.) is privately-owned. The Old Barlow Road, Forest Service Road S48, and a logging spur road cross the stream at RM 0.5, 1.3, and 2.3 respectively. Forest Service Road S4885 parallels the first mile of stream along the south side. A total of 3.5 miles, encompassing the mainstem and tributaries B and C, were surveyed July 7-8, 1983. Rainbow trout were observed in moderate numbers from the mouth to RM 2.0.

#### B. Watershed Characteristics

The basin is a shallow, southeast facing bowl. The valley drainage appears primarily subsurface with only a few well-developed surface

tributaries observed. Springlines and seeps within 100 feet of the stream margin are the major source of low flows. The tributaries that are present are typically small ((1 cfs), first order streams. The high level of subsurface flows and spring activity results in a very well regulated mainstem flow regime. This reduces the stream's sediment flushing capacity and lowers the quality of spawning gravels and bottom composition due to fine sediment deposition. The gradient is low (2-3 percent) to RM 1.6 and increases to 4-5 percent above this point.

### C. Geomorphology

The valley configuration is a flat bottom "V" with the valley floor ranging between 100-200 feet wide. The basin is filled with highly permeable glacial till deposits, which is likely responsible for the high degree of subsurface flows. The floodplain width is quite variable: Reach I, 70-120 feet, Reach II, 120-200 feet, and Reach III, 30 feet. The sideslopes are moderate (31-50 percent gradient) and appear predominantly stable. The drainage has been extensively logged, and this has contributed to some windthrow problems where opening of the canopy has occurred in or adjacent to wetlands and/or areas with a high water table (particularly RM 0.0-0.3).

#### D. Reach Description

Reach I (RM 0.0 - 1.6), comprising 50 percent of the surveyed mainstem, is low gradient (2-3 percent) and pool dominated (60 percent). Reaches II (RM 1.6 to 2.4) and III (RM 2.4 to 2.9) are higher gradient (4-5 percent) and riffle dominated. The flow in Reach II (5 cfs) is more than twice that observed in Reaches I or III. Large woody debris (LWD) is the dominant structural element in the channel in all three reaches.

#### E. Fisheries

Moderate numbers of rainbow trout (possibly a redband subspecies) were observed through RM 2.0. The habitat appears suitable for coho salmon and winter steelhead to RM 2.4. The overall fish Habitat Condition Rating is fair (HCR = 6.0). Rearing habitat is relatively limited in both amount and quality, especially Reaches II and III. Pools are generally small (4 sq. yds.) and shallow (12 inches), but have high cover provided by LWD.

Spawning habitat is scarce and patchy in distribution with 50 percent of the stream total of 290 sq. yds. of gravel rated as marginal. Nearly 75 percent of the good quality spawning habitat is located in Reach I. High levels of fine sediments were observed in the gravels of Reach I. Fifty-percent of the gravels are of a size class suitable for potential anadromous utilization.

Limiting factors appear to include passage barriers (culverts at RM 1.3 and 2.3, and a diversion dam at RM 1.6), poor pool development for holding and rearing, and low summer water temperatures (**40°-45°F**). Low summer flows, especially below the diversion dam, may limit fish production.

F. Riparian Area

The overall Riparian Condition Rating is high (RCR = 6.2). Positive factors influencing this score include the numerous wetland areas along the stream, the even distribution of 4-5 habitat units and a generally wide (100-200 ft.) valley bottom. Negative factors include the absence of deciduous species in the overstory, and localized loss of groundcover vegetation due to soil compaction in the Forest Creek Campground area. Snag patches are widely distributed on the stream.

G. Rehabilitation and Enhancement

Rehab/Enhancement opportunities are numerous and include passage enhancement at the passage barriers, pool development and gravel catchments throughout the stream, groundcover rehabilitation at Forest Creek Campground, and canopy manipulation (small patch cuts or bums; 1-2 acres) to stimulate riparian species diversity.

#### H. Special Interest

Special interest areas include the Old Barlow Road crossing (RM 0.50, the water diversion dam (D1, RM 1.6), and the very large springline area present at RM 2.1-2.4.

FOREST CREEK

Reach Summary

Reach I; RM 0.0 - 1.6:

1. The valley configuration is a flatbottom "V" with an average floodplain width of 80 feet.
2. The gradient is low 2-3 percent.
3. Riffle substrate composition is predominantly sediment/gravel mix, with 75 percent of the materials less than 6 inches in diameter.
4. Pools comprise 60 percent of the stream area and are largely dependent on LWD (70 percent).
5. Stream shading averages 80 percent and is provided by a coniferous overstory.
6. Two higher gradient (5 percent) atypical sections between RM 0.0-0.1 and RM 1.0-1.3 are riffle dominated (80 percent); the latter section also has low shading (50 percent), and a predominantly deciduous overstory. These sections are primarily boulder controlled. A 25 year-old clearcut along RM 1.0-1.3 has been slow to revegetate resulting in reduced shading and

LWD input. A recent partial-cut adjacent to wetlands along RM 0.1-0.2 appears to have noticeably accelerated windthrow in the riparian area.

Reach II; RM 1.6 - 2.4:

1. The valley configuration remains a flatbottom "V" and the floodplain increases in width (120-200 feet).
2. The gradient increases to 4-5 percent.
3. The riffle substrate decreases in size (fine sediment dominated) with 95 percent of the materials less than 6 inches in diameter.
4. The stream area becomes riffle dominated (80 percent).
5. Stream shading increases to 90 percent.
6. An atypical section similar to those observed in Reach I is present (RM 2.2-2.3): riffle dominated (90 percent), low shading, boulder controlled, and a reduced overstory due to a clearcut.

Reach III; RM 2.4 - 2.9:

1. The valley configuration is a flatbottom "V" with a 30 foot wide floodplain.

2. The gradient is similar to Reach II (5 percent).
3. All of the riffle substrate is less than 6 inches in diameter with small gravels and sand composing 90 percent.
4. The stream area is riffle dominated (70 percent).
5. Stream shading remains high (95 percent).
6. Flow is greatly reduced in this reach, due apparently to relatively high groundwater capacity, infiltration and subsurface flows. Flow is intermittent above RM 2.9.

FOREST CREEK

Fish Habitat Summary

Reach I; RM 0.0 - 1.6:

1. The habitat condition is rated fair (HCR = 6.1).
2. Rearing habitat is fair with pools composing 60 percent of the stream area. Pools are typically small (4 sq. yds.), shallow (less than 12 inches), with high effective cover from LWD. High quality pools suitable for adult anadromous holding are very limited throughout the reach.
3. Spawning habitat is fair to good, with 210 sq. yards present; and 50 percent of the gravels were rated marginal in quality. Fifty-five percent of the gravels are of a size class suitable for anadromous species.
4. Numerous debris jams are present and are partial barriers to anadromous fish passage (see survey map). Passage is blocked at culvert C1, (RM 1.3) and a diversion dam D1, (RM 1.6).

Reach II; RM 1.6 - 2.4:

1. The habitat rating remains fair (HCR = 6.4) although the amount of habitat doubles with the increased flows above the diversion dam.

2. Pool rearing habitat decreases, with riffles covering 80 percent of the stream area. The pools are smaller (2 sq. yds.) than the previous reach, and depths are predominantly less than 12 inches. Effective cover is high due to LWD. Few holding pools were observed. Rearing habitat is dominated by small runs and glides among the heavy debris loading present.
3. Spawning habitat is poor with decreases in gravel abundance (68 sq. yds.) and the percentage suitable for anadromous fish (50 percent of the gravels are less than 1 in. diameter.) Fifty percent of the gravels present were rated good quality.
4. Culvert C2 (RM 2.3) is a velocity and jump barrier.
5. Potential anadromous fish habitat ends at RM 2.4.

Reach III; RM 2.4 - 2.9:

1. The habitat is rated 4.8 (poor).
2. Rearing area decreases further with smaller pools (1 sq. yd.). Depths are similar to Reach II. The stream is riffle dominated (70 percent). No holding pools are present.
3. Spawning habitat is very poor. A total of 14 sq. yds. of gravels were counted; 50 percent were rated good, and only 10 percent were suitable for anadromous species.

4. Numerous small debris jams and root tangles restrict low flow passage.

Trib. B; RM 0.0 - 0.8:

1. Fair to good trout habitat is present. The habitat appears fair for steelhead, with pools predominantly small (1-2 sq. yds.) and shallow.
2. Abundant LWD input provides high levels of channel structure and high effective cover.
3. The flow was estimated at 1.5 cfs.
4. Gradient was 2 percent, and P:R = 4:6.

## FOREST CREEK

### Riparian Summary

Riparian development on Forest Creek is heavily influenced by the extremely well-regulated flows present. The flow regulation is a result of both natural and man-made features. Deep glacial till deposits filling the basin in the upper two-thirds of the drainage store much of the precipitation received, metering out the stream flow through dry periods in a large springline area (RM 2.1-2.4). Surface soil and subsoil horizons appear very permeable above this point, with surface flow intermittent above RM 2.9 (over three miles of stream channel are present above). The irrigation diversion at RM 1.6 removes over 90 percent of the flows at that point (6 cfs), not only lowering the amount of flowing water downstream, but again affecting the seasonal variation in flows below the dam.

Riparian development is highest in Reach II (RM 1.6-2.4) as a result. The comparatively large surface flows (6 cfs) combined with abundant spring activity in the area result in extensive wetland development (50 percent of the reach length). Timber harvest (clear and partial cuts) over much of the reach has increased the light penetration in the riparian zone and has encouraged greater structural diversity. Lower amounts of surface water, spring activity and light (dense coniferous canopy) limit the riparian development in Reaches I and III. Habitat diversity could likely be increased in those reaches through some selective patch cutting and/or burning to create

small openings (1-2 acres) near the stream or wetland areas. Care should be taken to select windfirm stands for treatment; heavy windthrow in and along a wetland at RM 0.3 (west bank) appears to be associated with an adjacent clearcut.

Reach I; RM 0.0 - 1.6:

1. The riparian habitat is rated moderate (RCR = 5.8).
2. The valley configuration is a wide, flat-bottom V (70-120 ft. wide floodplain). RM 0.0 - 0.1 is an atypical section, with the stream entrenched in a narrow V - notch (50 ft. deep).
3. Four habitat units are present: shrub, pole, small and large saw-timber.
4. Overstory was composed of four conifer species: cedar, hemlock, grand and Douglas-fir.
5. Springs and wetlands are present RM 0.3 - 0.4, 0.8, 1.3, and along the stream course of Trib. A (RM 0.0 - 0.1+).

Reach II; RM 1.6 - 2.4:

1. Riparian habitat is rated high quality (RCR = 6.8).

2. Valley configuration is a very wide flat bottom 'V' shape, with a floodplain 120-200 feet wide.
3. All five habitat units are present.
4. The overstory is similar to Reach I.
5. A large snag patch is present in a partial cut unit at RM 2.1. A large springline on both banks (predominantly in a clearcut on the north bank) from RM 2.1-2.4 contributes approximately 5 cfs to Forest Creek. Wetland development is extensive in this area.
6. Tributary B is a major tributary (1.5 cfs) to Forest Creek at RPI 1.8. Riparian habitat diversity is moderate due to heavy shading by the coniferous overstory (95 percent). Understory groundcover and shrub development is very low. Several large old cottonwoods were observed (two felled by beavers about 2-3 years ago).

Reach III; RM 2.4 - 2.9:

1. Riparian habitat is rated high quality (RCR = 6.7).
2. Valley configuration is a wide flatbottom "V" (300-foot wide floodplain, valley bottom = 150 feet).

3. Four habitat units are present: grass/forb, pole, small and large sawtimber.
4. The overstory species composition increases to six with the addition of spruce and white pine.
5. Small springs and seeps are numerous in the area, making up most of the creek flow. The creek is intermittent above RM 2.9. The stream flows underground in several areas below that point.

## FOREST CREEK

### Rehabilitation and Enhancement Summary

#### Passage Enhancement; RM 1.3, 1.6, 2.3:

Three passage barriers are present, the lowest occurring at culvert C1 (RM 1.3) which restricts access to 1.1 miles of potential anadromous fish habitat. A diversion dam (D1, RM 1.6) and another culvert (C2, RM 2.3) also block passage. Jump pool development could improve passage at these sites as well as baffling the culverts. If anadromous fish are introduced, screening the ditch entrance would be necessary to prevent loss of smolts in the ditchline.

Numerous debris jams are present in the stream and act as partial passage barriers (see survey map). Partial removal could rectify this problem. Access is good along most of the stream from S48 and spur roads in recent harvest areas. Due to the small size of the stream most work could be accomplished using hand tools.

#### Rearing Pool and Spawning Habitat Enhancement; RM 1.6 - 2.9:

Pool size and depth are low in Reaches II and III. Boulder berms or utilizing the abundant local LWD for log sills could improve pool scour and raise the

levels of the existing pools. These structures could also capture gravels to provide additional spawning habitat in these areas.

Riparian Diversity Enhancement; RM 0.0 - 1.6, 2.4 - 2.9:

A predominately coniferous overstory exists along most of the stream, especially within Reaches I and III. Opening up the canopy by small (1-2 acre) selective patch cuts or burning to increase light penetration to the understory could stimulate deciduous revegetation. Cottonwood planting would greatly benefit the riparian habitat, and could be established by planting seedlings in areas with opened canopies and disturbed soils.

Campground Rehab/Enhancement; RM 0.4:

Forest Creek Campground (RM 0.4) is a high recreational use area. Terrestrial and aquatic habitats have been heavily impacted in the vicinity. Spur road drainage problems north of the campground, surface erosion and soil compaction present rehabilitation opportunities within the campground area. Pool enhancement in the vicinity could result in increased recreational opportunities. These projects are of suitable size and scope for volunteer programs. The campground also provides a site for an interpretive and educational display illustrating the fisheries and wildlife habitat management practices within the drainage.

FOREST CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>				<u>POOLS</u>			<u>RIFFLES (%)</u>						
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I (0.0-1.6)	6.1	80	6:4	2	L	3	H	0	*	15	40	25	10	5
II (1.6-2.4)	6.4	90	2:8	4	L	2	H	0	0	5	35	45	20	4
III (2.4-2.9)	4.8	95	3:7	5	L	1	H	0	0	0	10	50	40	4

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L <12", M = 12 - 29", H >30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L <40%, M = 40-60%, H >60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5 percent

FOREST CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>			<u>TRIBUTARIES</u>
	<u>I</u>	<u>II</u>	<u>III</u>	<u>B</u>
Rainbow Trout	M	M	*	M

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, l = juvenile  
\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable, may not be present

FOREST CREEK

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0-1.6)	208	106	102
II (10.6-2.4)	68	33	35
III (2.4-2.9)	<u>14</u>	<u>7</u>	<u>7</u>
TOTAL	290	146	144

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (RM)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATION*</u>
0.0-2.4	Debris jams	None	P	Partial removal
1.3	Culvert	C1	N	Develop jump pool and install baffles.
1.6	Diversion dam	D1	N	Increase flow over dam, develop jump pool, and screen diversion ditch.
2.3	Culvert	c2	N	None; low priority for enhancement.

**LEGEND:**  
 F = full passage  
 P = partial passage  
 N = no passage

\* Refer to special case form for barrier characteristics.

**FOREST CREEK**

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH <b>(RM)</b>	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	<b>1"-3"</b>	3"-6"	
I (0.0-1.6)	1.3	0.3	6:4	3	1	89	27	None
II (1.6-2.4)	0	0.8	2:8	2	1	27	7	Potential anadromous habitat ends at RM 2.4
111(2.4-2.9)	<u>0.0</u>	<u>0.0</u>	3:7	1	1	<u>1</u>	<u>0</u>	None
Total	1.3	1.1				<b>117</b>	34	

**LEGEND:** Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R: Ratio of pool area:riffle area.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (ft.).  
 Spawning: Number of sq. yds. of gravels observed in the 1".3" and 3"-6" size classes.

FOREST CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (0.0-1.6)	85	85	100	100	Var	S-M	2	1-2	L
II (1.6-2.4')	90	100	100	100	Var	S	2	1-2	L
III (2.4-2.9)	90	100	100	100	Var	S-M	2	1	L

LEGEND: Total: % of total habitat area dependent on LWD  
 HQ: % of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
 SUMMER AND BANRFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANRFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	q	W	D	
I (0.0-1.6)	6	.4	.8	2	11	.9	70-120
II (1.6-2.4)	15	<b>.33</b>	<b>1</b>	5	16	.5	120-200
III (2.4-2.9)	3	.5	1	1.5	4	.5	30

LEGEND: W,w - Stream width (ft)  
 D,d - Stream depth (ft)  
 V - Velocity (feet/second)  
 Q - Average reach flow in cubic feet/second

FOREST CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

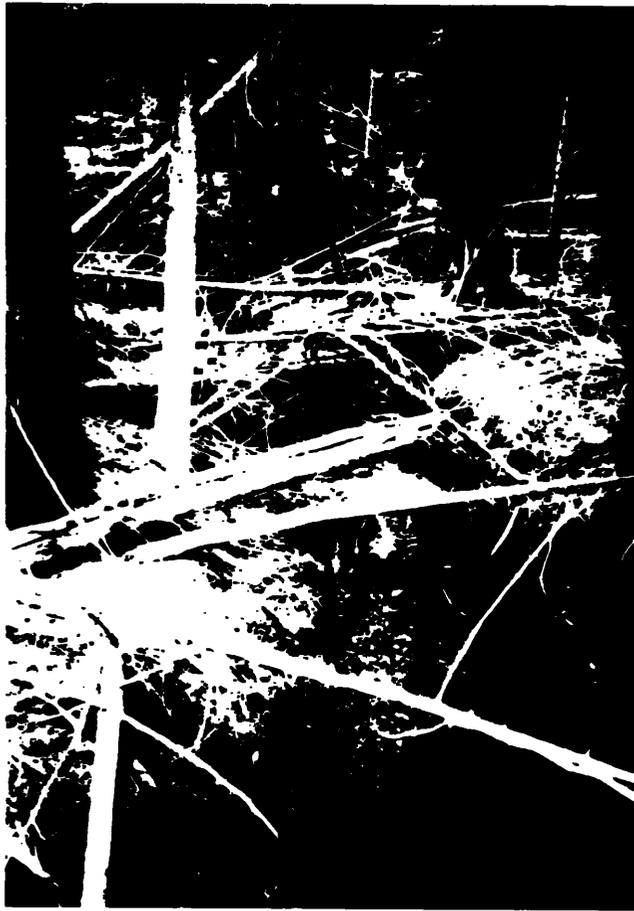
<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>		<u>%</u>	<u>SHADE</u>	<u>AIR/WATER</u>	
						<u>TEMP. °F</u>	<u>ASPECT/W - TIME</u>
I (0.0-1.6)	7/7/83	2	80		SE	52/45/54/45	1300-1630
II (1.6-2.4)	7/7-8/83	5	90		SE	49/40	1830
III (2.4-2.9)	7/8/83	1.5	95		SE	49/41	1015

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special</u>	<u>Habitat</u>
				<u>Con.</u>	<u>Dec.</u>				
I (0.0-1.6)	5.8	70-120	4	4	0	II	25	S	1
II (1.6-2.4)	6.8	120-200	5	4	0	II	50	S	2
III (2.4-2.9)	6.7	30	4	6	0	II	30	S	2

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: # Habitat Units (H  $\geq$ 4; M = 2-3; L  $\leq$ 1)  
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H >60%; M = 25-505;  
 L <25%  
 Size: Size of Wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5247N)



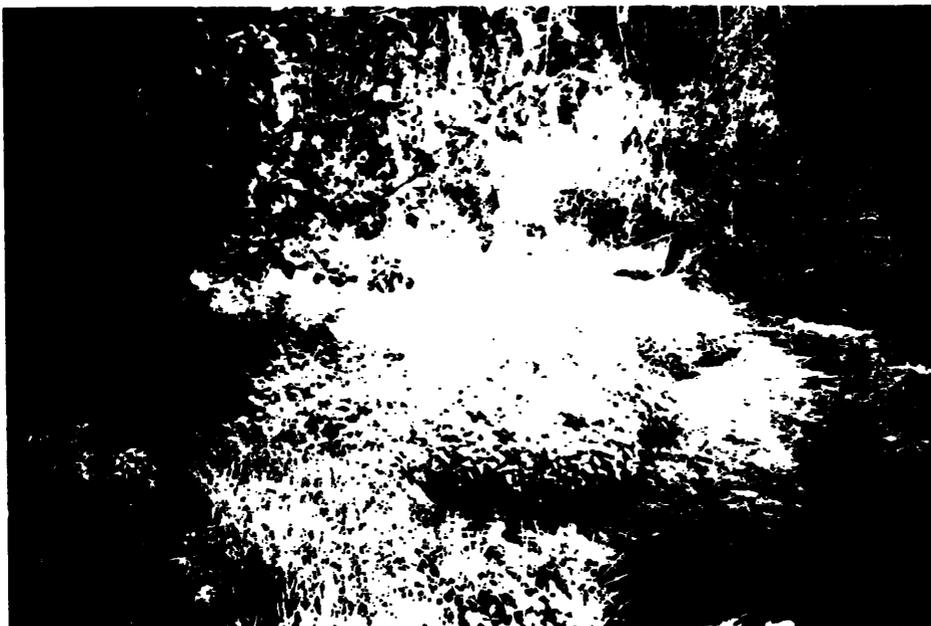
Trib. B is a small (1.5 cfs) perennial tributary entering Forest Creek at RM 1.7. About 0.8 mile of fair habitat for resident trout, steelhead, and coho is present. Dense coniferous canopy limits riparian habitat development on this stream.



LWD is the major structural component in the Forest Creek channel. Ninety percent of the high quality pools and spawning gravels are dependent on LWD however, debris loading in some areas is so heavy that it may block migration (see survey map). Well-regulated flows combined with heavy debris loading reduce the sediment flushing capability of the stream, particularly in Reach I. Partial removal of debris in some areas may improve fish habitat.

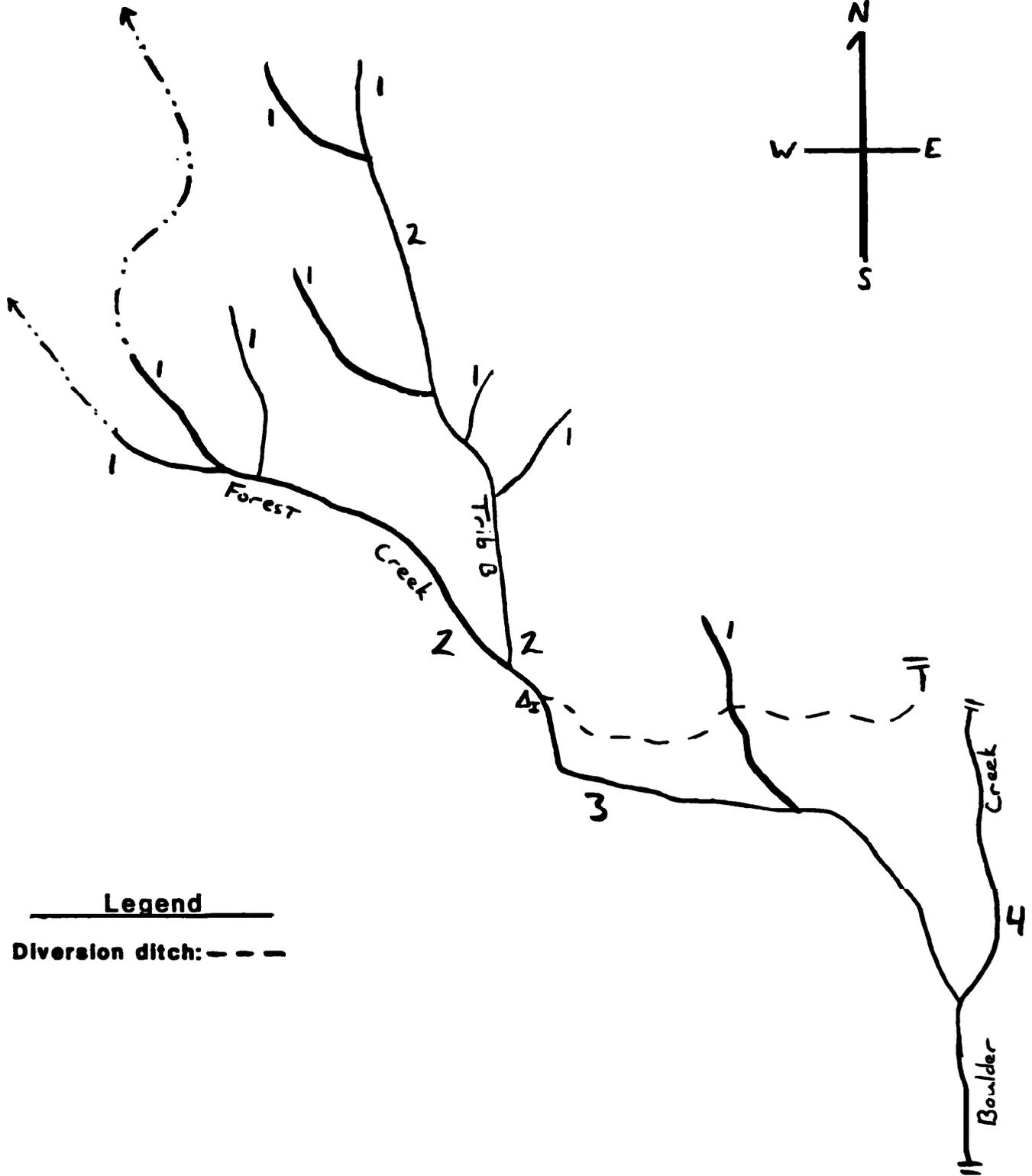
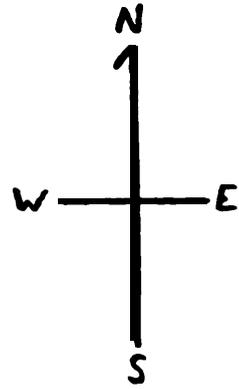


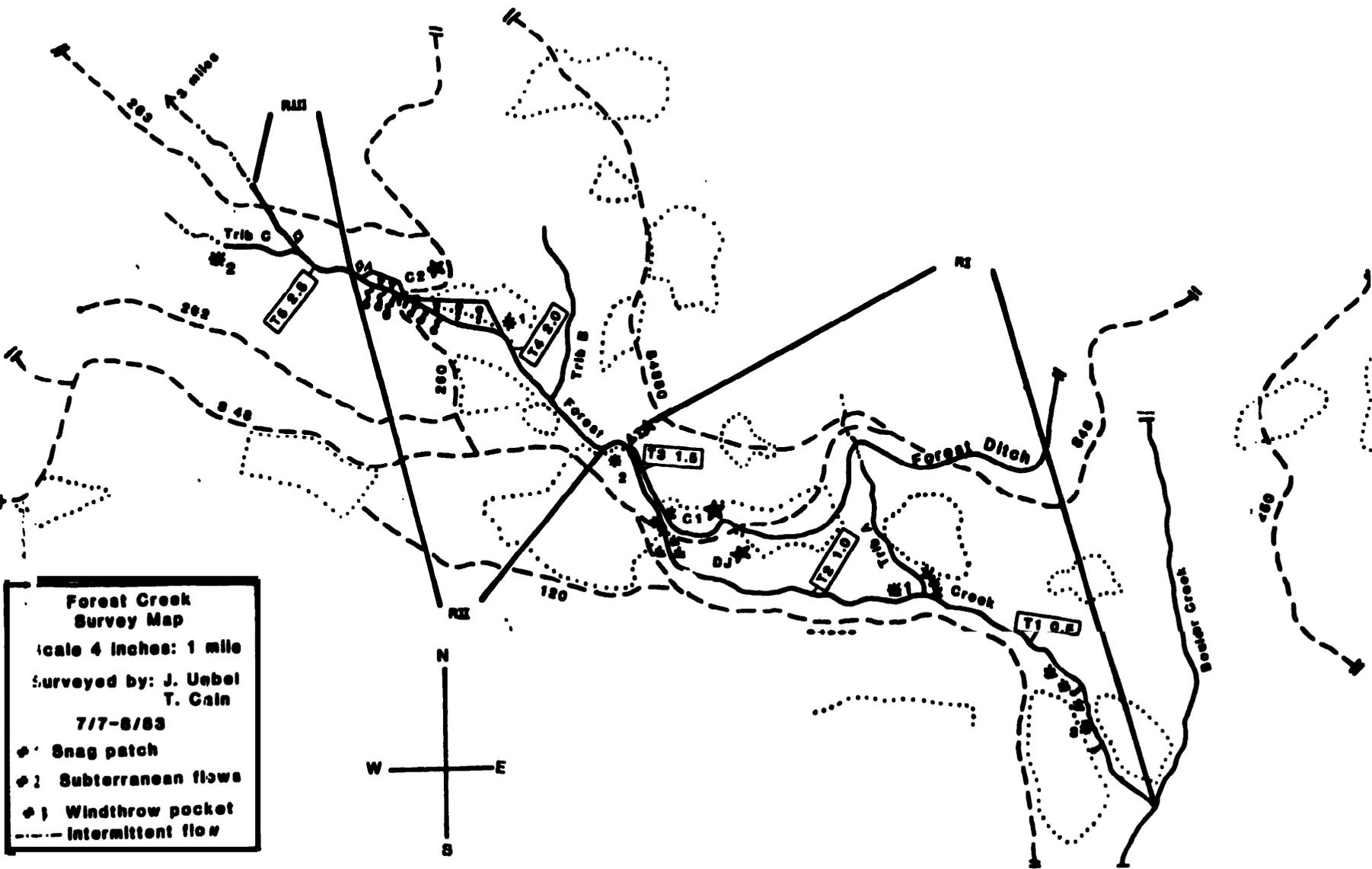
The Forest Creek ditch diversion dam at RM 1.6 is a complete barrier to fish migration. Culvert C<sub>1</sub>, downstream at RM 1.3, is also a complete barrier. Developin Jump pools below these structures would aid fish passage to 1.9 miles of 3air to good habitat for steelhead and coho ( baffling the culvert would also likely be required). about 90% of the flow (6 cfs) Is diverted here for irrigation purposes. The lowered flows below this point limit fish and riparian habltat development



A large springline Issues from the valley sideslopes in several partial and clearcut units, RM 2.1-2.4. approximately 5 cfs is added to the stream at this point. The high amount of groundwater recruitment on Forest Creek contrributes to a very well regulated flow regime and cold low flow water tempertaures (41°F). Temperature may be limiting fish production, particularly in the upper reaches

**Forest Creek  
Stream Order: 3d**





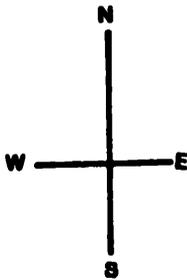
**Forest Creek  
Survey Map**

Scale 4 inches: 1 mile

Surveyed by: J. Uebel  
T. Cain

7/7-8/83

- ★ Snag patch
- Subterranean flows
- △ Windthrow pocket
- - - Intermittent flow



- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

**R<sub>I,II,III</sub>** REACH # and SECTION

**T<sub>1</sub> 1.0** TRANSECT # and RIVERMILE

 **OBSTRUCTION**       **BARRIER**

**J<sub>1,2,3</sub>** JAM and #  
**F( )<sub>1,2,3</sub>** FALLS, HEIGHT, md #  
**C<sub>1,2,3</sub>** CULVERT and #  
**B<sub>1,2,3</sub>** CHUTE and #

 DIVERSION STRUCTURE (I = water Is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUMP

 DEBRIS TORRENT TRACK

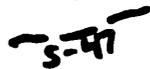
 SPRING

 UPPER LIMIT OF FISH PRESETN (A - limit of potential anadromous fish habitat)

 BAN EROSION (EXTENSIVE/SEVERE)

 1.2.3, :MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

HAZEL HOLLOW/OWL HOLLOW

BARLOW RANGER DISTRICT

Surveyors: Tom Cain County: Wasco  
Doug Kinzey

Dates Surveyed: July 31, 1984(Owl) Mouth Location: T2S,R12E, Sec. 31 (Owl)  
August 1, 1984 (Hazel) T4S, R11E, Sec. 36 (Hazel)

Tributary To: Jordan Creek (Owl) Watershed Area:  
Gate Creek (Hazel) 910 acres, 1.4 sq. mi. (Owl)  
5,500 acres, 8.6 sq. mi. (Hazel)

Drainage: White River

TRI Compartments: Stream Length:  
Owl - Cedar 1301 3.5 miles (Owl)  
Hazel - Gate 1505 7.0 miles (Hazel)  
IMMIGRANT - 1603

Potential Anadromous Species: Distance Surveyed  
2.0 miles (Owl)  
1.0 mile (Hazel)

Winter Steelhead (Owl) Stream Order:  
Winter Steelhead (Hazel) II (Owl)  
III (Hazel)

The SUMMER 1984 White River Habitat Inventory included two intermittent stream systems containing substantial drainage areas. Hazel Hollow, with a drainage area of 5,500 acres (8.6 sq. mi.) and Owl Hollow (910 acres, 1.4 sq. mi.), were surveyed for potential spawning areas during high flow conditions. These streams were also reviewed for their potential downstream impacts (i.e., sediment introduction, thermal concerns, etc.) on Gate Creek (Hazel Hollow) and Jordan Creek (Owl Hollow).

#### HAZEL HOLLOW

Hazel Hollow is a seven mile long channel with intermittent flows. It heads on Clear Point and initially flows southeast before it turns and flows northeast to its confluence with Gate Creek (RM 4.6 of Gate Creek). The Lost-Boulder Ditch enters the Hazel Hollow channel at RM 4.7 and uses it for 0.2 miles before it exits the channel at RM 4.5. This ditch carries water from Forest, Boulder, and Lost Creeks, and captures any flows that may be present in the upper drainage of Hazel Hollow (RM 4.7-7.0). The water is used for irrigation purposes on Smock Prairie.

The first mile of Hazel Hollow (RM 0.0-1.0) was surveyed on August 1, 1984. It was dry at the time of the survey. The channel in this area has a very low gradient (0.5 percent) and gravel/rubble substrates. An exception to this is a one-tenth mile section near the mouth which is 5 percent gradient and boulder dominated. Mean high water marks in this area indicate that flows may

not get deep enough for fish passage through this section. If passage is possible, 329 sq. yds. of potential spawning gravels were counted in the survey area.

The riparian vegetation is sparse and shading is low along most of the stream channel. Planting vegetation could increase shading along the channel but thermal problems may not be a concern during the periods that Hazel Hollow flows water. It appears that the stream is dry by early Summer, before high water temperatures become a concern.

Sediment introduction into Gate Creek could also be a concern during runoff events. Cattle grazing impacts and four stream fords in the survey area could be sources of sediments to Hazel Hollow. The sediment loading may be minimal due to the apparently short flowing period of Hazel Hollow and the probable increased flushing capacity of Gate Creek at the time that Hazel Hollow flows water. Erosion seeding and planting vegetation, as well as reducing the amount of grazing in the area, could minimize sediment introduction into Gate Creek.

## OWL HOLLOW

### Survey Summary

Owl Hollow is an intermittent, second order tributary to Jordan Creek. Stream length is 3.5 miles. The lower 1.1 miles are on private land.

Two miles of the Owl Hollow mainstem, from the mouth to above the road 2730-120 crossing, were surveyed on July 31, 1984. An upstream section, from RM 2.5 to 3.0 had been previously surveyed in June, 1984, as part of another project (Barlow KV Opportunities, 1984). The earlier survey identified large quantities of anadromous-sized spawning gravels, and possible sedimentation impacts to the Jordan Creek mainstem.

Approximately 10 square yards of spawning gravels suitable for steelhead are available at the mouth of Owl Hollow. Above RM 0.1, high gradients (10-30 percent) for 0.3 miles preclude anadromous use of potential upstream habitat. From RM 0.5 to 3.0, gradient is low (3 percent), with gravel the predominant substrate size class (60 percent of riffle substrate). The stream was flowing intermittently from RM 0.2 to 1.0, and dry above this point, in August, 1984.

Impacts to aquatic habitat quality associated with timber harvest occur from RM 1.1 to 1.6, and RM 2.5 to 3.0, along the Owl Hollow mainstem. Several tractor fords across and along the stream channel, the most recent apparently associated with the Pygmy Timber Sale, have destabilized streambanks and reduced bankside vegetation. Up to 50 percent of streambank length in the harvest units is exposed soil, and blanketing of bottom materials with a layer of fine sediments is characteristic. Rapid revegetation of these areas could help reduce potential downstream impacts to Jordan Creek.

KAnderson:paw (WP-PJS-5271N)



Hazel Hollow does not appear to gain sufficient flows for fish to pass this 5% gradient, boulder stretch (RM 0.1). If passage is possible, 329 square yards of potential spawning gravels are available above this area.



The gravel/rubble substrate above RM 0.1 could provide some winter steelhead spawning habitat with spring runoff flows. Rearing habitat is non-existent during the summer months so the juveniles would need to drop into Gate Creek to rear. Note the sparse overstory of ponderosa pine and oak.



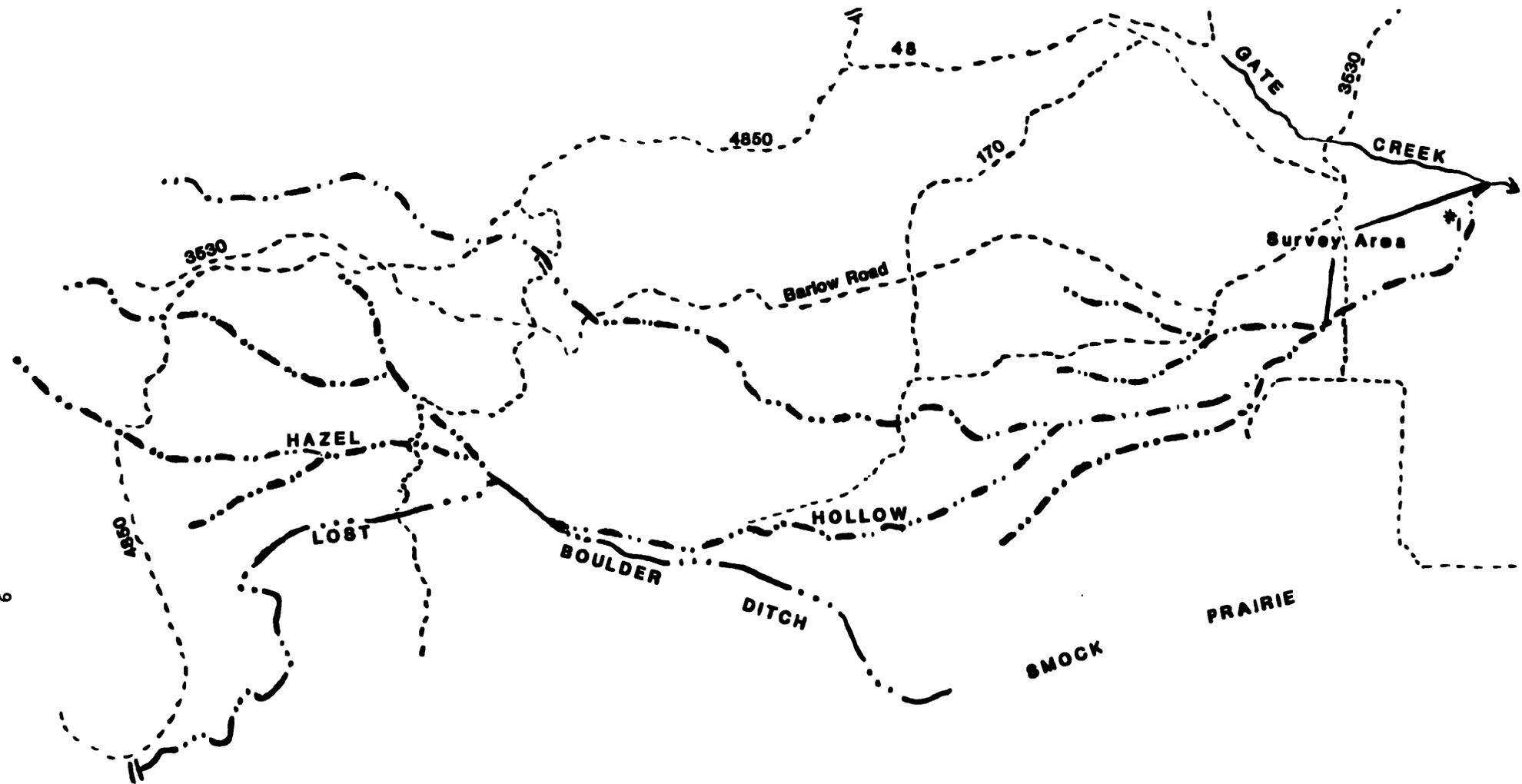
High spring flows could make these 10 sq. yds. of gravels, at the mouth of Owl Hollow, suitable for steelhead spawning. Owl Hollow is an intermittent tributary to Jordan Creek, and has 0.1 miles of potential anadromous fish habitat available.



Steep (20) stream gradients from RM 0.1-0.3 preclude potential anadromous fish use above this point. The initial 1.1 miles of Owl Hollow are on private land and any passage work would need to be coordinated with the land owner.



Owl Hollow on Forest Service land has been impacted by past and recent logging. Channel downcutting and tractor fords in the Pygmy Timber Sale area have decreased bank stability and may be an eventual source of sediments to Jordan Creek.



**HAZEL HOLLOW**

**STREAM ORDER/SURVEY MAP**

**Scale: 1.7 in: 1 ml**

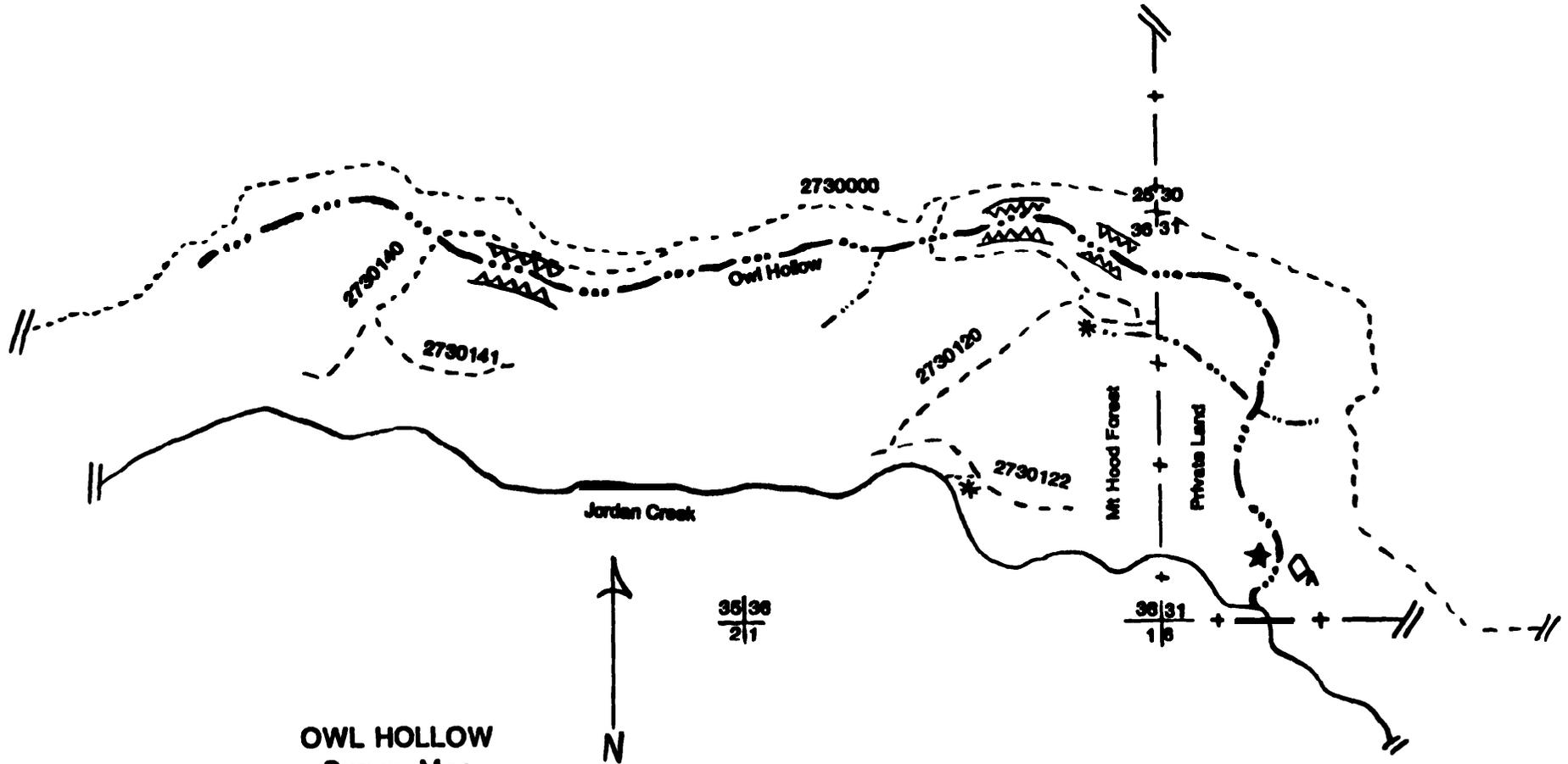
**Stream Order: Third**

**Surveyed by: T. Cain**

**D. Kinzey**

**8/1/84**

**\*<sub>1</sub> - 5% grad./boulder section**

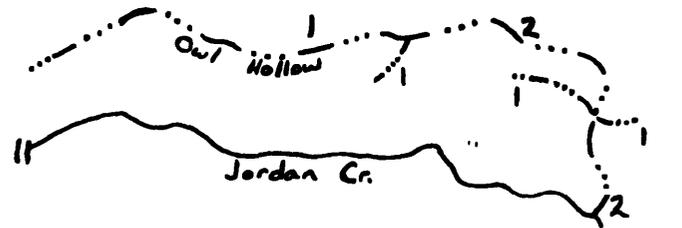


**OWL HOLLOW**  
**Survey Map**  
 Survey by: D.Kinzey  
 Scale: 2.5 in mi  
 7/31/1984

**Legend**

\* Road Erosion

**Stream Order: 2nd**



- STREAM SURVEY MAP SYMBOLS -

**CLEAR CUT BOUNDARY**

**R<sub>I,II,III</sub>** REACH # and SECTION

**T<sub>1</sub> 1.0** TRANSECT # and RIVERMILE

 **OBSTRUCTION**       **BARRIER**

**J<sub>1,2,3</sub>** JAM and #  
**F( )<sub>1,2,3</sub>** FALLS, HEIGHT, and #  
**C<sub>1,2,3</sub>** CULVERT and #  
**B<sub>1,2,3</sub>** CHUTE and #

 **DIVERSION STRUCTURE (I - water is used for irrigation purposes)**

 **MINE or ROCK PIT SITE**

 **BRIDGE**

 **LANDSLIDE, SLUMP**

 **DEBRIS TORRENT TRACK**

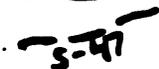
 **SPRING**

 **UPPER LIMIT OF FISH PRESENT (A . limit of potential anadromous fish habitat)**

 **BANK EROSION (EXTENSIVE/SEVERE)**

 **1,2,3, :MISCELLANEOUS**

 **WETLAND HABITAT**

 **ROAD AND ID NUMBER**

 **EARTHFLOW**

PINE CREEK

Barlow Ranger District

Surveyor:	Doug Kinzey	County:	Wasco
Date Surveyed:	September 19, 1984	Mouth Location:	T.3S., R.10E., Sec. 24
Tributary to:	Badger Creek	Watershed Area:	3.37 sq. miles
Drainage:	White River		2160 acres
TRI Compartments:		Stream Length:	3.3 miles
Badger 1401		Distance Surveyed:	2.8 miles
Bell 1503			
Rock 1502			
Game Fish:	Rainbow	Low Flow Width:	7 ft.
Potential Anadromous Species:		Stream Order:	III
Steelhead			
Average Fish Habitat Condition Rating:	6.6 (Fair to Good)		
Average Riparian Condition Rating:	5.4 (Moderate)		

## PINE CREEK

### Survey Summary

#### A. Stream Summary

Pine Creek originates from a spring area near the Valley View Cabin on Road 4860-140 and flows 3.3 miles east to its confluence with the Badger Creek mainstem at RM 17.3. Pine Creek drains a watershed of about 2160 acres. It provides about a third (5 cfs) of the Badger Creek low flow at their confluence.

The lower 2.8 miles of Pine Creek were surveyed on September 19, 1984. The drainage is contained within the Badger Creek Wilderness Area. Access is limited to trails. The Post Camp trail crosses Pine Creek at RM 1.0. The Pine Creek trail branches off at this point and runs along the northern ridgetop above the stream about one-half mile from it.

#### B. Geomorphology and Watershed Characteristics

The valley configuration of Pine Creek is a flat bottomed - V with moderately steep (greater than 50 percent) sideslopes. The floodplain width is narrow (30 feet) in Reach I and very wide (greater than 200 feet) in Reach II.

All Pine Creek tributaries, at the time of survey, were dry except for the 65 percent gradient Trib. A (1/10 cfs) at RM 0.5 and a series of springs flowing into a large wetland at RM 2.5. This wetland and the spring-fed headwaters of Pine Creek appear responsible for the apparent well-regulated nature of the system.

#### c. Reach Description

Two reaches are identified in Pine Creek, based primarily on valley width and gradient. Reach I (RM 0.0 - 2.3) has a very narrow (30 feet wide) floodplain, a high stream gradient (11 percent), with numerous fish passage barriers, and 40 percent boulder riffle substrates. Reach II has a very wide (greater than 200 feet) floodplain, a moderate gradient (6 percent), and a 20 percent boulder riffle substrate. Pool to riffle ratio is 4:6 in both reaches.

#### D. Fisheries

The overall fish habitat condition rating is fair to good (HCR = 6.6). Good pool to riffle ratios (P:R = 4:6) and shading (95 percent) are positive influences on the score. Limited spawning habitat quality and quantity (small beds, less than 30 sq. yards/mile) is the major negative influence.

Despite conditions apparently suitable for fisheries production, no fish were observed during the survey. A nearly continuous series of passage barriers

(Table IV) in Reach I may be preventing fish movement into the system. If passage enhancement work is done to provide access, the entire 2.8 miles surveyed appear suitable for anadromous use.

An alternative approach to providing adult access into this system could be introducing juveniles from the Badger Lake Road crossing (4860-140) at the headwaters to create a non-sustaining run utilizing the stream as rearing habitat. The stream section above RM 2.8 to the road (RM 3.3) was not included in the present survey.

#### E. Riparian Area

The overall riparian condition rating is 5.4 (moderate). Negative factors influencing this score are found primarily in Reach I (RCR = 4.9), and include the narrow (30 feet wide) floodplain, lack of deciduous overstory, and the lack of wetlands. Riparian quality improves dramatically in Reach II (RCR = 8.5) due to the presence of a large (15 acres) wet meadow/snag patch, rock outcrops and talus, and the very wide (greater than 200 feet) floodplain.

#### F. Rehabilitation/Enhancement

A priority for enhancement is fish passage work in Reach I if anadromous migration into this stream is desired. Numerous passage barriers occur between RM 0.0 - 1.5, including a 12 foot waterfall at RM 0.85. Work could be accomplished by hand tools and blasting.

An additional enhancement opportunity exists in the wet meadow complex at RM 2.4 - 2.6. Due to the absence of deciduous overstory species, cottonwood plantings in this area could improve vegetative diversity.

PINE CREEK  
Reach Summary

Reach I. RM 0.0 - 2.3:

1. The valley configuration is a narrow (averaging 30 feet wide), flat bottom - V with moderately steep (50-70 percent gradient) sideslopes.
2. The stream gradient is high, averaging 11 percent. Gradient varies from 10 percent to as high as 25 percent over short (100-200 feet) boulder/bedrock cascade sections (see passage barrier special case forms).
3. Boulders are the predominate riffle substrate size class (50 percent of riffle substrate).
4. Riffles dominate the stream area slightly (P:R = 4:6).
5. Stream shading as high (95 percent).

Reach II. RM 2.3 - 2.8:

1. The valley configuration widens to a very wide (greater than 200 feet), flat bottom V-shaped valley with moderate (30 percent) sideslopes.
2. Gradient decreases to 6 percent.

3. Boulders fall to 20 percent of riffle substrate composition, with the rubble and gravel size classes increasing to 30 percent each.
4. Pool to riffle ratio remains 4:6.
5. Stream shading continues to be high (90 percent).

PINE CREEK

Fish Habitat Summary

Reach I; RM 0.0 - 2.3:

1. Fish habitat is rated fair to good (HCR = 6.6).
2. Rearing habitat is fair throughout the reach. Pools comprise 40 percent of the surface area. Pools are small (4 sq. yards) and shallow (12 inches), with high effective cover. Fifty percent of pool habitat is associated with LWD.
3. Spawning habitat is limited. Fifty square yards were counted over the 2.3 miles of reach length, of which over half were rated marginal due to channel placement. Seventy percent of the gravels are associated with LWD.
4. A nearly continuous series of fish passage barriers (Table IV) presently preclude anadromous use of this potential habitat.

Reach II; RM 2.3 - 2.8:

1. Fish habitat improves slightly (HCR = 6.8).

2. Pool rearing habitat is similar to Reach I. Average pool surface area decreases to 2 square yards. The role of LWD in pool formation increases to 70 percent of all pools and 80 percent of the high quality pools.
  
3. Spawning habitat remains limited. Fifteen square yards were counted over the 0.5 miles of reach length, of which two-thirds were rated marginal due to channel placement. LWD remains associated with 70 percent of the gravels.
  
4. No fish passage barriers were noted.

## PINE CREEK

### Riparian Summary

#### Reach I; RM 0.0-2.3:

1. Riparian condition is rated moderate (RCR = 4.9).
2. The reach lies within a narrow (30 feet wide) flat bottom to V-notch V-shaped valley.
3. Structural diversity is high, with all five habitat units (grass-forb, shrub-seedling-sapling, poles, small sawtimber, large sawtimber) present. The shrub-seedling-sapling group is less well-represented at the upper end of the reach than the other groups.
4. The overstory is coniferous and averages four species. Douglas-fir, cedar, and western hemlock are dominant at the lower end of the reach. Spruce and silver fir begin replacing cedar in dominance by the upper end of the reach.
5. Rock bluffs and talus outcrops on both sideslopes along over 20 percent of the reach length are special habitats. A quaking aspen grove is located in the talus outcrop north of the stream at RM 2.0.

Reach II; RM 2.3 - 2.8:

1. The riparian condition rating increases to very high (RCR = 8.5).
2. The valley bottom widens to greater than 200 feet.
3. Structural diversity is very high. In addition to the continued presence of all five habitat units from Reach I, a large (about 15 acres) wet meadow complex and snag patch is located from RM 2.4 - 2.6.
4. Four coniferous species - spruce, mountain hemlock, silver fir, and white pine are present in the overstory. No deciduous species were noted.
5. In addition to the 15 acre wet meadow/snag patch at RM 2.4 - 2.6 already noted, talus slopes south of the stream for over half the reach length are a special habitat.

## PINE CREEK

### Rehabilitation/EnhancementSummary

#### Passage Enhancement; RM 0.0 - 1.5:

At least five logjams and three bedrock chute/waterfall total passage barriers would have to be modified if adult passage into this system is desired (Table IV). An additional five partial passage barriers could use some work. All logjams could be modified using hand tools. Boulder/bedrock barriers would likely require blasting. The 12' waterfall at RM 0.85 would probably require a laddering device such as an Alaska steep-pass.

Lack of deciduous overstory in the wet meadow are bordering this stream could be improved by planting species such as cottonwood to increase vegetative diversity.

PINE CREEK

**TABLE I - HABITAT DATA SUMMARY**

<u>REACH (R.M.)</u>	<u>STREAM</u>				<u>POOLS</u>			<u>RIFFLES (%)</u>					<u>SD</u>	<u>D</u>
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>		
I (0.0-2.3)	6.6	95	4:6	11	L	4	H	*	50	20	15	10	5	8
II (2.3-2.8)	6.8	90	4:6	6	L	2	H	-	20	30	30	10	10	6

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length: riffle length  
G: Average gradient (percent)  
d: Average maximum depth (L <12", M = 12 - 29", H >30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L 40 percent, M = 40-60 percent, H >60 percent)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5 percent

PINE CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 PT.

<u>Species</u>	<u>REACH</u>		<u>TRIBUTARIES</u>
	Pine I	Pine II	
Rainbow	( )	( )	

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
 a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
 ( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
<u>Pine Creek</u>			
I(0.0-2.3)	50	22	28
11(2.3-2.8)	15	5	10
TOTAL	<u>65</u>	27	<u>38</u>

PINE CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
Pine (0.0)	Boulder Chute	B0	P	Improve passage w/rock bar
Pine (0.1)	Bedrock Chute	B3	N	Blast to improve passage
Pine (0.15)	Logjam	J5	N	Improve passage using hand tools
Pine (0.15)	Bedrock Chute	B2	N	Blast
Pine (0.2)	<b>Log jam</b>	J4	N	Hand tools
Pine (0.25)	Logjam	J3	N	Hand tools
Pine (0.3)	<b>Log jam</b>	J2	P	Hand tools
Pine (0.4)	Bedrock Chute	B1	P	Blast
Pine (0.7)	<b>Log jam</b>	J1	P	Hand tools
Pine (0.9)	Waterfall (12')	F1	N	Alaska steep-pass
Pine (1.05)	Logjam	J6	N	Hand tools
Pine (1.2)	Bedrock Chute	B4	P	Blast
Pine (1.4)	<b>Log jam</b>	J7	N	Hand tools

F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (0.0-2.3)	0	2.3	4:6	4	1	20	20	
II (2.3-2.8)	0	0.5	4:6	2	1	6	6	
TOTAL	<u>0</u>	2.8				26	<u>26</u>	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced  
Pot.: Additional miles of habitat potentially available with complete passsage enhancement.  
P:R: Ratio of pool length: riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

PINE CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
	Total (%)	HO (%)	Total (%)	HO (%)	OR #	L	Dia	Source	
I (0.0-2.3)	70	70	50	50	Var	S,M	2	2	M
II (2.3-2.8)	70	70	70	80	Var	S,M	1-2	2	L

LEGEND

Total: Percent of total habitat area dependent on LWD.  
 HO: Percent of high quality habitat area dependent on LWD.  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable.  
 #: Number of logs/structure; S = single log, M = multi-log.  
 L: Average length of logs, expressed in channel widths.  
 Dia: Diameter of average logs in feet.  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	SUMMER				BANKFULL		Floodplain Width (Ft.)
	W	d	v	Q	W	D	
I (0.0-2.3)	7	0.75	1	5	9	1	30
II (2.3-2.8)	5	1	1	5	6	1.5	200

LEGEND: W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

PINE CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

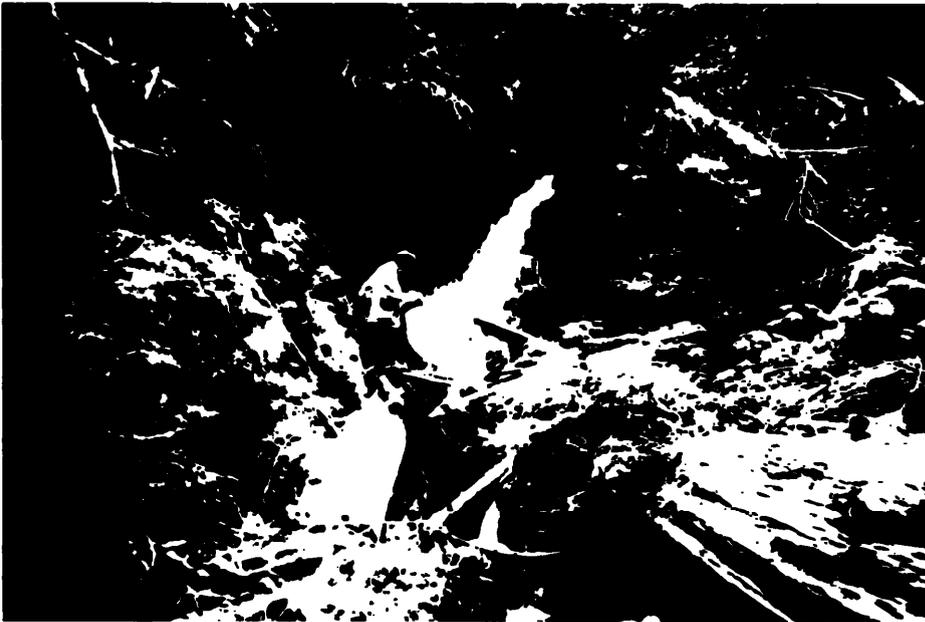
<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (0.0-2.3)	9/19/84	5	95	E	62/48	60/48	1330-1600
II (2.3-2.8)	9/19/84	5	95	E	67/50		1650

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special</u>	<u>Habitat</u>
			<u>Con.</u>	<u>Dec.</u>					
I (0.0-2.3)	4.9	30	5	4	0	II	0	0	1
II (2.3-2.8)	8.5	200	5	4	0	II	30	L	3

LEGEND: PCR: Riparian Condition Rating  
 F.P.: Floodplain width in feet  
 H.U.: # Habitat units (H  $\geq 4$ ; M = 2-3; L  $\leq 1$ )  
 Con: # Conifer species  
 DecL # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands:  
 (H 50 percent; M = 25-50 percent; L 25 percent)  
 Size: Size of wetlands  
 S = small (less than 1 acre)  
 L = large (greater than 1 acre)

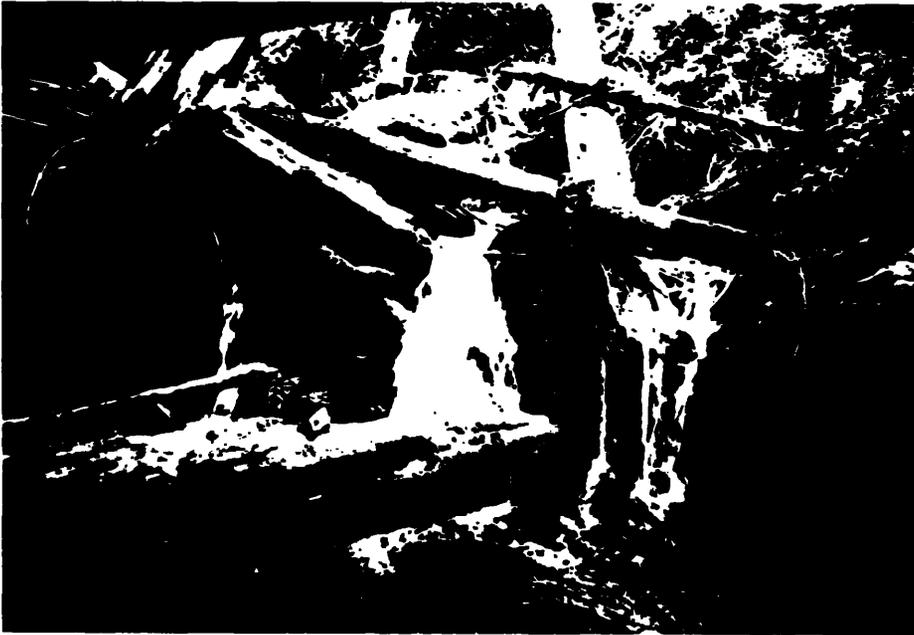
KAnderson:paw(WP-PJS-5191N)



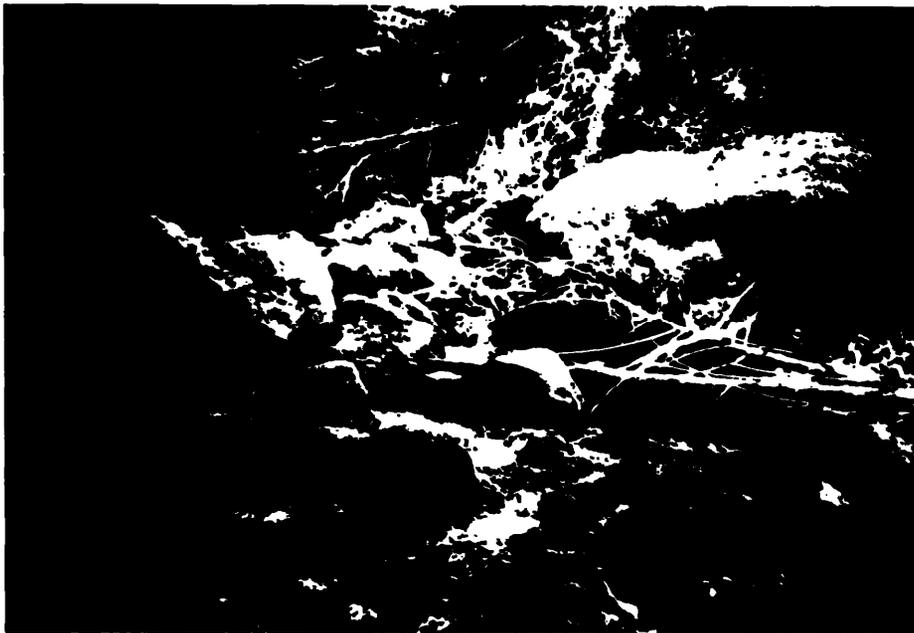
This 12 foot waterfall (#F1) at RM 0.9 may require laddering if access to a potential 1.7 miles of good upstream habitat is desired. An alternative to self-sustaining runs may be to introduce juveniles to the upstream end of the system and utilize the stream as rearing habitat.



The large (15+acres) wet meadow/snag patch from RM 2.4-2.6 is a special habitat for this stream. Its size and remote nature make it especially valuable to wildlife.



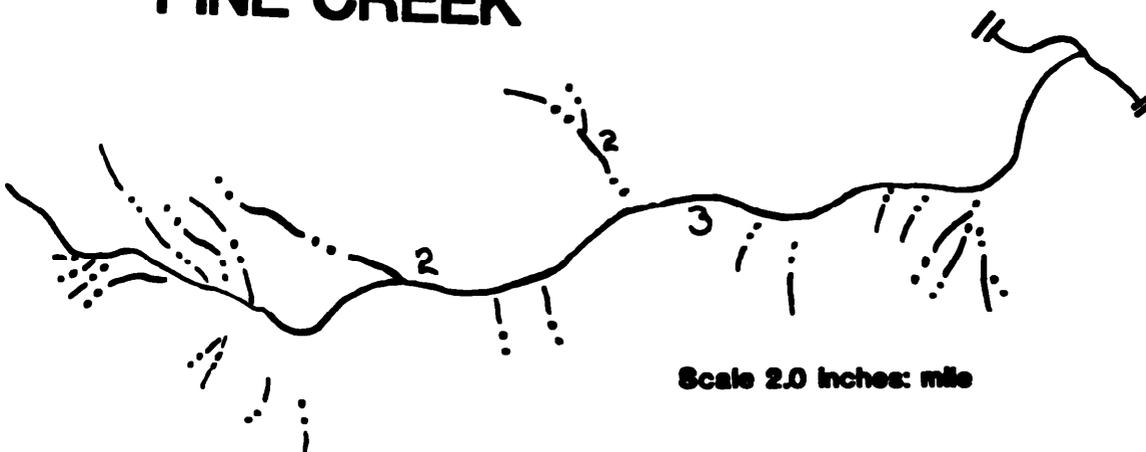
RM 0.25 - At least 7 logjam fish passage barriers (#J3 pictured) and 6 boulder/bedrock chutes, would require modification to permit adult passage through Pine Creek.



RM 0.65 - Boulder substrates and 10% gradient are characteristic of Pine Creek. Fish habitat is generally fair to good over the section surveyed.



**STREAM ORDER: 3rd  
PINE CREEK**



**Pine and Gumjuwac Creeks**

**Survey Map**

**Surveyed by: D. Kinzey**

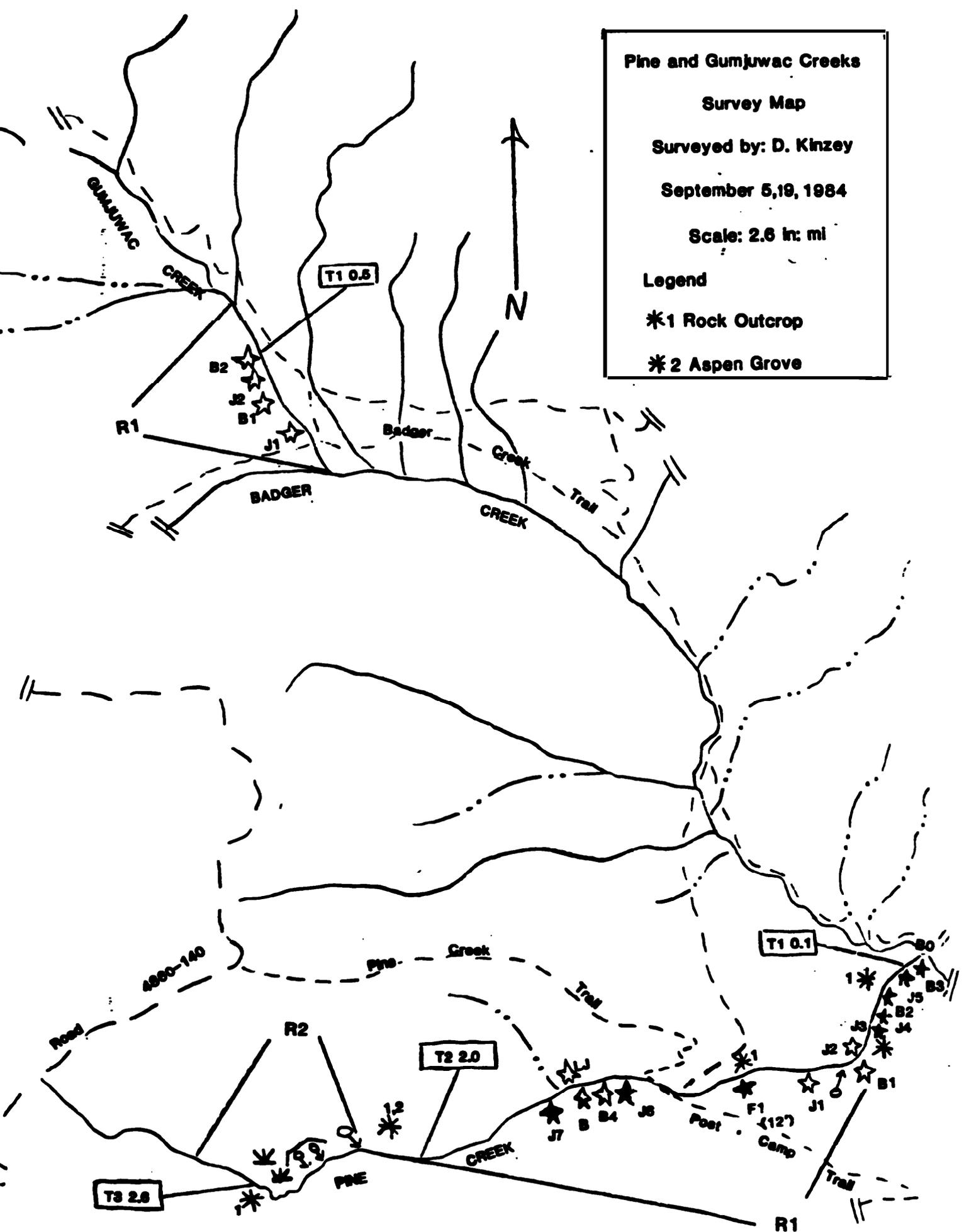
**September 5, 19, 1984**

**Scale: 2.6 in: mi**

**Legend**

**\*1 Rock Outcrop**

**\*2 Aspen Grove**



- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
<b>R<sub>1,II,III</sub></b>	REACH # and SECTION
<b>T<sub>1</sub> 1.0</b>	TRANSECT # and RIVERMILE
 OBSTRUCTION	 BARRIER
<b>J<sub>1,2,3</sub></b>	JAM and #
<b>F( )<sub>1,2,3</sub></b>	FALLS, HEITHY, AND
<b>C<sub>1,2,3</sub></b>	CULVERT and #
<b>B<sub>1,2,3</sub></b>	CHUTE and #
	<b>DIVERSION</b> STRUCTURE (I - water is used for irrigation purposes)
	MINE or ROCK PIT SITE
	BRIDGE
	LANDSLIDE, SLUMP
	DEBRIS TORRENT TRACK
	SPRING
	UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)
	BANK EROSION (EXTENSIVE/SEVERE)
	1.2.3, :MISCELLANEOUS
	WETLAND HABITAT
	ROAD AND ID NUMBER
	EARTHFLOW

ROCK CREEK

Barlow Ranger District

Surveyors: Tom Cain and Doug Kinzey

County: Wasco  
Hood River

Dates Surveyed: July 26, 30, August 30,  
September 21, 1984

Mouth Location:  
T.4S., R.1SE., Sec. 25

Tributary to: White River

Watershed Area:  
33,760 acres  
53 square miles

TRI Compartments:

Bell 1503  
Rocky 1502  
Stockton 1501  
Rock Creek 5  
Gate 1505  
Bus 1504  
Immigrant 1603

Stream Length: 16.3 miles

Distance Surveyed:  
7.0 miles mainstem  
1.8 miles N.F. Rock Creek

Gamefish: Rainhow Trout  
Largemouth Bass (reservoir)

Low Flow Width (Avg.): 5 ft.

Potential Anadromous Species:

Steelhead  
Coho  
Sockeye

Stream Order: V

Average Fish Habitat Condition Rating: 4.2 (Poor)

Average Riparian Condition Rating: 4.4 (Moderate)

## ROCK CREEK

### Survey Summary

#### A. Stream Summary

Rock Creek is a fifth order tributary to White River (RM 11.8 of White River). During summer low flows Rock Creek generally contributes less than 5 cfs at their confluence. Water withdrawals, at Rock Creek Reservoir and one below the reservoir, and the dry nature of the lower drainage area account for such a low summer flow. Portions of Rock Creek below the reservoir are often dry during the summer.

The drainage area is approximately 33,760 acres (53 sq. q i.) and is a mix of Federal, State, and private lands. Roughly 70 percent of the drainage lies within the contiguous Forest boundary. The 1974 Rocky Bum burned over 7,000 acres in the drainages of Rock, Threemile, and Gate Creeks. Much of Rock Creek, above the reservoir, is in the burn area (RM 9.3-14.6).

A dam at RM 8.3 creates Rock Creek Reservoir, an approximately 90 acre impoundment. The reservoir stores water from Rock, Gate, and Threemile Creeks (the latter two enter through diversion ditches) for irrigation and recreational purposes. The Oregon Department of Fish and Wildlife annually stocks the reservoir with trout.

Access to Rock Creek is at road crossings 48 (RM 8.0), 4810 (14.7), 4811 (15.0), and 4811-160 (16.0). Additional access is provided by numerous spur roads which parallel the stream along both sides from RM 8.8-14.7. Below the reservoir, 48140 and associated spur roads parallel the south side to the Forest boundary.

A total of 8.8 miles were surveyed, including 7.0 miles of mainstem (RM 6.7-13.7) and 1.8 miles of North Fork Rock Creek (RM 0.0-1.8). Potential anadromous fish habitat extends to RM 13.3 on the mainstem and RM 0.3 on North Fork Rock Creek. This includes the rearing potential of the reservoir. Trout were observed throughout the areas surveyed.

#### B. Watershed and Geomorphology

Rock Creek heads on the east side of Grasshopper Point and flows in a southeasterly direction to its confluence with White River. The valley configuration is typically a flat-bottom V with a narrow floodplain. An atypical stretch (RM 8.8-10.5) is a flat-bottom V with a wide floodplain.

The loss of overstory and understory vegetation during the Rocky Bum, and the subsequent poor revegetation (due, in part, to extensive cattle grazing) have created low stream shade conditions from RM 9.3-14.5. The low shading is creating high water temperatures (as high as **78°F**, 7/84) in the bum area. Water quality is also being affected by accelerated sediment loading from

unstable banks and a lack of in-channel large woody debris (LWD) which may have been removed during salvage and cleanup operations after the fire.

Only two perennial tributaries (North Fork Rock Creek and Tributary A) were identified. These, in addition to numerous spring seeps and small wetlands, help maintain a summer base flow of 1-2 cfs above the reservoir. Below the reservoir, groundwater appears to account for the 2 cfs present at the time of the survey. No tributaries were identified below the reservoir and no spill appears to occur at the dam except through an overflow channel during spring runoff. The flows throughout the survey area appear moderately flashy.

c. Reach Descriptions

Three reaches were delineated. They are distinguished primarily by floodplain width, flow, pool to riffle ratio and riparian conditions. Reach I (RM 6.7-8.3) has a narrow floodplain (40 ft. wide), a flow of 2 cfs below the reservoir, is pool dominated, and has moderate to high shading from overstory and understory vegetation. Reach II (8.8-10.5) has a broader floodplain (140 ft. wide), twice the flow of Reach I, an even mix of pools and riffles, and has low shade due to the Rocky Bum. Reach III (RM 10.5-13.7) has a floodplain and flows similar to Reach I, is riffle dominated, and has low shading in the burn area.

#### D. Fisheries

The overall fish habitat rating is 4.2 (poor). The habitat appears potentially suitable for steelhead (Reach I-III) and coho (Reach I-II). If stream temperatures are significantly reduced sockeye salmon could also be produced. Despite the low habitat rating, trout were observed in good numbers throughout the survey area. Electroshocking at three sites in Reach II showed an average population estimate of 92 trout/200 feet of stream with a range of 45-120.

Pool rearing habitat is fair. The amount of pool area is good but low to moderate depths (1-2 ft.) and low to moderate effective cover reduce pool quality. Spawning habitat is poor with gravels averaging 43 sq. yds./mile. Sixty-five percent of these are rated marginal quality. Most of the gravels counted were in small (1-2 sq. yds.) patches.

The Rock Creek Dam (RM 8.3) a 35 foot high earth fill structure is a total migration barrier, and prevents access to an additional 5.3 miles of potential anadromous fish habitat, including Rock Creek Reservoir. No other total barriers were identified.

#### E. Riparian Area

The overall riparian habitat is rated 4.4 (moderate). High riparian diversity in Reach I, a broad floodplain in Reach II, and the presence of special

habitats (rock bluffs, snags, and small wetlands) throughout, have positive effects on the score. Negative influences include the low riparian diversity of the Rocky Bum (Reaches II and III) and the narrow floodplains of Reaches I and III. Cattle grazing impacts also reduce the riparian quality.

Riparian rehabilitation efforts were initiated in August 1984 from RM 9.3-10.2. This primarily consisted of fencing off the floodplain from livestock, and stabilizing vertical banks by pulling them back to a lower angle of repose and planting/seeding them.

#### F. Rehabilitation and Enhancement

Rehabilitation efforts could center on protecting riparian areas from livestock. Benefits of such actions could be increased riparian diversity, increased stream shading, increased bank stability, and decreased sediment loading and stream temperatures. Enhancement opportunities include improving pool quality (depth and cover) and developing springs for off-channel livestock watering sites.

#### H. Special Interests

Special interest areas include Rock Creek dam and reservoir, the area of the 1974 Rocky Bum, the riparian and fisheries rehab/enhancement efforts in Reach II, and an exceptionally high value wildlife area at the head of North Fork Rock Creek.

## ROCK CREEK

### Reach Summary

#### Reach I; RM 6.7-8.3:

1. The valley configuration is a flat bottom V with a narrow floodplain. The floodplain width varies between 40-70 feet.
2. The stream gradient is typically less than 1 percent.
3. The substrate is predominantly gravel/rubble with a high incidence of silt, (20 percent of substrate).
4. The stream area is pool dominated (P:R=8:2).
5. Shading is low (20 percent) from RM 6.9 to 7.4, and high (90 percent) from 7.4 to 8.2 due to dense stands of streamside alder.

Note. RM 8.3-8.8 is inundated by Rock Creek Reservoir, an approximately 90 acre impoundment used for recreation and irrigation.

#### Reach II; RM 8.8-10.5:

1. Above the reservoir the valley broadens into a wide, flat bottom V with an average floodplain width of 140 ft.

2. The stream gradient increases to 3 percent.
3. The riffle substrate is rubble/gravel with fine sediments still present (15 percent of substrate).
4. The stream area is evenly balanced between pools and riffles (P:R=5:5).
5. The reach is within the 1974 Rocky Burn area. Shading is low (30 percent).

Reach III; RM 10.5-13.7:

1. The valley narrows to an average floodplain width of 40 ft.
2. The gradient increases to 5 percent.
3. The riffle substrate remains gravel/rubble dominated. Sediments are slightly reduced (10 percent).
4. Riffles increase to 70 percent of the stream area.
5. Stream shading remains low (20 percent) in the burn area.

North Fork Rock Creek; RM 0.0-1.0:

1. The valley is a flat-bottom V with a narrow floodplain (30 ft. wide).
2. The overall gradient is 8 percent with a range of 5-15 percent.
3. The riffle substrate increases in size from predominantly rubble (RM 0.0-0.4) to boulders (RM 0.4+).
4. The stream area is an even mix of pools and riffles.
5. Stream shading is 30 percent. The reach is in the Rocky Burn.

North Fork Rock Creek; RM 1.0-1.8:

1. The valley widens and the floodplain width increases to 200+ ft.
2. The gradient decreases to 6 percent.
3. Extensive cattle damage to banks results in a substrate composed of 60 percent silt.
4. Riffles compose 60 percent of the stream area.
5. Shading decreases to 10 percent.

## ROCK CREEK

### Fish Habitat Summary

The overall fish habitat is rated poor (4.2). Factors contributing to the low score are the low summer flows , poor stream shading (Reaches II and III), the generally low to moderate pool quality, and the high silt contents of the substrates. Although habitat conditions are generally poor, moderate numbers of rainbow trout were observed throughout the survey area. Electroshocking in Reach II indicates an even higher presence of trout. An average population estimate of 92 trout per 200 foot site, was calculated for the 3 sites. The sampling may indicate the cumulative effects of temperature and sediments on downstream habitat quality. The lowest site had the fewest fish captured (45) and low numbers of legal fish (4). The middle site had the most fish captured (120) but only one legal fish. One hundred and eleven fish were captured at the upper site and 14 were legal. Numerous sculpin were also captured at the upper site, while only one was caught at the middle site and none at the lowest site.

The habitat appears suitable for potential coho salmon (Reach I and II) and steelhead (Reaches I-III, through RM 13.3). Sockeye salmon could also be produced in the reaches above the reservoir if significantly lower water temperatures could be achieved. An additional 0.3 miles of potential steelhead habitat is available in North Fork Rock Creek.

The Rock Creek dam (RM 8.3) was the only total passage barrier identified. Passage would need to be created, or facilitated by trap and haul of returning adults, if utilization of all the potential habitat above the dam were desired. Screening the irrigation ditch intake in the reservoir would need to be done to prevent losses of smolts during downstream migration.

Rehabilitation and enhancement efforts, funded by the Forest Service, were conducted in Reach II during August 1984. Project work included fencing 0.9 miles of riparian area, bank pull-back and stabilization, pool development, and planting deciduous species. More than eighty boulder and log structures were constructed to improve the fish habitat. The benefits should be an increase in riparian vegetation, stream shading, and improved pool quality. A decrease in sediment loading and stream temperatures should also result.

Reach I; RM 6.7-8.3:

1. The fish habitat is rated 4.6 (poor). Despite this score, a relatively high number of legal sized trout were observed. These could be from fish stocked in the reservoir and washed down through the overflow channel.
2. Pool rearing habitat is good. The stream area is pool dominated (80 percent). Pools are typically large (20 sq. yds.) with moderate depths (1-3 ft.) and moderate effective cover provided by overhanging

vegetation. Sediment deposition is common in pools. The water temperature at the time surveyed (7/30/84) was **69°F**.

3. Spawning habitat is poor. Only 72 sq. yds. of gravels were counted. Over 80 percent of the gravels are of a size suitable for potential anadromous utilization. Seventy percent are rated marginal quality. Sediments in the gravel interstitial spaces could reduce potential egg survival.
4. Passage through the reach is fair. Numerous small debris jams (RM 6.9-8.0) could be partial barriers during low flows. Al 1 appear passable with high flows. Partial removal could be done to insure passage. The dam for Rock Creek Reservoir is at the upper end of the reach and is a total barrier. An additional 4.5 miles of potential anadromous stream habitat and approximately 90 acres of lake habitat exist above the dam.

Reach II; RM 8.8-10.5:

1. The fish habitat is rated 5.8 (fair).
2. Rearing habitat is fair. Pool area and quality decrease from the previous reach. The pool to riffle ratio is 5:5. Pools average 6 sq. yds. in size with low to moderate depths and moderate effective cover from vegetation and LWD. An atypical portion immediately above

the reservoir (RM 8.8-9.3) is similar to the good rearing habitat found in Reach I. Beaver activity in this area has created good pools (20 sq. yds., mod. depths), with a dense alder understory providing high effective cover. The water temperature ranged from **56°F - 62°F**. Thermographs placed at RM 9.3 recorded temperatures as high as **78°F** (July 1984).

3. Spawning habitat improves slightly. One hundred square yards of gravel (59 sq. yds./mi.) were counted and greater than 50 percent of these are suitable for potential anadromous utilization. Gravel quality also improves with 50 percent of the gravels rated as good quality.
4. No passage barriers were observed.

Reach III; RM 10.5-13.7:

1. The fish habitat rating decreases to 3.9 (poor). Potential anadromous fish habitat extends to RM 13.3.
2. Rearing habitat is poor as pool area and quality decrease from the previous reach. Riffles dominate the stream area (70 percent) and pools are typically small (2 sq. yds.) with shallow depths (1') and low effective cover. The water temperature ranged from **57°F** to 62°F (8-30-84).

3. Spawning habitat quality and quantity decreases from the previous reach. Over 70 percent of the 128 square yards of gravel counted are rated as marginal quality. Fifty percent are of a size class suitable for potential anadromous utilization. The gravels average 40 sq. yds./mile.
4. Numerous small debris jams (RM 11.0-11.5) could act as low flow passage barriers, but appear to be passable with higher flows. Partial removal could insure passage.

North Fork Rock Creek; RM 0.0-1.0:

1. The fish habitat is rated 3.5 (poor). RM 0.0-0.3 is suitable for potential anadromous utilization. Trout were observed throughout the reach.
2. Pool rearing habitat is poor-fair. Pools compose 50 percent of the stream area and are typically small (2 sq. yds.), shallow (less than 1 ft. deep), with high effective cover.
3. Nine square yards of gravel were counted with 40 percent suitable for potential anadromous use and 90 percent rated marginal quality.
4. Partial removal of small debris jams could improve passage (RM 0.0-0.3).

North Fork Rock Creek; RM 1.0-1.8:

1. The fish habitat rating decreases to 2.3 (very poor). Extremely low flows (0.1 cfs), poor shading (10 percent), and heavy sedimentation reduce the habitat quality. Low numbers of trout were observed through RM 1.8.
2. Rearing habitat is poor. Pools are small and shallow (less than 1 sq. yd. and 1 ft. deep) with low effective cover.
3. No gravels were counted.
4. The 4810-140 culvert (RM 1.0) is a jump (3') and velocity (4 percent gradient) barrier to trout.

## ROCK CREEK

### Riparian Habitat Summary

The overall Riparian Condition Rating is 4.4 (moderate). Positive factors influencing this score include the riparian habitat diversity in Reach I, the wide floodplain in Reach II, and the presence of special habitats (wetlands, rock bluffs, and snags) along portions of the stream. Negative factors include the impacts of cattle grazing, loss of overstory shading (Reaches II and III) due to the 1974 Rocky Burn, and the narrow floodplains of Reaches I and III.

Riparian rehabilitation in Reach II (RM 9.3-10.2) was initiated in August 1984. These efforts included fencing the riparian area from cattle, development of a watering trough for an alternative source of water, pull back of vertical banks, erosion control seeding, and planting cottonwoods. Anticipated results are a recovery of riparian vegetation by minimizing grazing impacts in the floodplain, and improving water quality by reducing sediment loading and water temperatures.

An exceptionally high value wildlife area occurs on North Fork Rock Creek (RM 1.6+). The combination of a large (approx. 30 acres) snag patch, a large (approx. 20 acres) sedge meadow/wetland, stands of quaking aspen, a fish-bearing stream, and a rocky knob adjacent, give this area a disproportionate value for wildlife. Good browse is also abundant upslope.

This area is currently fenced, but cattle are inside the enclosure and are impacting the wetland. Closing the gate along the fence could eliminate access to livestock and reduce the degradation of habitat.

Reach I; RM 6.7-8.3:

1. The riparian habitat is moderate (RCR=5.3).
2. The valley configuration is a narrow, flat-bottom V, with an average floodplain width of 40 ft.
3. All five habitat units (grass-forbs, shrubs-seedlings-saplings, poles, large and small saw timber) are present.
4. An average of two coniferous species (Douglas-fir, grand fir, and ponderosa pine) and one deciduous species (oak) were observed in the overstory.
5. Special habitats observed were rock outcrops (RM 6.7-7.2) and small wetlands (RM 8.0-8.3).

Reach II; RM 8.8-10.5:

1. The riparian habitat remains moderate quality (RCR=5.7).

2. The valley broadens and the average floodplain width increases to 140 ft.
3. Only two habitat units were observed: grass-forbs and shrubs-seedlings-saplings. Poles, large and small saw timber were destroyed in the 1974 Rocky Bum (RM 9.3-10.5). An atypical stretch (RM 8.8-9.3) has four habitat units, with large saw timber lacking.
4. No overstory is present in the bum area. An overstory of ponderosa pine occurs from RM 8.8 to 9.3.
5. Special habitats observed were wetlands (RM 8.8-9.3) and a snag patch (RM 10.3-10.5).

Reach III; RM 10.5-13.7:

1. The riparian habitat is rated 3.9 (poor).
2. The valley narrows to a flat-bottom V with an average floodplain width of 40 ft.
3. Habitat units in the Rocky Burn are grass-forbs and shrubs-seedlings-saplings.
4. No overstory is present.

5. Rock outcrops (RM 10.8-11.3), snag patches (RM 10.5-10.7), and small spring seep/wetlands throughout the reach are the special habitats present. Two spring areas (RM 13.1 and 13.3) add approximately 50 percent (1 cfs) of the flow in this reach. Cattle damage (trampled soils and banks) was evident at the springs and they could be fenced for protection.

North Fork Rock Creek; RM 0.0-1.0:

1. The riparian habitat is rated 4.2 (moderate).
2. The valley configuration is a flat bottom V with a narrow floodplain (average width = 30 ft.).
3. Habitat units are similar to Reach III of Rock Creek (grass-forbs, shrubs-seedlings-saplings).
4. No overstory is present.
5. Small wetlands along 10 percent of the reach are a special habitat.

North Fork Rock Creek; RM 1.0-1.8:

1. The riparian habitat quality remains moderate (RCR=5.9). The higher score reflects the value of the high quality wildlife area (RM 1.6+) and the broader floodplain width.

2. The valley configuration is a very wide flat-bottom V with a floodplain width greater than 200 ft.
3. Habitat units remain grass-forbs and shrubs-seedlings-saplings.
4. No overstory is present.
5. Special habitats located at RM 1.6+ include an approximately 30 acre snag patch, a large sedge meadow/wetland (approx. 20 acres), and a rocky knob. Stands of quaking aspens are also in this area.

## ROCK CREEK

### Rehabilitation and Enhancement Summary

#### Livestock Fencing, RM 6.7-7.5, 13.1, 13.25, 13.7, N. Fork RM 1.0-1.8:

Livestock impacts to streambanks, substrates, and streamside vegetation are moderate to heavy along the entire stream length surveyed. Areas in which impacts are particularly severe include the lower section of Reach I, from the Forest Boundary (RM 6.7) to RM 7.5, where dense streamside alder stands begin protecting the channel; the special habitat sedge wetland snag patch and downstream channel of Reach II, North Fork Rock Creek (N. Fork Rock Cr. RM 1.0-1.8); and the special habitat cottonwood spring areas south of the mainstem at RM.13.1, 13.25, and 13.7. These latter spring areas, 1-2 acres each, could be developed with watering troughs to provide livestock water while protecting the springs themselves. Much of Reach II, North Fork Rock Creek, from RM 1.4 to above 1.8, is already fenced, but a gate below Road 4810 was open and cattle were inside the enclosure during the survey. Another high-priority fencing area, RM 9.3 to 10.0, was fenced this year as part of the Rock Creek Riparian Rehabilitation project.

Deciduous Planting, RM 9.4-13.7, N. Fork RM 1.0-1.6:

Summer water temperatures in 1984 were recorded as high as 78°F on Rock Creek in the Rocky Burn area, with diurnal fluctuations as great as **20°F**. Planting fast-growing deciduous species, such as cottonwood, along the stream in the Bum area would help reduce stream high temperatures and stabilize daily fluctuations. Additional benefits would include improving bank stability and increasing riparian vegetative and structural diversity for wildlife.

ROCK CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>				<u>POOLS</u>			<u>RIFFLES (%)</u>					<u>SD</u>	<u>D</u>
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>		
<b><u>Rock Cr. Mainstem</u></b>														
1(6.7-8.3)	4.6	90	8:2	1	<b>M</b>	<b>20</b>	<b>M</b>	-	10	20	40	10	<b>20</b>	<b>5</b>
II(8.8-10.5)	5.8	30	5:5	3	L-M	6	M	-		40	35	10	<b>15</b>	<b>3</b>
111(10.5-13.7)	3.9	20	3:7	5	L	2	L	-	5	20	50	15	<b>10</b>	<b>2</b>
<b><u>North Fork Rock Creek</u></b>														
(0.0-1.0)	3.5	30	5:5	8	L	2	H	-	40	30	20	10	<b>*</b>	<b>2</b>
(1.0-1.8)	2.3	10	4:6	6	L	1	L	-	-	-		10	<b>90</b>	<b>3</b>

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R Ratio of pool length:riffle length  
G: Average gradient  
d: Average maximum depth (L  $\geq$  12", M = 12 - 29", H  $\leq$  30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\geq$  40%, M = 40-60%, H  $\leq$  60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

ROCK CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>			<u>TRIBUTARIES</u>	
	<u>-I</u>	<u>II</u>	<u>III</u>	<u>N.F. Rock Creek: I II</u>	
Rainbow Trout (a)	M	M	M		L M
Rainbow Trout (j)	M	M	L		M M

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
<u>Rock Cr. Mainstem .</u>			
I(6.708.3)	72	20	52
II(8.8.10.5)	100	52	48
III(10.5-13.7)	128	35	93
<u>N.F. Rock Creek:</u>			
(0.0-1.0)	9	1	8
(1.0-1.8)	0	0	0
<b>TOTAL</b>	<b><u>309</u></b>	<b><u>108</u></b>	<b><u>201</u></b>

ROCK CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
<u>Rock Cr. Mainstem</u>				
6.9-8.0	Debris jams	--	P	Partial low flow barriers.
8.3	Dam	--	N	Possibly create passage through overflow channel.
12.4	Debris jams	--	F	Appear passable with high flows. Could do some partial removal.
<u>N.F. Rock Creek:</u>				
1.0	Culvert	CA	N	Above anadromous habitat. Barrier to trout.

LEGEND:  
F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
<u>Rock Cr. Mainstem</u>								
I(6.708.3)	1.6	-	8:2	20	2	39	27	Rock Cr. Res. dam @ RM 8.3.
II(8.8.10.5)	-	1.7	5:5	6	1-2	37	17	
III(10.5-13.7)	-	2.8	3:7	2	1	66	-	
<u>N.F. Rock Creek.</u>								
(0.0-0.3)	-	0.3	5:5	2	1	1	0	
TOTAL	<u>1.6</u>	4.8				<u>143</u>	44	

Legend:

- i l . : Miles of habitat presently accessible to anadromous fish if introduced.
- Pot.: Additional miles of habitat potentially available with complete passage enhancement.
- P:R: Ratio of pool length : riffle length.
- Area: Average pool area (sq. yds.).
- Depth: Average pool depth (feet).
- Spawning: Number of Sq. Yards of gravels observed in the 1"-3" and 3".6" size classes.

ROCK CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		OR	<u>LWD CHARACTERISTICS</u>			
	Total (%)	HQ (%)	Total (%)	HQ (%)		#	L	Dia	Source
<u>Rock Cr. Mainstem</u>									
I(6.7-8.3)	30	*	30	5	Perp.	M	1	1-2	T
II(8.8-10.5)	40	35	50	70	Perp/Var.	S/M	2	1	L
III(10.5-13.7)	65	60	70	80	Perp Var.	S/M	1-2	1	M
<u>N.F. Rock Creek.</u>									
(0.0-1.0)	100	100	40	100	Perp.	M	2	1	T
(0.0-1.8)	--	--	50	100	Var	S	1-2	1	L

**LEGEND:** Total: Percent of total habitat area dependent on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	Q	W	D	
<u>Rock Cr. Mainstem</u>							
I(6.708.3)	4	0.5	1	2	7	1	40
II(8.8.10.5)	5	0.4	2	4	6	1	140
III(10.5-13.7)	4	0.3	1.5	2	6	0.6	40
<u>N.F. Rock Creek:</u>							
(0.0-1.0)	2	0.25	1	0.5	4	0.75	30
(1.0-1.8)	2	0.1	0.5	0.1	5	1	200+
w,w:	Stream width (ft)						
D,d:	Stream depth (ft)						
v:	Velocity (feet/second)						
Q=	Average reach flow in cubic feet/second						

ROCK CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>	<u>A/W</u>	
<u>Rock Cr. Mainstem</u>							
1(6.7-8.3)	7/30/84	2	90	E	--	82/69	1815
11(8.8-10.5)	7/26/84	4	30	SE	62/56	72/62	0900-1100
III(10.5-13.7)	8/30/84	2	20	E	48/48	69/62	1030-1245

N.F. Rock Creek:

(0.0-1.0)	9/13/84	0.5	30	SE	--	74/59	1145
(1.0-1.8)	9/13/84	0.1	10	E	--	64/58	1500

TABLE IX - RIPARIAN HABITAT SUMMARY

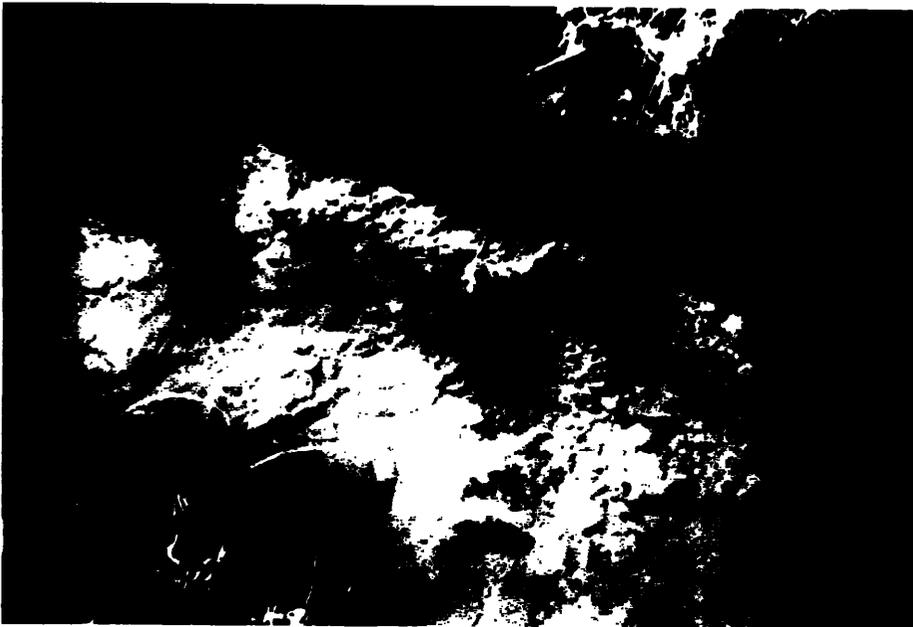
<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u> F.P. (ft.)	<u>VEGETATION</u>			<u>ASPECT</u>	<u>AQUATIC</u>			<u>Special Habitat</u>
			H.U.	Overstory	Con. Dec.		Streamclass	Wetland%	Size	
<u>Rock Cr. Mainstem</u>										
1(6.7-8.3)	5.3	40	5	2	1	II	15	S		2
11(8.8-10.5)	5.7	140	2	0	0	II	20	S		1
111(10.5-13.7)	3.9	40	2	0	0	II	10	S-L		2
<u>N.F. Rock Creek:</u>										
(0.0-1.0)	4.2	30	2	0	0	II	30	S		2
(1.0-1.8)	4.9	200+	2	0	0	II	10	S		2

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain width in feet  
 H.U.: # Habitat units (H ≥ 4., M = 2-3., L ≤ 1)  
 Con: # Conifer species  
 Dec: # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands;  
 (H >50%; M = 25-50%., L <25%)  
 Size: Size of wetlands  
 S = small (less than 1 acre)  
 L = large (greater than 1 acre)

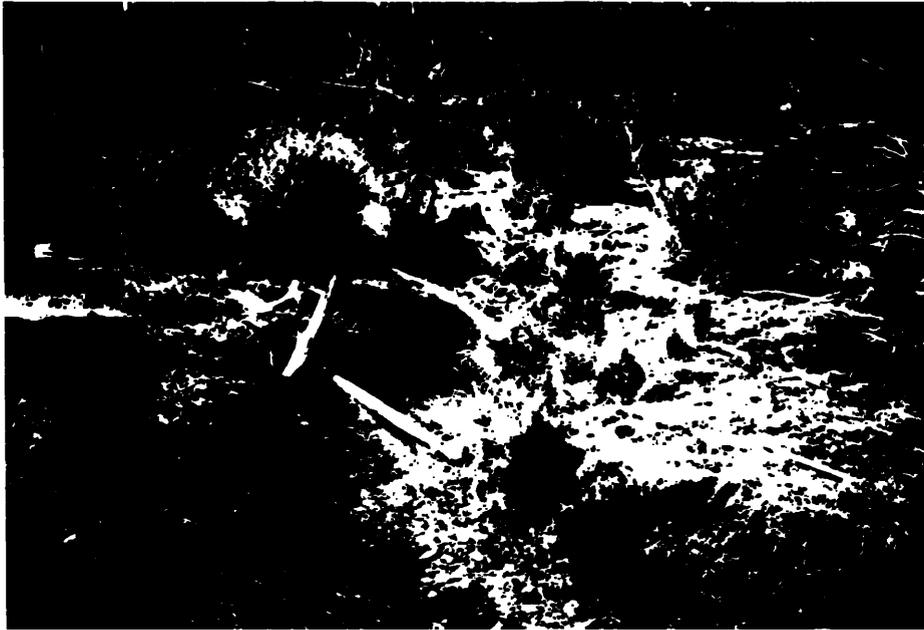
KAnderson:paw (WP-PJ-5148N)



Reach I (RM 6.7 - 8.3) contains the best pool rearing habitat in the area surveyed. Pools are large (20 sq. yds. ) with moderate depths and moderate effective cover. The pool to riffle ratio is 8:2 which is largely influenced by numerous beaver dams from RM 7.3 - 8.0.



Sediment deposition is a common problem throughout Rock Creek. Pool bottoms are frequently covered with silt and riffle substrates contain as high as 20% fine sediments. Reduced bank vegetation and bank stability, due to cattle grazing, likely aggravate this problem.



High water temperatures are concerns in Reaches II and III, where Rock Creek flows through the area of the 1074 Rocky Burn. Shading is low (20 - 30%) due to the loss of the overstory during the fire. The subsequent recovery of the riparian vegetation has been depressed due to livestock grazing. Temperatures as high as 780F were recorded during the summer.



Rehabilitation and enhancement work in Reach II included sloping and stabilizing vertical banks, pool development, fencing off the floodplain from cattle, planting deciduous plant species, and erosion seeding. An increase in the riparian vegetation could increase bank stability, stream shading, and effective pool cover. Less sediment loading and lower stream temperatures could also result.



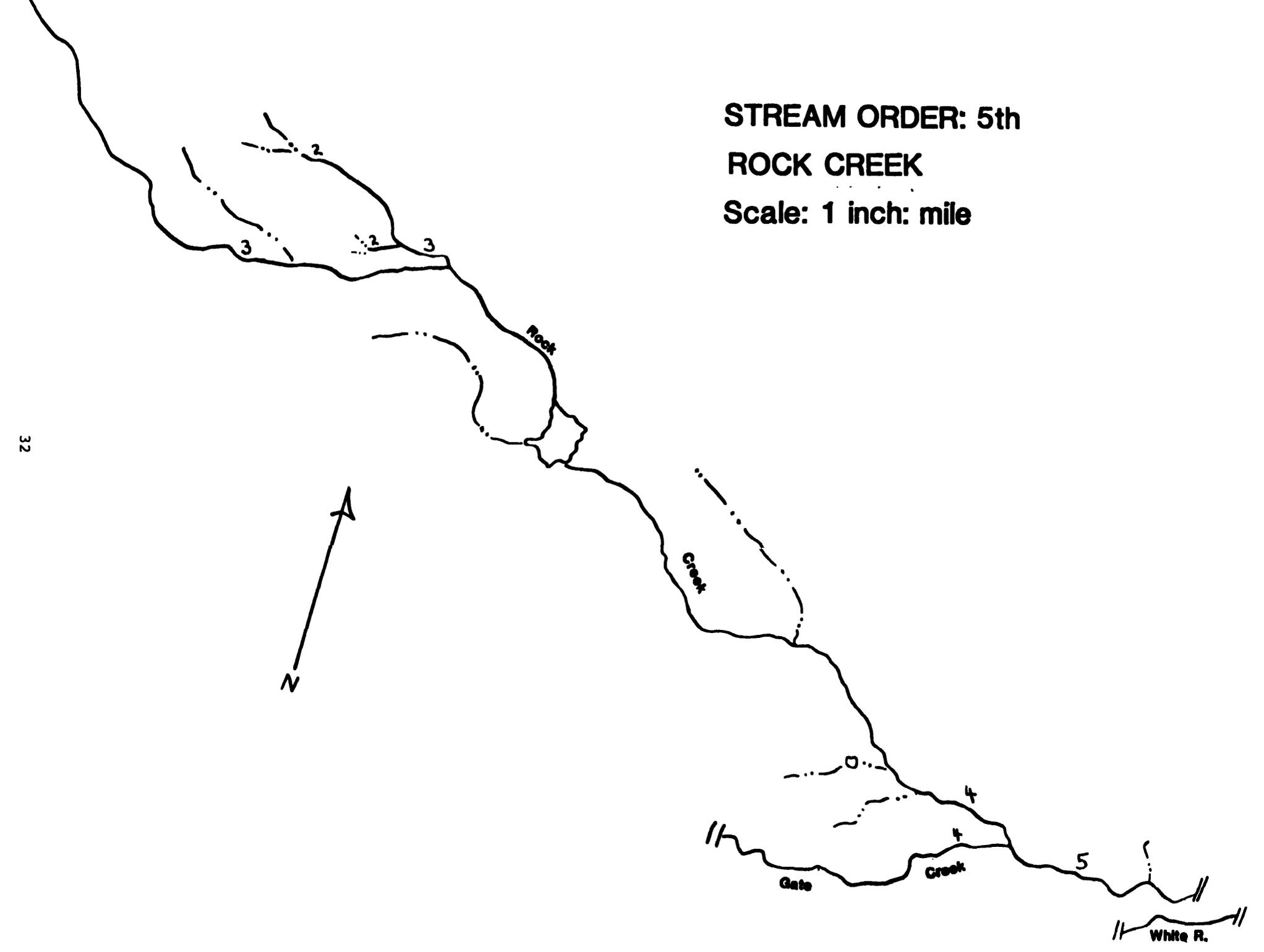
A large (30 acre) snag patch, a 20 acre sedge meadow/wetland, and stands of quaking aspen create an exceptional wildlife area at the head of North Fork Rock Creek (RM 1.6 - 1.8). An adjacent rocky knob also adds value to this area. Cattle damage to the wetland could be reduced by insuring that livestock cannot get into the exclosure that currently surrounds this site.

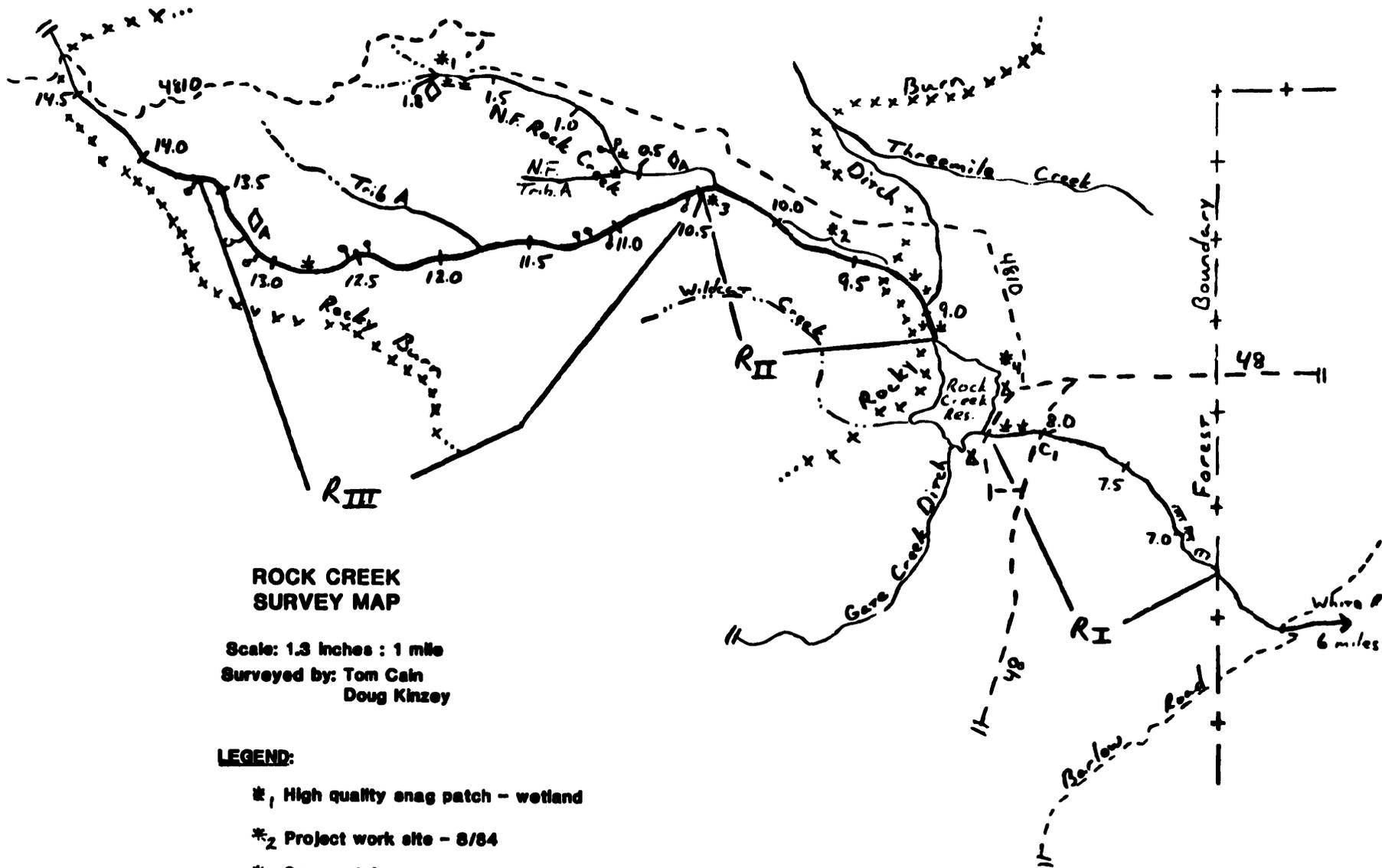


The fish habitat in Reach III (RM 10.5 - 13.7) is rated as poor, (HCR = 3.9). Pool and spawning habitat quality is poor during low flow conditions. Steelhead could potentially utilize the habitat through RM 13.3 during high spring flows. Numerous small debris jams (RM 11.0 - 12.0) act as low flow barriers but appear passable with higher flows. Photo taken at RM 11.9.

**STREAM ORDER: 5th**  
**ROCK CREEK**  
**Scale: 1 inch: mile**

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- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

**R<sub>1,II,III</sub>** REACH # and SECTION

**T<sub>1</sub> 1.0** TRANSECT # and RIVERMILE

**★ OBSTRUCTION**

**★ BARRIER**

**J<sub>1,2,3</sub>** JAM and #  
**F( )<sub>1,2,3</sub>** FALLS, HEIGHT, and #  
**C<sub>1,2,3</sub>** CULVERT and #  
**B<sub>1,2,3</sub>** CHUTE and #

 DIVERSION STRUCTURE (I - water is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUMP

 DEBRIS TORRENT TRACK

 **SPRING**

 UPPER LIMIT OF FISH PRESENT (A ■ limit of potential anadromous fish habitat)

 BANK EROSION (EXTENSIVE/SEVERE)

1.2.3, : MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

Culvert # A Stream Trib A Rock Date 9/21/84

Gradient greater than 14%: Yes 7% No. \_\_\_\_\_

Type of structure (check)  
Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure 30 ft. Diameter of structure 3.5 x 5 ft.

Are baffles present? Yes \_\_\_\_\_ No.

Jumping distance into culvert from pool: Height 1/2

Pool present below culvert: Length 10, width 8, depth 3

Stream above culvert: Width 2, gradient 7%

Stream flowing water: Yes  No \_\_\_\_\_

Other comments: Flowing 1' x 1" deep, 2' fill. Very marginal habitat - maybe no fish. 1/2 ft/s  
1/2 cfs

RM 110 (N: Fork)

Culvert # \_\_\_\_\_ Stream N. Fork Rock Date 9/21/84

Gradient greater than 14%: Yes 4% No. \_\_\_\_\_

Type of structure (check)  
Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure 30 ft. Diameter of structure 3 ft.

Are baffles present? Yes \_\_\_\_\_ No.

Jumping distance into culvert from pool: Height 3

Pool present below culvert: Length 5, width 4.1, depth 2

Stream above culvert: Width 3, gradient 6

Stream flowing water: Yes  No \_\_\_\_\_

Other comments: Flowing 1" x 2" 30' / 12' = 2.5 f/s, 5' fill, 0.8 miles of resident trout habitat above culvert.

Culvert # \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Gradient greater than 14%: Yes \_\_\_\_\_ No. \_\_\_\_\_

Type of structure (check)  
Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure \_\_\_\_\_ ft. Diameter of structure \_\_\_\_\_ ft.

Are baffles present? Yes \_\_\_\_\_ No. \_\_\_\_\_

Jumping distance into culvert from pool: Height \_\_\_\_\_

Pool present below culvert: Length \_\_\_\_\_, width \_\_\_\_\_, depth \_\_\_\_\_

Stream above culvert: Width \_\_\_\_\_, gradient \_\_\_\_\_

Stream flowing water: Yes \_\_\_\_\_ No \_\_\_\_\_

Other comments: \_\_\_\_\_

Culvert # \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Gradient greater than 14%: Yes \_\_\_\_\_ No. \_\_\_\_\_

Type of structure (check)  
Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure \_\_\_\_\_ ft. Diameter of structure \_\_\_\_\_ ft.

Are baffles present? Yes \_\_\_\_\_ No. \_\_\_\_\_

Jumping distance into culvert from pool: Height \_\_\_\_\_

Pool present below culvert: Length \_\_\_\_\_, width \_\_\_\_\_, depth \_\_\_\_\_

Stream above culvert: Width \_\_\_\_\_, gradient \_\_\_\_\_

Stream flowing water: Yes \_\_\_\_\_ No \_\_\_\_\_

Other comments: \_\_\_\_\_

Special Case Form - Tributaries

North Fork Rock Trib A

TRIB I.D. \_\_\_\_\_ Stream Rock Date 8-30-84

Per X INT \_\_\_\_\_ Gradient 7 %

WIDTH 1 ft.  $\bar{x}$  Depth 0.25 ft.  $\bar{x}$  VEL 1 ft/s

Q 0.25 c.f.s. M.H.W. WIDTH 1.5 ft

Poor trout habitat, sand and small gravel substrate.

R.M 11.85

TRIB I.D. A Stream Rock Date 9-21-84

Per X INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH 1 ft.  $\bar{x}$  Depth 0.2 ft.  $\bar{x}$  VEL 1 ft/s

Q 0.2 c.f.s. M.H.W. WIDTH 2 ft

Very poor trout habitat, no fish observed. Barrier culvert near mouth.

TRIB I.D. \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Per \_\_\_\_\_ INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH \_\_\_\_\_ ft.  $\bar{x}$  Depth \_\_\_\_\_ ft.  $\bar{x}$  VEL \_\_\_\_\_ ft/s

Q \_\_\_\_\_ c.f.s. M.H.W. WIDTH \_\_\_\_\_ ft

TRIB I.D. \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Per \_\_\_\_\_ INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH \_\_\_\_\_ ft.  $\bar{x}$  Depth \_\_\_\_\_ ft.  $\bar{x}$  VEL \_\_\_\_\_ ft/s

Q \_\_\_\_\_ c.f.s. M.H.W. WIDTH \_\_\_\_\_ ft

TRIB I.D. \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Per \_\_\_\_\_ INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH \_\_\_\_\_ ft.  $\bar{x}$  Depth \_\_\_\_\_ ft.  $\bar{x}$  VEL \_\_\_\_\_ ft/s

Q \_\_\_\_\_ c.f.s. M.H.W. WIDTH \_\_\_\_\_ ft

TRIB I.D. \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Per \_\_\_\_\_ INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH \_\_\_\_\_ ft.  $\bar{x}$  Depth \_\_\_\_\_ ft.  $\bar{x}$  VEL \_\_\_\_\_ ft/s

Q \_\_\_\_\_ c.f.s. M.H.W. WIDTH \_\_\_\_\_ ft

TRIB I.D. \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Per \_\_\_\_\_ INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH \_\_\_\_\_ ft.  $\bar{x}$  Depth \_\_\_\_\_ ft.  $\bar{x}$  VEL \_\_\_\_\_ ft/s

Q \_\_\_\_\_ c.f.s. M.H.W. WIDTH \_\_\_\_\_ ft

TRIB I.D. \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Per \_\_\_\_\_ INT \_\_\_\_\_ Gradient \_\_\_\_\_ %

WIDTH \_\_\_\_\_ ft.  $\bar{x}$  Depth \_\_\_\_\_ ft.  $\bar{x}$  VEL \_\_\_\_\_ ft/s

Q \_\_\_\_\_ c.f.s. M.H.W. WIDTH \_\_\_\_\_ ft

## GUMJUWAC CREEK

Barlow Ranger District

Surveyor: D. Kinzey	County: Wasco
Date Surveyed: September 5, 1984	Mouth Location: T.3S., R.10E., Sec. 10
Tributary to: Badger Creek	Watershed Area: 1,212 acres 1.9 sq. miles
Drainage: White River	
TRI Compartments: Badger 1401 Flag 1402	Stream Length. 1.5 miles
Game Fish: Rainbow trout	Distance Surveyed: 0.7 miles
Potential Anadromous Species. Steelhead	Average Low Flow width: 8 ft.
	Stream Order: IV
Average Fish Habitat Condition Rating: 6.6 (fair to good)	
Average Riparian Condition Rating: 4.4 (moderate)	

## GUMJUWAC CREEK

### Survey Summary

#### A. Stream Summary

Gumjuwac Creek heads in the near-vertical walled rocky ridgetops between Gunsight Butte and Lookout Mountain, flowing southeast about a mile and a half to its confluence with the Badger Creek mainstem at river mile (RM) 20.1. It is a fourth-order stream, draining a watershed of approximately 1,212 acres. Gumjuwac Creek provides about half (8 cfs) of the Badger Creek low flow discharge at their confluence.

The drainage is wholly contained within the Badger Creek Wilderness Area. Access is limited to trails. The Badger Creek trail crosses Gumjuwac Creek at RM 0.1. The Gumjuwac Creek trail parallels the northwest side of the stream for most of its length. Road 3550 runs along the western edge of the drainage.

This survey was conducted September 5, 1984, from RM 0.0 to 0.7. This is the probable extent of potential anadromous habitat.

#### B. Watershed and Geomorpholngy

The valley configuration of Gumjuwac Creek is a narrow (30 feet wide), flat bottomed V-shape with moderately steep (50-70 percent) sideslopes within the area surveyed. The basin has a major fork at RM 0.7. Flows appear flashy.

#### C. Reach Description

Gumjuwac Creek is characterized as a single reach over the area surveyed. Gradient averages 12 percent, varying from 10 to 14 percent. Small boulders 1-3 feet in diameter compose 40 percent of the riffle substrates. The stream is slightly riffle dominated (P:R = 4:6). Large woody debris (LWD) is associated with 40 percent of the high quality pools and 60 percent of the high quality spawning gravels.

#### D. Fisheries

Fish habitat rates fair to good (HCR = 6.6). Good summer base flows, a balanced pool to riffle ratio, high riffle quality, and shading all contribute positively to the score. Pool quality (shallow depths and small area) and low spawning gravel counts (30 yards/mile) are negative factors reducing the score.

No fish were observed during the survey, perhaps due to low light conditions. Habitat appears suitable for resident rainbows and, potentially, steelhead trout.

#### E. Riparian Area

The riparian condition rating is moderate (RCR = 4.4). The narrow valley bottom (30 feet wide), and lack of deciduous overstory or special habitats, negatively influence the score. High structural diversity, with all five habitat units present, is the major positive influence.

F. Rehabilitation/Enhancement

Improving passage at barriers located at RM 0.15, 0.3, and-0.5 is a priority if anadromous use of this stream is desired.

Structural enhancement in the form of log sills/boulder berms, both to improve rearing habitat and to retain spawning gravels, could improve fish production throughout the reach. Due to access and the wilderness designation of the drainage, work would likely need to be performed using hand tools and native materials.

GUMJUWAC CREEK

Reach Summary

Reach I; RM 0.0-0.7:

1. The valley configuration is a narrow (30 feet wide), flat-bottom V-shape, with moderately steep (60 percent) sideslopes.
2. Gradient is high (12 percent).
3. Boulder/rubble comprises 70 percent of the riffle substrate.
4. Riffles are slightly dominant (P:R = 4:6).
5. Stream shading is high (90 percent).

GUMJUWAC CREEK

Fish Habitat Summary

Reach I; RM 0.0-0.7:

1. Fish habitat is rated fair to good (HCR - 6.6).
2. Rearing habitat is fair throughout the reach. Pools are small (2 square yards) and shallow (12 inches), with moderate effective cover. Ten percent of all pools and 40 percent of the high quality pools are associated with LWD.
3. Spawning habitat is limited. Half of the 20 square yards of gravels counted were rated marginal due to channel placement. Fifty percent of all spawning gravels and 60 percent of the high quality gravels are associated with LWD.
4. Passage barriers are a 4' jump log sill at RM 0.15, a 3' jump logjam and 3' boulder falls at RM 0.3, and a 4' jump boulder falls at RM 0.5.

GDMJUWAC CREEK

Riparian Summary

Reach I; RM 0.0-0.7:

1. The riparian condition rating is moderate (RCR = 4.9)
2. The valley bottom is a narrow (30 feet wide) flat-bottom "V".
3. Structural diversity is high, with all five habitat units (grass-forb, shrub-seedling-sapling, poles, small sawtimber, and large sawtimber) well represented.
4. The overstory is coniferous, dominated by Douglas-fir. Cedar and western hemlock are also present.
5. No special habitats were noted in this survey.

## GUMJUWAC CREEK

### Rehabilitation/EnhancementSummary

#### Passage Enhancement, 0.15,0.3, 0.5:

A 4' jump log sill passage barrier at RM 0.15 could be notched to lower the lip, and have downstream boulders rearranged to provide a jump pool. A combination 3' jump logjam and 3' boulder falls at RM 0.3 could be modified with hand tools and blasting to improve passage. The 4' jump boulder falls at RM 0.5 could be modified with a rock bar and/or blasting.

#### Structural Enhancement, 0.0-0.7:

Construction of log sills/boulder berms both to retain gravels and to increase low flow pool depths and area could improve spawning and rearing capabilities of the stream throughout the reach.

GUMJUWAC CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>				<u>POOLS</u>			<u>RIFFLES (%)</u>						
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I (0.0-0.7)	6.6	90	4.6	12	L	2	M	-	40	30	15	15	-	8

LEGEND: HCR: Habitat Condition Rating  
 St: Percent of stream shaded  
 P:R: Ratio of pool length:riffle length  
 G: Average gradient (%)  
 d: Average maximum depth (L = 12", M = 12 - 29", H = 30")  
 A: Average pool area (sq. yards)  
 EC: Effective cover (L = 40%, M = 40-60%, H = 60%)  
 BR: Bedrock  
 SD: Sand  
 D: Average depth (inches)  
 \*: Present, but less than 5%

GUMJUWAC CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

REACH

I

( )

TRIBUTARIES

GUMJUWAC CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
0.15	Logjam	J1	P	Hand tools
0.3	Boulder Falls (3')	B1	P	Hand tools
0.3	Logjam	J2	P	Hand tools
0.5	Boulder Falls (4')	B2	P	Hand tools/blastng

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (0.0-0.7)	0.2	0.5	4:6	2	1	12	2	
TOTAL	0.2	0.5				12	2	

Legend: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length : riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of Sq. Yards of gravels observed in the 1".3" and 3"-6" size classes.

GUMJUWAC CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (0.0-0.7)	50	60	10	40	Perp	S	2	2	L

LEGEND: Total: Percent of total habitat area dependant on LWD  
 HO: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure: S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	Q	W	D	
I (0.0-0.7)	8	1	1	8	15	1.5	30+

w,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

GUMJUWAC CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (0.0-0.7)	9/15/84	8	90	SE	48/44		1330

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special</u>	<u>Habitat</u>
			<u>Con.</u>	<u>Dec.</u>					
I (0.0-0.7)	4.9	30	5	4	0	II	0	0	0

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain width in feet  
 H.U.: # Habitat units (H - 4; M = 2-3; L - 1)  
 Con: # Conifer species  
 Dec: # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands;  
 (H 50%; M = 25-50%; L 25%)  
 Size: Size of wetlands  
 S = small (less than 1 acre)  
 L = large (greater than 1 acre)

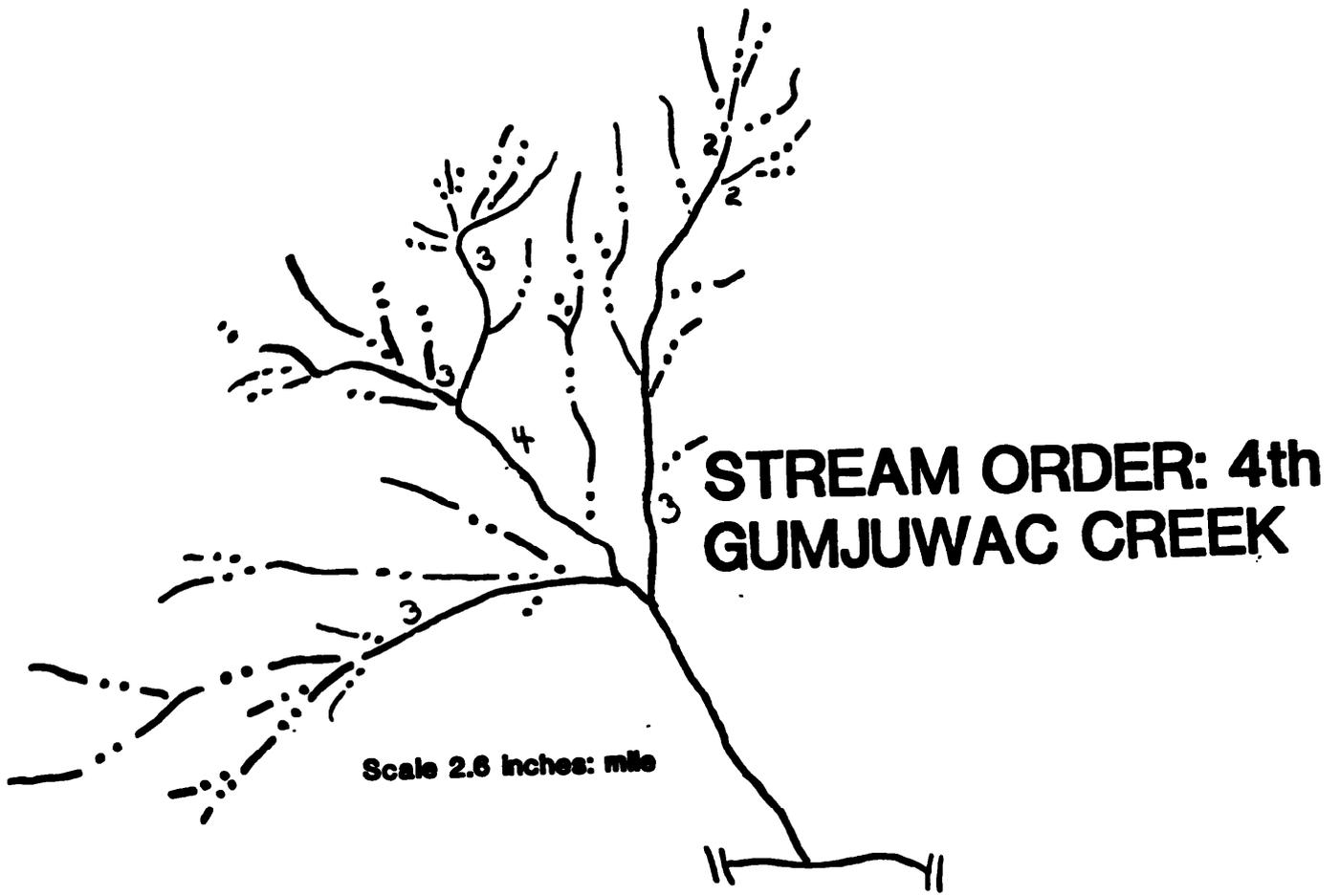
KAnderson:paw (WP-PJS-5146N)



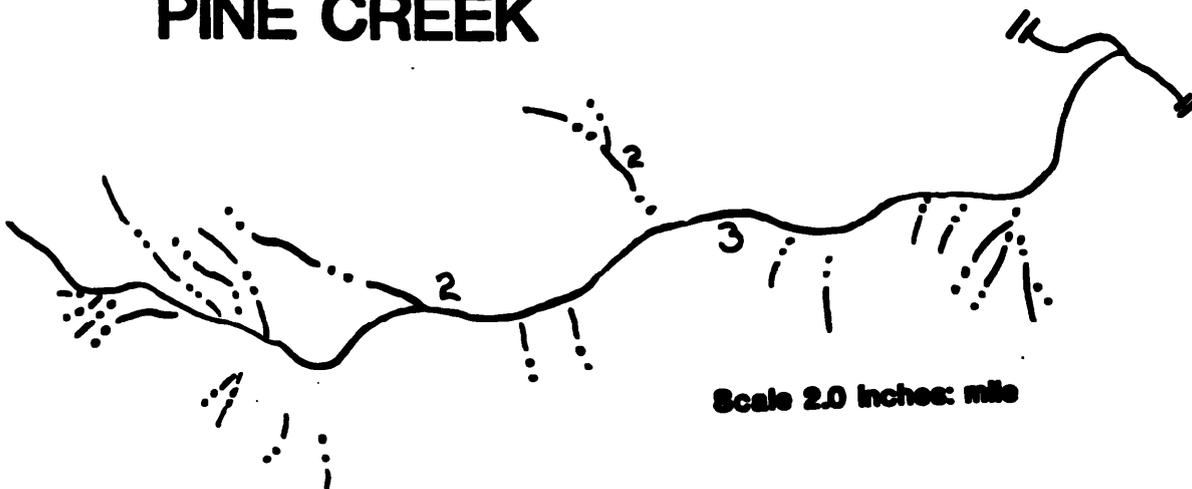
Gumjuwac Creek (photo center) Is a major tributary to Badger Creek (foreground), providing about half the Badger Creek discharge at their confluence. Gumjuwac Creek has 0.7 miles of potential anadromous habitat.



Four partial passage barriers on Gumjuwac Creek, beginning with this 4' jump log sill at RM 0.15, could be easily modified with hand tools and local materials to improve passage. Other barriers are a small (720 cu. ft.) logjam at RM 0.3, and boulder cascades at RM 0.3 and 0.5



**STREAM ORDER: 3rd  
PINE CREEK**



**Pine and Gumjuwac Creeks**

**Survey Map**

**Surveyed by: D. Kinzey**

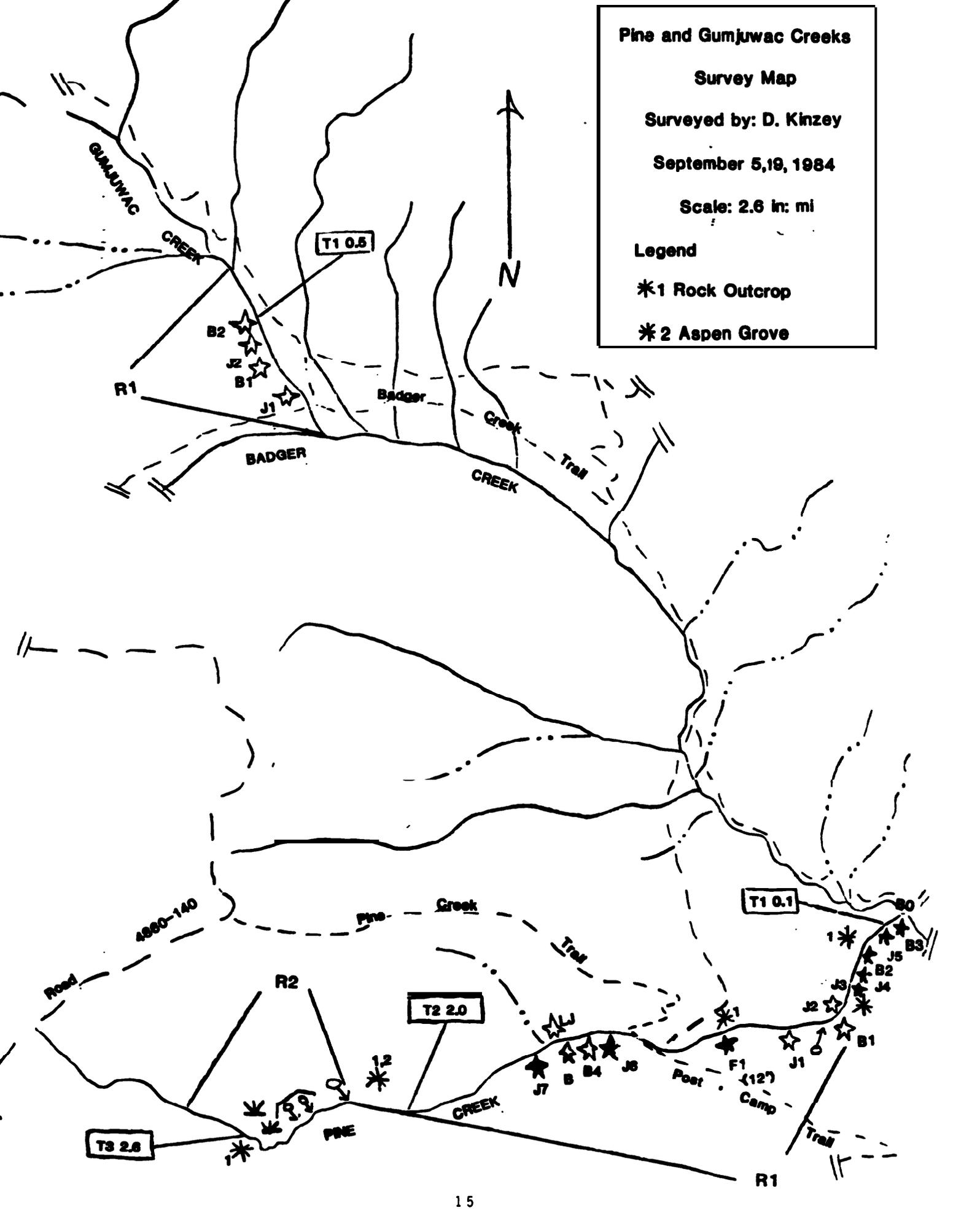
**September 5, 19, 1984**

**Scale: 2.6 in: mi**

**Legend**

**\*1 Rock Outcrop**

**\*2 Aspen Grove**



- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

R<sub>I,II,III</sub> REACH # and SECTION

T<sub>1</sub> 1.0 TRANSECT # and RIVERMILE

★ OBSTRUCTION                      ★ BARRIER

J<sub>1,2,3</sub> JAM and #  
 F( )<sub>1,2,3</sub> FALLS, HEIGHT, and #  
 C<sub>1,2,3</sub> CULVERT and #  
 B<sub>1,2,3</sub> CHUTE and #

 DIVERSION STRUCTURE (I = water is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUMP

 DEBRIS TORRENT TRACK

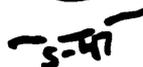
 SPRING

 UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)

 BANK EROSION (EXTENSIVE/SEVERE)

\* 1,2,3 : MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

Falls/Catch # B1 Stream Gumjuwar Date 10/22/04  
 Location: T. \_\_\_ S. \_\_\_ Stream Survey Mile 0.3  
 Size: W 10', H 4', L 5' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_  
 Is pool present below the falls? Yes \_\_\_ No ✓  
 Length \_\_\_', width \_\_\_', depth \_\_\_'  
 Other comments: 3' jump ju. about at  
logjam # J2.

Falls/Catch # B2 Stream Gumjuwar Date 10/22/04  
 Location: T. \_\_\_ S. \_\_\_ Stream Survey Mile 0.5  
 Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_  
 Is pool present below the falls? Yes \_\_\_ No ✓  
 Length \_\_\_', width \_\_\_', depth \_\_\_'  
 Other comments: 4' jump boulder falls. Could  
improve depth of jump pools.

Falls/Catch # B3 Stream Gumjuwar Date 10/22/04  
 Location: T. \_\_\_ S. \_\_\_ Stream Survey Mile 0.7  
 Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient 0% Barrier: Yes \_\_\_ No ✓  
 Is pool present below the falls? Yes \_\_\_ No \_\_\_  
 Length \_\_\_', width \_\_\_', depth \_\_\_'  
 Other comments: Bedrock chutes and slides  
marking probable end of  
anadromous habitat.

Location: T. \_\_\_ S. \_\_\_ Stream Survey Mile 0.  
 Barrier \_\_\_ Partial Barrier ✓ No Barrier \_\_\_  
 Woody Material: L 2' x W 20' x H 2' = Volume 80 cu. ft.  
 Sediment Plains: L 10' x W 15' x D 2' = Volume 300 cu. ft.  
 Washout Potential: Appears Stable ✓ Does Not Appear Stable \_\_\_  
 Comments: Log sill with 4' jump pool  
development. Notch sill and buildup  
jump pool.

Log Jam # J2 Stream Gumjuwar Date 10/22/04  
 Location: T. \_\_\_ S. \_\_\_ Stream Survey Mile 0.3  
 Barrier \_\_\_ Partial Barrier ✓ No Barrier \_\_\_  
 Woody Material: L 20' x W 6' x H 6' = Volume 720 cu. ft.  
 Sediment Plains: L 10' x W 20' x D 6' = Volume 2400 cu. ft.  
 Washout Potential: Appears Stable ✓ Does Not Appear Stable \_\_\_  
 Comments: 3' jump about 20 feet behind  
3' jump boulder fall. (B1).

Log Jam # \_\_\_ Stream \_\_\_ Date \_\_\_  
 Location: T. \_\_\_ S. \_\_\_ Stream Survey Mile \_\_\_  
 Barrier \_\_\_ Partial Barrier \_\_\_ No Barrier \_\_\_  
 Woody Material: L \_\_\_' x W \_\_\_' x H \_\_\_' = Volume \_\_\_ cu. ft.  
 Sediment Plains: L \_\_\_' x W \_\_\_' x D \_\_\_' = Volume \_\_\_ cu. ft.  
 Washout Potential: Appears Stable \_\_\_ Does Not Appear Stable \_\_\_  
 Comments: \_\_\_

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BEAR SPRINGS RANGER DISTRICT

Clear Creek

Frog Creek

Barlow Creek

Buck Creek

Bonney/Red Creek

Iron Creek

Alpine Creek

McCubbins Creek

White River

CLEAR CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: Jeff Uebel county: Wasco  
Tom Cain  
David Wiswar Mouth Location:  
T.5S., R.10E., Sec. 11

Dates Surveyed: July 20, 27-28, 1983  
August 2-3, 1983 Watershed Area: 23,000 acres  
36 sq. miles

Tributary to: White River Stream Length: 11.8 miles

Drainage: Deschutes Distance Surveyed:  
7.8 miles mainstem  
1.5 miles Camas Creek  
1.5 miles Clear Lake Tribs.

TRI Compartments: Clear 2202  
Duke 2106  
Bearpaw 2105  
Camas 2103 Average Low Flow Width: 14 ft.

Game Fish: Rainbow Trout Stream Order: V  
Brook Trout

Potential Anadromous Species: Chinook  
Coho  
Steelhead  
Sockeye

Average Fish Habitat Condition Rating: 7.9 (Good)

Average Riparian Condition Rating: 8.6 (Very High)

## CLEAR CREEK

### Survey Summary

#### A. Stream Summary

Clear Creek is a major tributary of White River, contributing approximately 25 percent of the flow (20 cfs) at their confluence (RM 29.9 of White River). Two dams are located on the mainstem; a diversion dam at RM 7.8 which diverts over 95 percent of Clear Creek's flow (25 cfs), and Clear Lake Dam (RM 11.8) which has created a 557 acre impoundment used primarily for streamflow regulation. The reservoir receives heavy recreation usage. On August 3, 1983, the discharge at this dam measured 27 cfs.

The drainage area is 23,000 acres, with 80 percent located on National Forest Systems Land and 20 percent (RM 8.3-9.8) on the Warm Springs Indian Reservation (Godbout-Uebel, 1982).

Forest Service Roads S42, S2130, and U.S. Highway 26 cross Clear Creek at RM 11.3, 4.4, and 6.9 respectively. Keeps Mill and Clear Creek Campgrounds are located at RM 0.0 and 3.5 respectively.

A total of 11.0 miles were surveyed July 20, 27-28, 1983, and August 2-3, 1983. This included 7.8 miles of Clear Creek (RM 0.0-3.0, and 7.0-11.8) and 3.0 miles of tributaries, excluding Frog Creek (see Frog Creek Survey). The area between RM 3.0 and 7.0 was surveyed in July, 1982, by Godbout and Uebel. Their data has been incorporated into this report under Reach II. A copy of the 1982 survey is included as Addendum 1 of this report.

B. Watershed Characteristics and Geomorphology

The valley configuration of Clear Creek is generally a shallow "U" shape. Side slopes are gentle (0-30 percent), except for the first reach which is a flat bottom "V-shaped" gorge with moderate to steep side slopes (50-70 percent) composed of rock cliffs and talus slopes. The stream gradient gradually decreases from 4-5 percent in the gorge at the mouth to 1-2 percent at RM 11.8. Floodplain width is variable ranging from 100 to 200 feet. The stream has very well regulated flows. This is apparently the result of the two dams and the extensive wetland development throughout, particularly in Reach III. Due to the well regulated flows, the stream appears to have a low sediment flushing capacity. Tributaries are typically small with only two major tributaries, canas and Frog Creek, adding a combined total of 8 cfs to Clear Creek.

c. Reach Descriptions

Three reaches were identified. These are distinguished primarily by gradient and substrate composition: Reach I is 4 percent and predominantly boulder substrate, Reach II is 3 percent and gravel/rubble, while Reach III is 2 percent and small gravel and sand. Reach I and II, representing over 65 percent of the stream area, are riffle dominated while Reach III is pool dominated (70 percent).

D. Fisheries

The overall fish habitat rating is 7.9 (good). Moderate numbers of rainbow and brook trout were observed from the mouth to RM 11.8. The habitat appears potentially suitable throughout for chinook, coho, and steelhead trout. Very good spawning and rearing habitat for sockeye salmon are also present in Clear Lake and its tributaries. Stream rearing area is good in the typically high quality pools. The amount of pool area is comparatively limited, however, in the first two reaches. The amount and quality of spawning habitat is limited on much of the stream (Reaches I and III). Spawning habitat, however, is excellent in Reach II. More than 1,700 square yards of gravel (90 percent of the stream total) were found in this reach. Excessive water temperatures could limit fish production in Reach III. Temperatures were measured as high as **65°F**. This is of particular interest given the generally cool, damp summer of 1983. Fish passage is blocked in Reaches I and II by three logjams, and by the dams located at RM 7.8 and 11.8.

E. Riparian Area

The overall Riparian Condition Rating (RCR) is very high, (8.6). There is high riparian diversity in terms of species composition, balance, structural units, and special habitats (wetlands, snag patches, talus slopes, and rock cliffs). A sensitive plant species, Lycopodium annotinum, was observed in the drainage. Signs of heavy wildlife usage including beaver, elk, and deer were seen all along the stream. An osprey and several great blue herons were also sited on the stream near the reservoir.

F. Rehabilitation and Enhancement

High priority rehab/enhancement opportunities include passage enhancement at the barrier logjams (RM 1.4, 1.8, and 2.4) and the diversion dam (RM 7.8). Increasing pool rearing area in Reaches I and II, and spawning habitat improvement in Reaches I and III, are lower priority possibilities.

H. Special Interest

Special interest areas include the diversion and Clear Lake dams, the population of a sensitive plant species, remains of an old flume which apparently connected the Clear Creek ditch to the Frog Creek ditch (RM 7.5), Keeps Mill site and artifacts, and Camas Prairie at the headwaters of Camas Creek.

## CLEAR CREEK

### Reach Summary

#### Reach I; RM 0.0 - 1.5:

1. The valley configuration is a deep (400 ft.), flat-bottom "V" gorge with an average floodplain width of 90 feet.
2. The gradient averages 4 percent.
3. The substrate is boulder dominated (80 percent).
4. The stream area is primarily riffle (70 percent).
5. Stream shading is low (30 percent).
6. Channel structure is provided by boulders.

#### Reach II: RM 1.5 - 7.8:

1. The valley configuration widens to a broad, shallow "U" shape and the average floodplain width increases to 160 feet.

2. The gradient decreases to 3 percent.
3. The riffle substrate size class decreases with gravel/rubble materials predominant (65 percent).
4. Pool area increases, but the stream remains riffle dominated (60 percent).
5. Shading increases to 60 percent.
6. LWD plays a major role in pool and spawning habitat development.

Reach III; RM 7.8 - 11.8:

1. The valley configuration and floodplain width are similar to Reach II.
2. The gradient decreases to 2 percent.
3. The riffle substrate size class decreases with 90 percent of the materials having diameters less than 6 inches.
4. Pool area increases to 70 percent of the stream area.
5. Shading is the same as Reach II.
6. Essentially all channel structure is provided by LWD.

Camas Creek: RM 0.0-1.5

1. The valley configuration ranges from a V-notch with a 20 foot wide floodplain (RM 0.0-0.2) to a broad U-shape with a floodplain width of 1,000+ feet in Camas Prairie (RM 1.2+). The transitional area (RM 0.2-1.2) is a flat-bottom V with an average floodplain width of 40 feet.
2. A very high gradient section (20-35 percent) is present from the mouth to RM 0.2. The gradient gradually lowers to 4 percent by RM 0.5. The gradient continues to decrease to very low (1 percent) in Camas Prairie.
3. The riffle substrate decreases in size from predominantly boulder (RM 0.0-0.2) to gravel/rubble (RM 0.2-1.2). The substrate in Camas Prairie is a fine clay sediment.
4. The stream area averages 70 percent riffle from RM 0.0 to 1.2. Within Camas Prairie long pools and glides exist (P:R = 9:1).
5. Shading is high (80-90 percent) from the mouth to RM 1.2. Essentially no overstory exists within Camas Prairie and shading is greatly reduced (5 percent). This apparently results in high water temperatures (76°F)

within the Camas Prairie/meadow complex. Cool groundwater recharge (springs and seeps), as well as increased shading between RM 1.0-1.2 increases flow and reduces the water temperature downstream (**54°F** at RM 1.0).

## CLEAR\_CREEK

### Fish Habitat Summary

The overall fish habitat is rated 7.9 (good). Moderate numbers of rainbow and brook trout were observed throughout the system. Rainbow trout appeared more numerous in the riffle dominated Reach I, while brook trout were predominant in the increased pool area of Reaches II and III. Electroshocking at RM 8.5 in 1982 showed a species composition of 75 percent brook trout and 25 percent rainbow (Cain and Smith, 1982).

Approximately 22 miles of potential anadromous fish habitat are present in the Clear Creek system including 11.8 miles of mainstem, and 10 miles of tributary habitat (see Frog Creek survey). An additional 1.5 miles of lake tributaries and the area of Clear Lake (557 acres) could potentially be utilized by sockeye salmon juveniles. Mainstem habitat appears potentially suitable for chinook, coho, and steelhead production.

A possible thermal problem could occur in Reach III where temperatures were measured as high as **65°F**. This is apparently due to the warm spill from the lake surface. The surface temperature of the lake was **67°F**. Other limiting factors include passage barriers (logjams and a diversion dam), and poor spawning habitat in Reaches I and III.

Camas Creek, a major tributary to Clear Creek (RM 1.2), was surveyed and 1.0 mile of potential anadromous habitat was identified. However, passage into the creek is blocked from RM 0.0-0.2 due to high gradient (20-35 percent) and low flow (2 cfs). As a result, one management option would be to maintain the existing creek resident trout fishery, possibly to be utilized as a control study area to compare the impact of introduced anadromous fish populations on resident trout populations in other streams that are accessible to anadromous species.

Trib. B, RM 7.0, is another major tributary of Clear Creek, contributing 30 percent (1.5 cfs) of the combined flows at their confluence. Habitat quality for resident trout is good in the lower 0.3 miles below the intersection with the Frog Creek Ditch, although low summer water temperatures (**45°**) may limit fish production. Potential habitat quality is fair to good for steelhead and coho in the accessible lower half mile. A culvert crossing (under Highway 26) at RM 0.2 appears passable to all salmonids.

Reach I; RM 0.0 - 1.5:

1. The fish habitat is rated good (HCR = 7.8).
2. Rearing habitat quality is good although the area is riffle dominated (70 percent ). Pools are typically moderate size (17 sq. yds.) with depths averaging 2-3 feet. Effective cover is high and is provided by the large boulder substrate, pool depth, and turbulence. Numerous very high quality

pools appear suitable as potential holding areas for spring chinook and summer steelhead.

3. Spawning habitat is poor. Approximately 60 percent of the 46 sq. yds. of gravels observed were rated marginal quality due to poor channel placement. Ninety-five percent of the gravels are of a size suitable for anadromous utilization (1-6").
4. Logjam J1 is a total passage barrier (RM 1.4).

Reach II; RM 1.5 - 7.8:

1. The habitat condition rating increases to 8.5 (excellent).
2. Pool rearing area increases slightly to 40 percent. Pool size remains moderate (avg. 13 sq. yds.) and average depths decrease to 1-2 feet. Effective cover continues to be high and is provided by LWD, overhanging brush, clinging moss mats, and water turbulence. Excellent rearing habitat is also found in numerous channel braids. Although pool area increases to 60 percent at the upper end of this reach, the pool quality decreases due to diminishing flows closer to the diversion dam at RM 7.8.
3. Spawning habitat is excellent. Over 90 percent (1,714 sq. yds.) of all the gravels counted in the mainstem of Clear Creek (1,858 sq. yds.) occur in this reach. Sixty-five percent of these are rated marginal quality due

to placement in the channel and high sediment loading. Seventy-five percent are of a size class suitable for anadromous species.

4. Two partial passage barriers are created by logjams J2 (RM 1.8) and J3 (RM 2.45). Partial removal of these could enhance passage. The diversion dam at the head of this reach (RM 7.8) is a complete passage barrier.

Reach III: RM 7.8 - 11.8:

1. The habitat is rated 7.1 (good).
2. Pool rearing area is excellent as the P:R increases to 7:3. The average pool size increases to 55 sq. yds. The depth and effective cover are similar to Reach II, and again, excellent rearing area is found in numerous channel braids.
3. Spawning habitat is poor as gravel abundance decreases (98 sq. yds.). Eighty percent of the gravels are marginal and less than 50 percent are of a size suitable for anadromous species. Heavy sedimentation of the gravels was noted.
4. No passage barriers were observed up to Clear Creek Dam (RM 11.8). The dam (50 ft. high) is a total barrier and is the upstream limit of potential mainstem anadromous fish habitat. Sockeye salmon could potentially be reared in Clear Lake. Fair to good spawning and rearing

habitat for both resident and anadromous fish was observed in the lower 0.5 miles of lake tribs. D, E, F. Approximately 200 sq. yards of gravels were observed in the tribs. (especially Trib. D), with 50 percent suitable for anadromous fish and 50 percent of the total of marginal quality.

Camas Creek: RM 0.0 - 1.5:

1. The fish habitat is rated poor to fair quality (HCR=5.0).
2. Pool rearing habitat is poor from the mouth to RM 1.2. The stream is riffle dominated (70 percent) and pools are small (1 sq. yd.) and shallow (12 inches). Moderate to high effective cover is provided by LWD and overhanging vegetation. Within Camas Prairie, pool rearing area is greatly increased (P:R=9:1) but high water temperatures (**76°F**) preclude usage as summer rearing habitat. Water temperatures are **54°F** at RM 1.0.
3. Spawning habitat is poor with gravels distributed in small (1-2 sq. yd.) patches. Only 34 sq. yds. of gravels were observed within the 1.5 mile survey section and 80 percent were rated marginal quality. Sixty percent are of a size class suitable for potential anadromous utilization.

4. High gradient cascades (20-35 percent) from RM 0.0-0.2 restrict upstream fish migration into Camas Creek. To access the 1.0 miles of potential anadromous habitat upstream, major channel modifications (i.e., jump pool development and consolidation of flows) would be needed. Another management option would be to leave the stream as a resident trout fishery.

## CLEAR CREEK

### Riparian Habitat Summary

The overall Riparian Condition Rating (RCR) is 8.6 (very high). Positive factors influencing this score include: the high horizontal and vertical diversity of streamside vegetation, good representation and balance of all the habitat units, the generally wide valley bottom and floodplain, and the presence of numerous special habitat units (wetlands, snag patches, talus slopes, and rock cliffs). A well regulated flow regime exists throughout due in part to two dams and the extensive wetland areas present along much of the stream corridor. A plant species, Lycopodium annotinum, listed as sensitive for the National Forest System of Oregon, was discovered at two sites (RM 9.1 and 9.8).

#### Reach I; RM 0.0 - 1.5:

1. The riparian condition rating is 7.6 (high).
2. The valley configuration is a flat-bottom "V" with a floodplain averaging 90 feet wide.
3. Four habitat units are present: shrub-seedling-sapling, poles, and small and large sawtimber.

4. The overstory is composed of coniferous species predominantly ponderosa pine, white pine, Douglas-fir, larch, and noble fir. Cedar and hemlock are also present. No deciduous species are in the overstory.
5. Special habitat units include talus slopes (70 percent of the length), rock cliffs (40 percent of the length), and small wetlands (10 percent of the length). Small isolated snag patches are also present.
6. A dense deciduous understory occurs along the stream margin.

Reach II; RM 1.5 - 7.8:

1. The riparian habitat condition increases to 9.1 (very high).
2. The valley configuration widens to a "U" shape and the average floodplain width increases to 160 feet.
3. All five habitat units are present.
4. The overstory composition ranges between 4-7 conifer species, adding spruce to the previous list, and one deciduous species (alder).
5. Special habitat units include small and large wetlands, snag patches, seep springs, rock cliffs, and talus slopes.

6. Channel braiding is common throughout.
7. The area of the confluence with Trib. B (RM 7.0-7.3) has particularly diverse habitat types. Braiding is extensive on both mainstem and trib. channels in this area, and a rich blending of "edge" and special habitats are present.

Reach III; RM 7.8 - 11.8:

1. The riparian condition rating remains very high (RCR = 8.6).
2. The valley configuration and floodplain is similar to Reach II.
3. All five habitat units are present.
4. The coniferous overstory composition is similar to Reach II. No deciduous species were seen in the overstory.
5. Small and large wetlands occur throughout. A large meadow occurs between RM 9.6-9.8. Small snag patches and individual snags are present along the entire length. Talus slopes and rock outcrops are present but limited. A muskeg wetland occurs at RM 11.7-11.8.
6. Channel braiding is similar to Reach II.

7. A plant species (Lycopodium annotinum) listed as sensitive on the Forest was seen at RM 9.1 and 9.8.

Camas Creek; RM 0.0 - 1.5:

Riparian diversity is good with a good balance of 4-5 habitat units from the mouth to RM 1.2. Camas Prairie (RM 1.2+) is a large wetland/dry meadow complex which forms the head of Camas Creek. No overstory exists within the meadow. The overstory below Camas Prairie to the mouth is predominantly composed of conifers (Douglas-fir, true fir, and ponderosa pine) with occasional alder. A thick deciduous understory exists in this section especially from RM 0.0-0.2 and 0.5-0.8. Special habitats observed include rock cliffs (RM 0.000.2), talus slopes (RM 0.0-0.3), wetlands (RM 0.5-0.7 and 0.9+), and the dry meadows of Camas Prairie.

CLEAR CREEK

Rehabilitation/EnhancementSummary

Passage Enhancement; RM 1.4, 1.8, 2.5:

Logjams form partial to full migration barriers RM 1.4-2.5. The six miles of mainstem and tributary stream accessible above these obstructions is of exceptionally high quality and presents a habitat range suitable for spring chinook, coho, and summer and winter steelhead. Alteration (partial removal) or bypassing these jams to improve passage would appear to be a high priority if anadromous fish are introduced to the White River basin (especially J1 at RM 1.4). Access is remote in these gorge locations, but it appears that all three projects are relatively small scale and could easily be handled by a crew using hand tools and chainsaws.

Passage Enhancement; RM 7.8, 11.8:

The diversion dam at RM 7.8 is a total barrier (5 ft. high) to fish migration. If natural production of anadromous fish is desired from the four miles of excellent habitat above the diversion, improvement of both upstream and downstream (smolt) passage will be required. This would probably involve screening both inlet and outlet ditchlines at the impoundment, as well as developing a jump pool or weir step-down below the dam. Virtually complete

channel dewatering occurs in low water periods below the dam; increasing flow at this point would improve passage as well as rearing habitat conditions downstream (RM 5.4-7.8). There is road access to the site.

The Clear Lake Dam (RM 11.8) also presents an impassable barrier. Providing fish passage at this site would likely require a high degree of planning and investment, the dam is an earth-fill structure approximately 50 feet high. Heavy equipment access is excellent. There appears to be fair to good potential for developing a self-sustaining sockeye run in the lake if passage were provided. Otherwise, the lake could be used to rear juvenile anadromous fish or be maintained solely as a trout fishery.

Rearing Habitat Enhancement; RM 0.0-1.5, 7.5-7.8:

Pool area and depth in Reach I (RM 0.0-1.5) and RM 7.5-7.8 appear relatively limited. Structural in-channel improvement would be comparatively simple due to the low gradient (1-5 percent) and well regulated flow regimes present. However, extensive wetland development in Reach II, and very limited road access on Reach I will likely preclude heavy equipment in much of these areas. Both rearing and spawning habitat improvement (see below) are relatively low priority.

Spawning Habitat Enhancement; RM 0.0-1.5, 7.8-11.8:

Spawning habitat is quite limited for trout and salmon in Reaches I and III. It appears that spawning habitat improvement in these areas is a comparatively low priority even if anadromous fish were introduced to the system. This is due both to the diversion dam barrier at RM 7.8, as well as the abundance of gravels in Reach II, which are likely sufficient for seeding all available habitat downstream to the mouth with juvenile fish. However, numerous opportunities exist in Reaches I and III for improvement, and these could be coupled with rearing habitat enhancement. Due to low bed load movement, gravels would likely have to be introduced. The presence of wide floodplains and old channel braids in these areas provide opportunities for both off-channel spawning and rearing improvements (most abundant in Reach III.) Due to poor equipment access, much of the work would probably be limited to hand-operated tools.

CLEAR CREEK

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>					<u>POOLS</u>				<u>RIFFLES (%)</u>				
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I(0.0-1.5)	7.8	30	3:7	4	M	17	H	0	80	15	5	0	0	11
11(1.5-7.8)	8.5	60	4:6	3	M	13	H	0	20	30	30	15	5	10
III(7.8.11.8)	7.1	60	7:3	2	M	55	H	0	*	10	20	40	25	11

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq 12"$ , M = 12 - 29", H  $\geq 30"$ )  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq 40\%$ , M = 40-60%, H  $\geq 60\%$ )  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>		
	<u>I</u>	<u>II</u>	<u>III</u>
Rainbow Trout - a	H	H	M
Rainbow Trout - j	L	*	*
Brook Trout - a	M	L	M
Brook Trout - j	*	M	M

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile  
\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

CLEAR CREEK

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0-1.5)	46	20	26
II (1.5-7.8)	1,714	595	1,119
III (7.8-11.8)	<u>98</u>	20	- 78
TOTAL	1,858	635	1,223

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
1.4	Logjam	J1	N	Partial Removal
1.8	Logjam	J2	P	Partial Removal
2.45	<b>Logjam</b>	J3	P	Partial Removal
7.8	Diversion Dam D1		N	Increase flow over dam, develop jump pool, and screen the diversion ditch.
11.8	Clear Lake Dam D2		N	None

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Trout migration barrier only; anadromous fish could pass obstacle.

CLEAR CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (0.0-1.5)	1.4	0.1	3:7	17	2.0	18	26	Logjam blocks
II (1.5-7.8)	-	6.3	4:6	13	2.0	960	274	upstream
III (7.8-11.8)	-	4.0	7:3	55	2.0	39	5	access at RM 1.4.
<u>Tribs.</u>								
<b>B (0.0-0.5)</b>		<b>0.5</b>	<b>5:5</b>	<b>1</b>	<b>1.0</b>	<b>25</b>	<b>0</b>	<b>Small trib. (1 cfs)</b>
<b>D ( " " )</b>		<b>0.5</b>	<b>5:5</b>	<b>2</b>	<b>1.0</b>	<b>30</b>	<b>0</b>	<b>" " "</b>
<b>E ( " " )</b>		<b>0.2</b>	<b>4:6</b>	<b>1</b>	<b>1.0</b>	<b>42</b>	<b>0</b>	<b>" " (Some intermittent flow)</b>
<b>F ( " " )</b>	<u>. </u>	<u>0.3</u>	<b>6:4</b>	<b>1</b>	<b>1.0</b>	<u>14</u>	<u>2</u>	<b>" " "</b>
TOTAL	1.4	11.9				1,128	307	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: . Additional miles of habitat potentially available with complete passage enhancement.  
 P:R.: Ratio of pool length:riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (ft.).  
 Spawning: Number of sq. yds. of gravels observed in the 1".3" and 3"-6" size classes.

CLEAR CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (0.0-1.5)	10	10	10	10	Var	S-M	1-2	2+	T
II (1.5-7.8)	75	85	50	60	Var	S-M	1-2	1-2	M
III (7.8-11.8)	95	100	95	95	Var	S-M	1-2	1-2	L

LEGEND: Total = % of total habitat area dependent on LWD  
 HQ = % of high quality habitat area dependent on LWD  
 OR = angle of orientation to flow; Perp = perpendicular,  
 Var = variable  
 # = number of logs/structure; S = single log, M = multi-log  
 L = average length of logs, expressed in channel widths  
 Dia = diameter of average logs in feet.  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
 SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	q	W	D	
I (0.0-1.5)	17	1.2	1.2	24	23	2	70-120
II (1.5-7.8)	11	.6	1.1	7	14	1.5	120-200
III (7.8-11.8)	18	1.2	1.3	28	25	1.7	120-200

LEGEND: W, w = Stream width (ft)  
 D, d = Stream depth (ft)  
 v = Velocity (feet/second)  
 Q = Average reach flow in cubic feet/second

**CLEAR CREEK**

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (0.0-1.5)	7/20,27/83	24	30	E	63/54	68/54	1500-1900
II (1.5-7.8)	7/12-13/82 7/27-28/83	7	60	E	63/42	82/52	1000-1900
III (7.8-11.8)	7/28/83 8/2-3/83	28	60	E(7.8-9.5) S(9.5-11.8)	68/60	68/65	1100-1745

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>		<u>Streamclass</u>	<u>AQUATIC</u>		
		<u>F.P. (ft.)</u>	<u>Overstory</u>	<u>Con. Dec.</u>		<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>
I(0.0-1.5)	7.6	90	5	0	I	25	S	3
11(1.5-7.8)	9.1	160	5	1	I	40	S-L	3
111(7.8-11.8)	8.6	150	5	0	I	95	S-L	2

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: Habitat Units (High  $\geq 4$ ; Moderate 2-3; Low  $< 1$ )  
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H =  $> 50\%$ ;  
 M = 25-50%, L =  $< 25\%$   
 Size: Size of Wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

XAnderson:paw(WP-PJS-5252N)



Reach I of Clear Creek (RM 0.0 - 1.5) lies in a deep canyon with steep sideslopes of heavy timber interspersed with open talus and bedrock cliffs. localized wetlands and snag patches are well distributed in the riparian area of this reach. The stream area is riffle-dominated (70%) with numerous very high quality pools interspersed.



Jam 33 (RM 2.5) is the uppermost of three small logjams limiting upstream migration to the excellent habitat of Reaches II and III. If anadromous fish are introduced into the white River System, passage enhancement at these jams would be a high priority. Care should be taken to preserve the excellent habitat associated with the jams. Note the high quality riparian habitat development in the background.



View of Camas Creek at RM 1.4, in Camas Prairie. This stream is a tributary to Clear Creek (at RM 1.3). It is not accessible to upstream migrating fish from the mainstem due to the sustained high gradient cascades at its mouth. The stream has fair-good habitat conditions for resident trout. The "prairie" is a large wetland complex (200 acres) offering excellent wildlife habitat and range forage.



Clear Creek irrigation ditch diversion structure at RM 7.8. About 95% of low flows are diverted at this point (25 cfs), and habitat quality is significantly decreased for two miles downstream by this water withdrawal. The structure is a total barrier to upstream fish migration. Four miles of exceptionally high quality habitat (potentially suited for coho, steelhead and sockeye) lie above this dam. three small logjams present partial to full migration barriers below this point (RM 1.4 - 2.5).



Typical view (RM 11.4) of the extensive, high quality riparian and fish habitat conditions present throughout Reaches II and III on Clear Creek (RM 1.5 to 11.4). Beaver ponds, wetlands, and snag patches are numerous along the stream channel in both reaches. Fish habitat is dominated by glides and oools (70% of the stream area) in Reach III (shown); Reach II is riffle-dominated (70%) and contains 90% of the total spawning gravels observed in the mainstem (1,800 sq. yards).



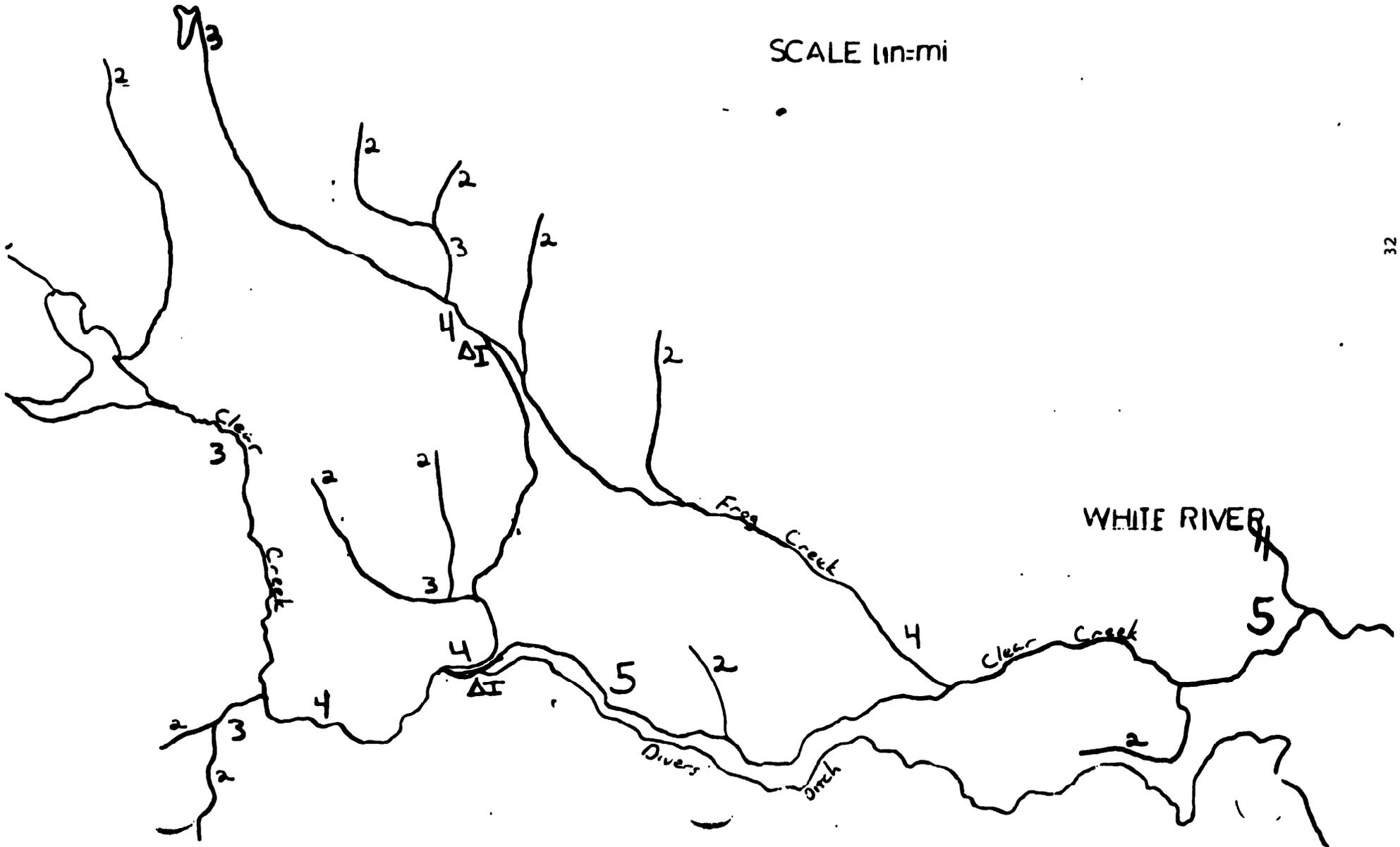
A fifty foot dam at RM 11.8 creates Clear Lake (550 acres) and also presents a complete barrier to upstream fish migration. The lake currently supports resident brook and rainbow trout, and is also stocked with trout by the ODFM in response to heavy recreational fishing pressure on the lake. This impoundment appears suitable for rearing juvenile anadromous fish (chinook coho, steelhead, and sockeye).

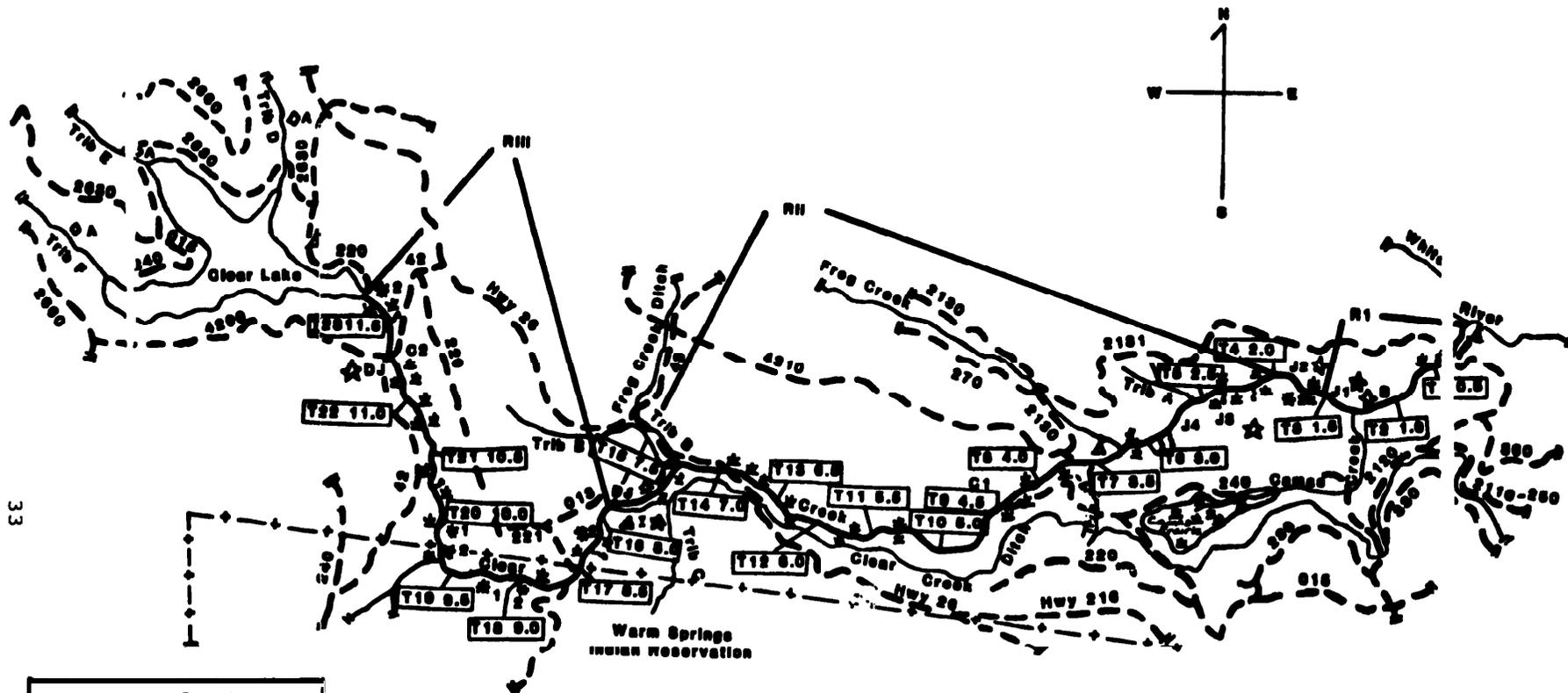


Clear Lake tributary F, at RM 0.2. Fair to good quality habitat conditions for resident trout (and potentially for coho, sockeye, and steelhead) exist on Clear Lake tribs D, E, and F. These streams are heavily utilized at present by brook trout from the lake for spawning and rearing.

# STREAM ORDER 5th CLEAR CREEK

SCALE 1in=mi





33

**Clear Creek  
Survey Map**

Scale: 1 inch: 1 mile

Surveyed by: J. Uebel  
T. Cain  
D. Wisler

7/20, 27-28/83 and  
8/2-3/83

#1 Sensitive Plant  
*Lycopodium annotinum* site

#2 Snag patches

Note: : Transects 7-14 (RMS.0-7.0) were  
completed during the 1982 survey  
of Clear Creek by Uebel and  
Godbout

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
R <sub>I,II,III</sub>	REACH # and SECTION
T <sub>1</sub> 1.0	TRANSECT # and RIVERMILE
★	OBSTRUCTION
★	BARRIER
J <sub>1,2,3</sub>	JAM and #
F( ) <sub>1,2,3</sub>	FALLS, HEIGHT, and #
C <sub>1,2,3</sub>	CULVERT and #
B <sub>1,2,3</sub>	CHUTE and #
▲	DIVERSION STRUCTURE (I = water is used for irrigation purposes)
✂	MINE or ROCK PIT SITE
— —	BRIDGE
→	LANDSLIDE, SLUMP
~→	DEBRIS TORRENT TRACK
~●	SPRING
◇	UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)
▲▲▲▲	BANK EROSION (EXTENSIVE/SEVERE)
*	1,2,3, :MISCELLANEOUS
⊖	WETLAND HABITAT
—5-47	ROAD AND ID NUMBER
⊖	EARTHFLOW

CLEAR CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: Kevin Godbout, County: Wasco  
Jeff Uebel

Date Surveyed: 7/12-13/82 Mouth Location: TSS, R10E, Sec 11

Tributary to: White River Watershed Area: 36 square miles  
23,000 acres

Drainage: Deschutes Mainstream Length: 12 miles

TRI Compartment:  
Clear, Duke, Bearpaw, Camas  
2206 2106 2105 2103 Distance Surveyed: 4.0 miles

Game Fish: Brook trout Low Flow Width (Average): 18 feet  
(Steelhead)  
(Coho) Stream Order: V

Average Habitat Condition Rating: 8.5, "excellent"

Average Riparian Area Quality Rating: 9.3, "excellent"

Average Stream Stability Score: 9.8, "very stable"

( ) Habitat suitable but major passage work needed for utilization

## CLEAR CREEK

### STREAM SURVEY SUMMARY

Clear Creek is a fifth order tributary to the White River. It appears to contribute more than 10 percent to White River's low flow at their confluence (T.SS., R.10E., Sec. 11). On July 12, 1982, at river mile (RM) 3.5, the flow was estimated at 20 cfs. A total of 4.5 miles were surveyed from RM 3.0 to 7.5, on July 12 and 13.

The majority (80 percent) of the stream lies within National Forest System Lands on the Bear Springs Ranger District. Approximately 20 percent of the drainage area lies in the Warm Springs Indian Reservation (RM 8.3 to 9.8).

Forest Service roads S-42 and S-401, and Highway 26 cross the creek at RM 11.3, 4.4, and 6.9 respectively. A Forest Service campground (Clear Creek) is located at RM 3.5.

An irrigation diversion is present at RM 7.7. During low flow periods, the entire stream flow is diverted (Gardner/Uebel, 1978). Other special uses are several range allotments located near the creek in the Camas Prairie area, and a large flood control/recreational use impoundment near the headwaters (Clear Lake).

Clear Creek drains an area of roughly 23,000 acres, or 36 square miles. The drainage pattern is basically pinnate. Frog Creek, a large perennial tributary (RM 3.2), contributes 15 percent of the low flow (3 cfs). One other perennial tributary was observed in the survey area.

Clear Creek flows through a very wide (200 ft.+), U-shaped, flat-bottomed valley at a relatively constant 3 percent gradient. This results in a wide (200 ft.) floodplain.

The entire survey section RM 3.0 to 7.2 is relatively homogeneous, and is identified as a single reach. Typically, this well-regulated stream flows over a gravel/rubble substrate. Overall stream shading is low (50 percent), and moderate numbers of juvenile and adult brook trout were observed.

Exceptions to this reach are found at RM 4.4 - 5.2, and 6.0 - 6.3. At these locations, the gradient increases (5 percent) and the valley width decreases to 70 ft. This results in a decrease in floodplain and true riparian vegetation development. Likewise, fish numbers apparently decrease in these areas as rearing and spawning habitat quality decrease in the small to large boulder substrate.

At present, a large falls at the mouth of White River blocks anadromous fish access to this system. Recent analysis by the Oregon Department of Fish and Wildlife (ODFW) has indicated that the White River system has great potential for salmon and steelhead, and they have established the provision of passage

at the falls as a high priority project. Successful completion of this project would introduce anadromous fish to the Clear Creek drainage.

This drainage (including Frog Creek) possesses interspersions of excellent quality coho salmon and winter steelhead habitat. Judging from past surveys and the results of this survey, Clear Creek could be one of the major fish producing drainages in the White River system, particularly for coho. Old survey notes (Uebel/Gardner 1978) indicate that high quality habitat exists throughout the length of Clear Creek and much of Frog Creek. However, irrigation diversions on each of these streams may complicate anadromous fish management above the dams.

The overall fish habitat condition is "excellent" (HCR is 8.5). Positive factors include: high amounts of effective cover; ample spawning habitat; base flows (averaging 10 - 12 cfs); and moderate numbers of juvenile and brook trout. These factors are primarily responsible for the high rating.

Pool area averages 40 percent of the stream. Pools are generally moderate in area (15-20 sq. yds.) and depth (average 2 ft. deep), and have high effective cover from clinging moss, large woody debris (LWD), boulders, and overhanging brush. Pool size and depth diminish in the lower flows at the upper end (RM 6.0 - 7.2) of the reach.

Spawning habitat is abundant in the surveyed reach, although patchy in distribution. Most of the gravels (95 percent) were found below RM 6.0. Over

60 percent of the 1455 square yards of gravels noted were found in the lower 1.1 miles surveyed. Seventy percent of the total observed were rated marginal because of poor placement in the channel. Seventy percent of the total observed were of a size class suitable only for anadromous fish utilization.

The stream stability is rated as very stable (SSR 9.8). This high rating is due to: the Clear Lake dam and an irrigation diversion contributing to a well-regulated flow regime; high streambank and channel substrate stability (low amount of bank erosion (5 percent), and substrate detachment (10 percent)); and the high degree of channel structure provided by large woody debris, which promotes good pool development.

The true zone of riparian vegetation is wide and dense. The riparian area quality is rated as very high (RQR = 9.3). Major factors contributing to this rating include: the U-shaped valley resulting in wide (120-200') floodplain development; high aquatic habitat diversity consisting of a large continuous streamside wetland area and suitable habitat to support resident and anadromous fisheries; and the very good vegetative structural diversity (provided by a mixed coniferous and deciduous overstory associated with a variety of age and size classes). Additionally, ground cover is high (90 percent).

Wildlife use of the streamside wetlands appears heavy. Deer and elk sign, as well as recent and abandoned beaver activities, were frequently observed. Coyote, bobcat, and porcupine sign were also noted.

Rehab/enhancement opportunities are abundant in this reach. Improving pool area, depth, and also spawning gravel availability in the boulder dominated sections RM 4.4 - 5.2 and 6.0 - 6.3 is the highest priority for enhancement of fish habitat. Streambank stabilization near Clear Creek Campground could be tied to pool enhancement in that area.

Maintenance of streamside vegetation on the south side of this east-west orientated stream may keep water temperature at desirable current levels (50°F). The presence of continuous wetlands from RM 3.0 - 6.5 indicate that management emphasizing streamside buffer zones are appropriate. Protection appears to be a high priority for these wet areas, which likely act as water storage sites, providing well-regulated stream flows and a high diversity of wildlife habitat.

The major limiting watershed factor is the diversion of the entire low flow for Tygh Valley irrigation. This may limit the width and development of the true riparian plant community below the diversion and hinder the production of resident trout through reduction of rearing area. The quality and quantity of fishing experiences available downstream in the high-use recreation areas near Clear Creek campground are likely also affected through the reduced flows.

Frog Creek appears to be similar to Clear Creek in the high quality of aquatic and terrestrial habitats provided. It supports moderate numbers of brook trout. An irrigation diversion at RM 4.7 diverts 100 percent of low flows at that point, tying it into the Clear Creek canal system.

## Reach Summary

### CLEAR CREEK

#### Reach I: RM 3.3 - 7.2:

1. Stream shading is low (50 percent), with an east-west orientation.
2. Gradient is 3 percent.
3. Riffle dominates 60 percent of the stream area.
4. Riffle substrate is dominated by gravel/rubble (65 percent) with diameters averaging 1 inch - 12 inches.
5. The valley configuration is a flat-bottom "U" with floodplains in excess of 200 feet.
6. The zone of riparian vegetation is wide to very wide (120 - +200 feet) and is very diverse, composed of five or more habitat units.

Reach Exceptions: These are discontinuous atypical areas, not considered long enough to be a reach.

RM 4.4 - 5.2, 6.0 - 6.3:

1. Gradient increases to 5 percent.
2. P:R is reduced to 3:7.
3. Riffle substrate composed of large boulders (3 - 6 ft. diameter) and bedrock.
4. The valley configuration is a flat-bottom "V" resulting in decreased floodplain and valley bottom width (less than 100 ft.).

## Fish Habitat Summary

### CLEAR CREEK

#### Reach I: RM 3.3 - 7.2:

1. The habitat condition score is 8.5, "excellent". Moderate numbers of brook trout are found throughout the reach.
2. Spawning habitat is good, but patchy in distribution. RM 3.3 - 4.4 contains over 60 percent of the total 1,455 square yards observed on Clear Creek. Only 5 percent of the total were counted above RM 6.0. Seventy percent of the gravels noted were considered marginal due to poor placement in channel. Seventy percent of the total gravels were of a size class suitable for anadromous fish utilization only.
3. Rearing habitat is good overall. Moderate pool size and depth (average 15 square yards, 12 - 20 inches deep) is enhanced by high effective cover from LWD, boulders, clinging mosses, and overhanging brush. Pool quality is lower at the upper end of the reach, where reduced flow and channel braiding lower pool depth.
4. Good potential coho and winter steelhead habitat is present throughout reach; excellent coho habitat is present RM 3.3 - 4.4.

Frog Creek: RM 0.0 - 0.1:

1. Habitat condition score is 7.5, "good".
2. Spawning and rearing habitat is very similar to Clear Creek, except for the reduced flow of Frog Creek (2 cfs in its main channel at the mouth). Spawning habitat observed translates to 150 square yards/mile.

## CLEAR CREEK

### Riparian Habitat Summary

The riparian area quality is very high (RQR 9.3). This high rating is the result of: the wide to very wide valley bottom width resulting in a well-developed floodplain (120-200+ ft.); a perennial base flow and habitat to support both resident and anadromous salmonids; the presence of high value wildlife wetlands (over 50 percent of the surveyed area); and good vegetative structure and composition consisting of a mixed coniferous (fir, cedar, hemlock) and deciduous (alder) overstory composed of a variety of age/size classes (seedling/sapling, pole, small and large sawtimber). Additionally, ground cover is high (90 percent), and consists of mixed grass/forb, shrub habitat units (sedge, fern, salmon berry, and Oregon grape). This contributes to the wide and dense true zone of riparian vegetation.

The impact of the water diversions reduces the overall score by altering the flows present during low flow or drought years influencing fish and wildlife habitat and wetland area development. Enhancement of the riparian area habitat quality could be accomplished by maintaining canopy openings to promote continued vegetative structural diversity.

## FROG CREEK

The riparian area quality is very high (RQR 9.2). This high rating is the result of: a very wide valley bottom resulting in a well developed floodplain, perennial base flow and habitat to support a resident trout and anadromous fish population; numerous streamside wetlands; and good vegetative structure consisting of a mixed coniferous and deciduous overstory composed of a variety of age/size classes. As in Clear Creek, this stream maintains a wide and dense true zone of riparian vegetation.

## CLEAR CREEK

### Rehabilitation and Enhancement Summary

#### Meadow Stabilization - RM 3.5:

At RM 3.5, in the vicinity of the Clear Creek campground, a channel braid meanders through a meadow area. Heavy recreational use is causing some bank erosion. A planting of streamside vegetation or bank armouring through boulder or LWD placement could increase the bank stability. The opportunity also exists to monitor the impact of the nearby recreation development on this area.

#### Road Closure: RM 6.0 - 6.7:

Upon completion of stream adjacent timber sale activity, the closure of several roads (RM 6.0 - 6.7) may be advisable. Planting of trees and construction of barriers may be options. This could serve to reduce harassment in high valuable riparian and wildlife production areas.

#### Spawning Enhancement: RM 4.4 - 7.2:

Spawning habitat deteriorates markedly above RM 4.4. The highest priority areas for enhancement are the boulder dominated sections RM 4.4 - 5.2 and 6.0 - 6.3, which contain virtually no spawning habitat. These areas could

be improved by using V-shape boulder berms for catchments. The gravel/rubble substrate predominant RM 6.3 - 7.2 is not suitable for spawning. Log K-dams, boulder berms, or gabion sills could be used as catchments for gravels in this area. Due to the flow regulation and low gradient in the reach of Clear Creek, bedload movement may not be adequate to seed in structures with gravel, gravels may have to be hauled in. Stream access is poor-fair for heavy equipment, either off of Highway 26 or old logging spurs on the north bank.

Rearing Enhancement: RM 3.3 - 7.2:

Pool area and depth are low in many areas through this reach. In particular, the boulder reaches RM 4.4 - 5.2 and 6.0 - 6.3 lack good rearing area. Boulder berms (see spawning enhancement, above) could raise existing pool levels and promote pool scour for larger, deeper pools on the downstream side. RM 3.3 - 3.6 lacks structure, and large log or gabion sills, or boulder berms, could increase pool area from the existing P:R ratio of 2:8. Creation of one or more large deep pools adjacent to the campground (RM 3.5) could enhance fish production and recreational opportunities.

Braided channels and low flow contributed to small shallow pools RM 5.5 - 5.7 and 6.3 - 7.2. Cutting notches in natural sill logs to consolidate flows and promote scour, as well as the installation of K-dams (see spawning enhancement, above), could improve pool quality in these areas.

## CLEAR CREEK

### Stream Stability Summary

The stream is very stable. The stream stability rating (SSR) is 9.8. Major factors which contribute to this rating include: the well-regulated flow regime due to the Clear Lake dam, and Tygh Valley irrigation diversion; streambanks which are well-vegetated (90 percent) and contain a moderate amount of bank rock with diameters greater than 1 foot resulting in little (5 percent) streambank erosion, low channel substrate detachment (10 percent) due to a lack of channel scour promoting high substrate stability; and a high amount of channel structure due to large woody debris creating long and deep pools throughout the reach.

Stream channel structure and the basic elements of fish habitat are heavily dependent on LWD. Over 40 percent of the stream area consists of long pools. The majority of these high quality pools are associated with large woody debris. Most of this debris is of a local origin due to the well-regulated flow regime. The transportation capacity of this stream is low. Likewise, its capacity to adjust and recover from potential changes in flow and/or sediment production may be limited.

## FROG CREEK

Frog Creek appears to be very stable (SSR 8.5). Factors which contribute to this rating include: a well-regulated flow regime; stable streambanks; high substrate stability; and good channel structure. Like Clear Creek, this stream appears to be dependent on LWD for fish habitat and stream stability.

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>					<u>POOLS</u>				<u>RIFFLES (%)</u>				
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I (3.3-7.2)	8.5	55	4:6	3	M	16	H	0	15	30	35	15	5	0.8
Frog Creek (0.0-0.1)	7.5	80	6:4	3	M	2	H	0	20	30	20	15	15	0.3

LEGEND: HCR = Habitat Condition Rating  
 S = Percent of stream shaded  
 P:R = Ratio of pool length:riffle length  
 G: = Average gradient (%)  
 d: = Average maximum depth (L  $\leq$ 12", M = 12-29", H  $\geq$ 30")  
 A: = Average pool area (square yards)  
 EC: = Effective cover (L  $\leq$ 40%, M = 40-60 percent, H  $>$ 60%)  
 BR: = Bedrock  
 SD = Sand  
 D = Average depth (feet)  
 \* = Present, but less than 5 percent

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u> I	<u>TRIBUTARIES</u> Frog Creek
Brook trout - a	L	L
Brook trout - j (Steelhead) (Coho)	M	M

LEGEND: L = Low (0-5), M = Moderate (6-50), H = High (50+)  
 a = Adult, j = Juvenile  
 \* = Habitat suitable; presence reported but not observed  
 ( ) = Habitat suitable; but major passage work needed for utilization

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.N.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (3.3-7.2.)	1,440	455	985
Frog Creek (0.0-0.1)	<u>15</u>	<u>5</u>	<u>10</u>
TOTAL	1,445	460	995

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
			None observed	

LEGEND: F = Full passage  
 P = Partial passage  
 N = No passage

\*Trout migration barrier only; anadromous fish could pass obstacle

TABLE V - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (3.3-7.2)	80	90	50	70	Perp	S+M	1-2	1-2	M
Frog Creek (0.1)	50	70	50	*	Perp	M	1-2	1	L

LEGEND:

Total = Percent of total habitat area dependent on LWD

HQ = Percent of high quality habitat area dependent on LWD

OR = Angle of orientation to flow (Perp = Perpendicular, Var = Variable)

# = Number of logs/structure (S = Single log, M = Multi-log)

L = Average length of logs, expressed in channel widths

Dia = Diameter of average in feet

Source: L = Local  
T = Transported  
M = Mixture of local and transported

\* = None observed

TABLE VI - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	w	d	v	q	W	D	
I (3.0-7.5)	8	0.5	1	4	10	1.5	200+

LEGEND:

W,w = Stream width (feet)

D,d = Stream depth (feet)

V = Velocity (feet/second)

Q = Average reach flow in cubic feet/second

TABLE VII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u> A/W	A/W	
I (3.0-7.5)	7/12	20	50	East	74/49		1000-1400
Frog Creek	7/12	3	80	South			

TABLE VIII - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>				<u>AQUATIC</u>		
			<u>E.P.</u> <u>(ft.)</u>	<u>H.U.</u>	<u>Understory</u> <u>G.C.%</u>	<u>Overstory</u> <u>Con. Dec.</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>
I (3.0-7.5)	9.3	200+	H	H	3	1	I	M	S-L
Frog Creek	9.2	200+	H	H	3	2	I	M	S-L

LEGEND:

- RCR = Riparian Condition Rating
- F.P. = Floodplain
- H.U. = Habitat units (H  $\geq$ 5, M = 3-5, L  $\leq$ 3)
- G.C. = Ground cover percentage
- Con. = Number of conifer species
- Dec. = Number of deciduous species
- Wetland = Streamlength with adjacent wetlands (H  $\geq$ 50%, M = 25-50 %, L  $\leq$ 25%)
- Size = Size of Wetlands
  - S = Small (Less than 1 acre)
  - L = Large (Greater than 1 acre)

TABLE IX - STREAM STABILITY SUMMARY

REACH (R.M.)	SSR	FLOW REGIME			STREAM BANKS			CHANNEL SUBSTRATE			
		Ratio MF:LF	LWD Ornt	LAT CUT	ER	RC	VEG	DTCH	TONE	IMBRC	VEG
I (3.0-7.5)	9.8	1:1	R	L	L	L	H	L	MD	H	YRP
Frog Creek	8.5	1:1	R	L	L	L	H	L	MD	M	YRP

**LEGEND:**

SSR = Stream stability rating

Ratio MF:LF = Ratio between mean annual flow width and the seasonal low flow width

LWD ORNT = Large woody debris orientation (ll parallel:R Random)

LAT CUT = Lateral cuttin (H >80%, M = 20-80%, L <20%)

ER = Bank erosion (H >50%, M = 20-50%, L <20%)

RC = Rock content (Diameter 1 ft.) (H >65%, M = 30-65%, L <30%)

VEG = Vegetative cover (Ground cover & root matrix)  
(H >80%, M = 50-80%, L <50%)

DTCH = Percent detached (H >50%, M 20-50%, L <20%)

TONE = B-(Bright), MB-(Moderately bright), MD-(moderately dull), D-(Dull)

IMBRC = Imbrication (degree of substrate packing)  
(Low = two size classes or less, Moderate = three to five size classes, High = five size classes)

VEG = Vegetation (Y=Yes, N=No, R=Riffles, P=Pools)

\*Data on channel structure not included due to modification of data collection & evaluation procedures

KAnderson:paw (WP-PJS-5262N)



The basic elements of fish habitat and channel structure are heavily dependent upon large woody debris. Pool development is high as 40% of the stream area is in pools. They average 15-20 sq. yds. in depth and 2 ft. deep in areas.



At R.M. 4.2 and throughout the survey, the true zone of riparian vegetation is well developed (RCR 9.3). The valley bottom width (200 ft.), numerous wetland areas, a mixed deciduous/coniferous and second growth overstory, and a high groundcover factor (90%) contribute to the high score.



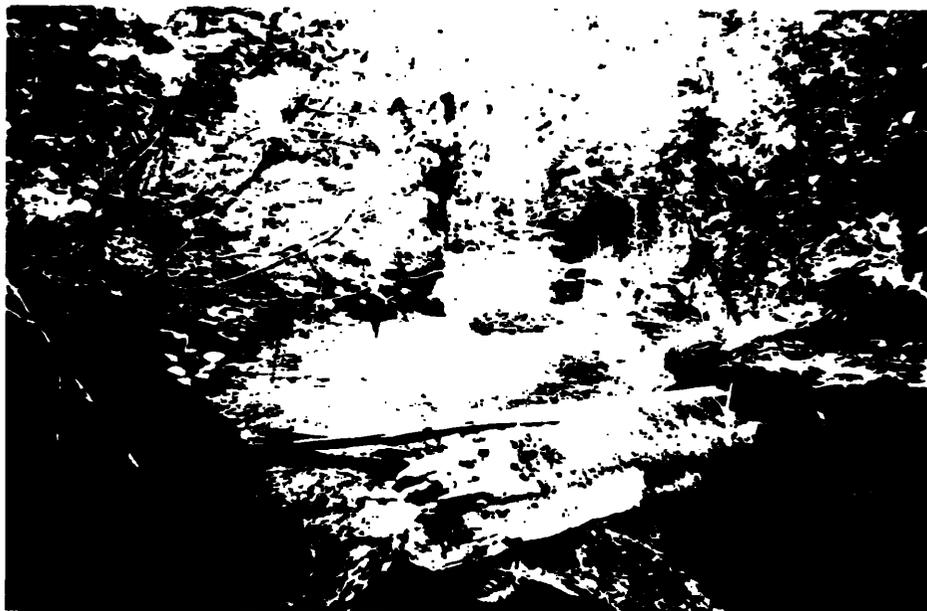
This pool at R.M. 5.95 is suitable for rearing coho salmon. This drainage possesses excellent quality coho salmon and winter steelhead habitat and could be the major producing drainage in the White River system should passage over the White River Falls be established.



Recent beaver activity is present at R.M. 3.7. Yildlife use of the stream appears heavy as deer, elk, coyote, and bobcat signs were noted.



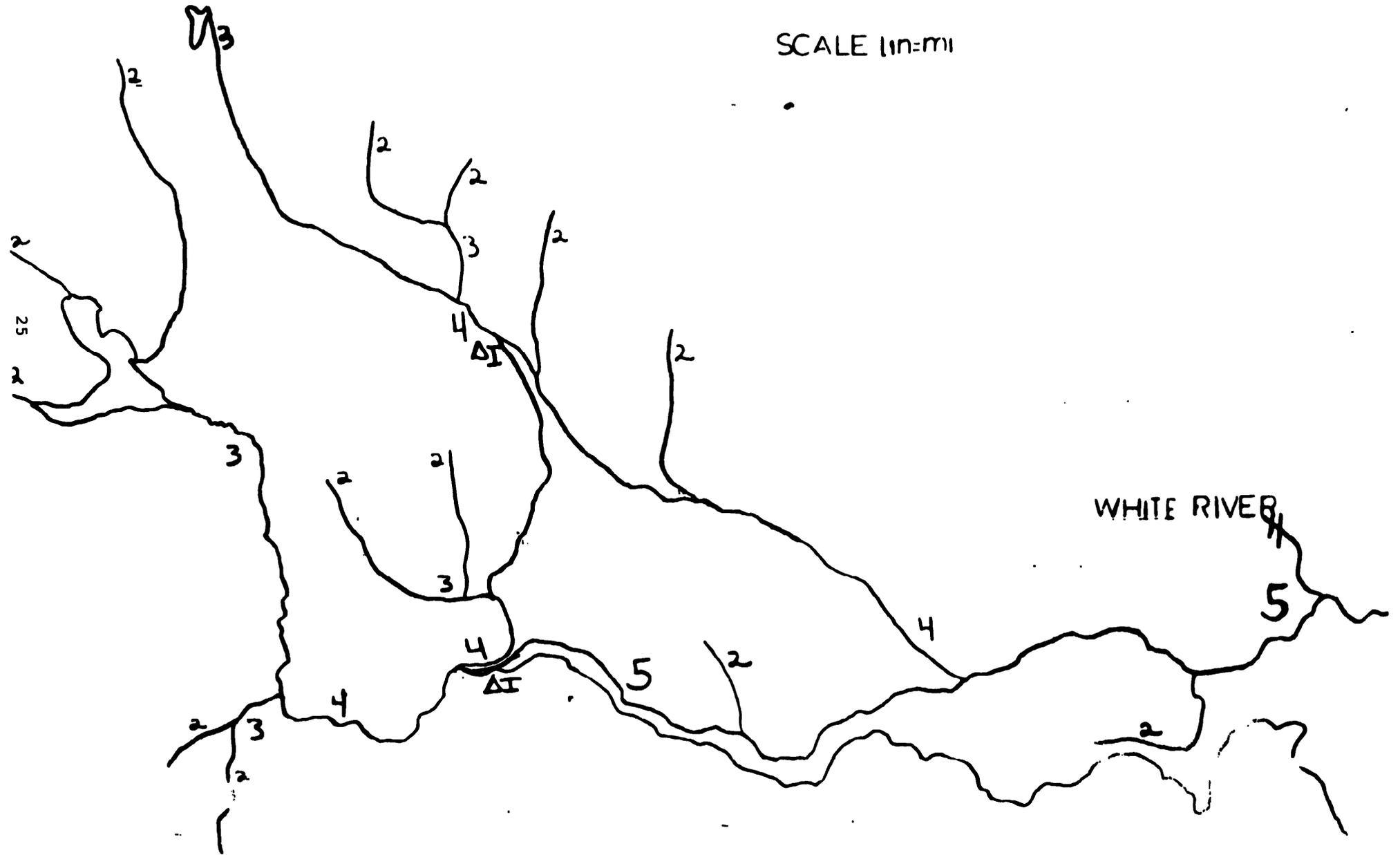
At R.M 3.2, Frog Creek enters the main stem. It is similar to Clear Creek in the high quality of the aquatic and terrestrial habitat present. The limiting factor on both these systems appears to be the diversion of low flows for Tygh Valley irrigation.



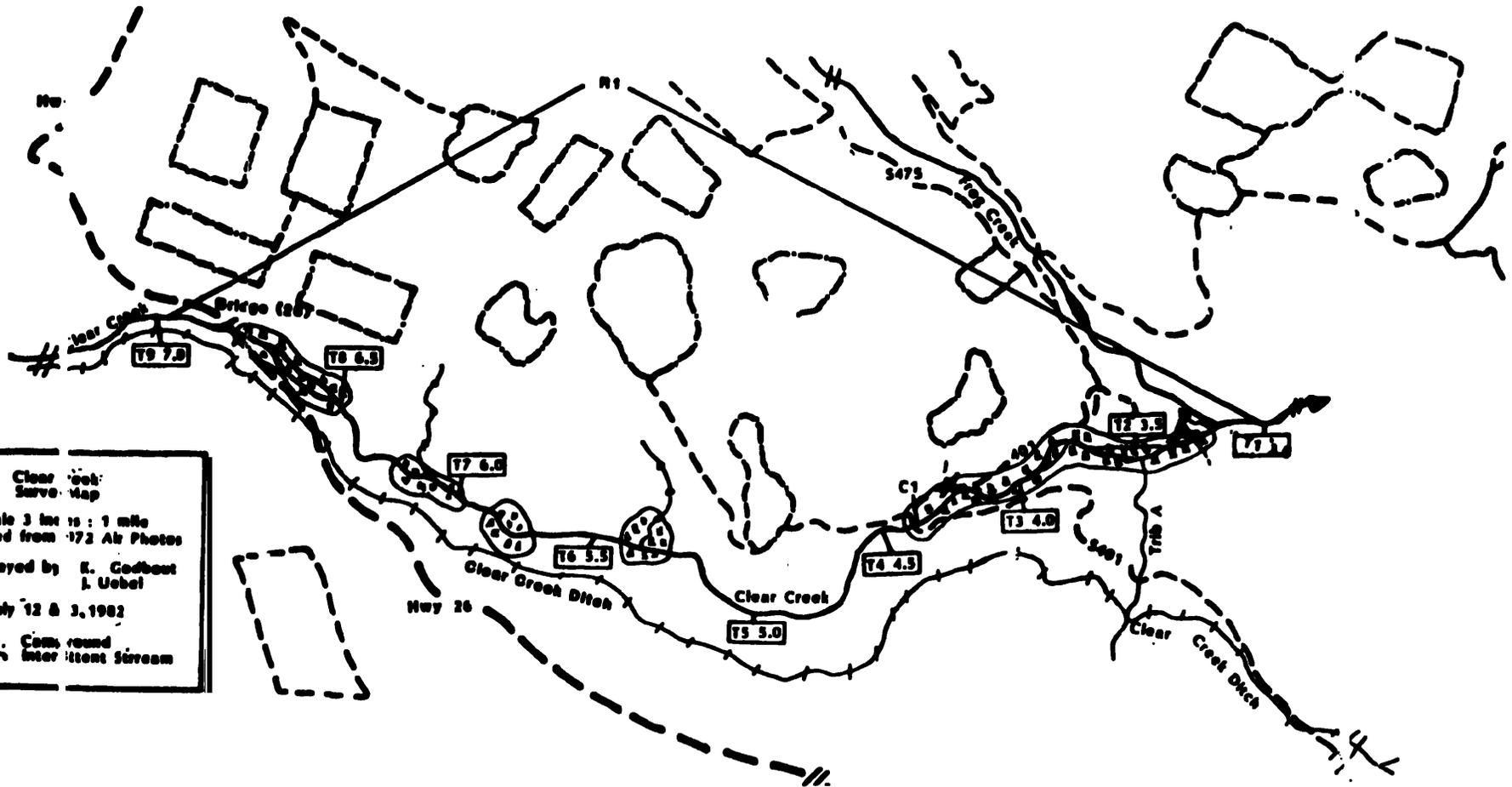
This site at R.M. 4.8 shows the atypical reach area found on 20% of the survey RM 4.4-5.2 and 6.0-6.3. An increase in gradient (5%), boulder substrate, and decreased riparian diversity and fish habitat are characteristic of this area.

# STREAM ORDER 5th CLEAR CREEK

SCALE 1in=mi



Clear Creek  
 Serv. Map  
 Scale 3 in : 1 mile  
 Mapped from 172 Air Photos  
 Surveyed by E. Godbout  
 J. Uebel  
 July 12 & 3, 1962  
 Camp round  
 Interm. Stream



FROG CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar County: Wasco  
Doug Kinzey  
Mouth Location:  
TSS., R10E, Sec. 8

Dates Surveyed: July 20-21 and 26-28, 1983

Tributary to: Clear Creek  
Watershed Area:  
8,107 Acres  
12.7 Sq. Mi.

Drainage: Deschutes

TRI Compartments: Stream Length: 8.5 Miles  
Frog 2205  
Bearpaw 2105 Distance Surveyed:  
Camas 2103 Mainstem; 8.5 Miles  
Tributary A; 0.2 Miles  
Tributary B; 0.8 Miles

Game Fish: Rainbow trout Low Flow Width (Avg): 6 Feet  
Brook trout

Potential Anadromous Species: Stream Order: III  
Coho Salmon  
Steelhead Trout

Average Fish Habitat Condition Rating: 6.7 (Fair-Good)

Average Riparian Condition Rating: 5.7 (Moderate)

## FROG CREEK

### Survey Summary

#### A. Stream Summary

Frog Creek is a third order tributary of Clear Creek providing approximately one-third of the low flow (7 cfs) at their confluence. Frog Lake is located at the north end of the drainage; flow from the outlet of the lake (RM 8.5) to RM 7.8 is intermittent. A diversion structure at RM 4.6 channels about 95 percent of low flows (12 cfs) into the Frog Creek Ditch. This flow reduction affects fish habitat and riparian development for over a mile downstream. Low flow increases to 6 cfs by RM 3.0, due to groundwater feeding. Forest Service Road 2130 and associated spurs 260 and 270 provide access to the lower 2.5 miles of stream. Forest Service Road 43 crosses the creek at RM 3.5 and spurs 4320 and 2610 parallel the stream above that point. Frog Lake Campground lies adjacent to the lake and to U.S. Highway 26. Resident trout were observed from the stream mouth to RM 7.5.

#### B. Watershed Characteristics and Geomorphology

Frog Creek has a well-regulated flow regime and drains a broad, shallow, flat-bottom V shaped valley. Valley side slopes are of gentle (<30 percent) to moderate (50 percent) gradients. Floodplain widths are

variable, ranging from 30 feet to greater than 200 feet. Stream gradient is low, remaining two percent throughout its length. There are two major tributaries in the system. Tributary A, entering at RM 2.75 provides 1 cfs at low flows. Tributary B contributes 1/2 of low flows (5 cfs) of Frog Creek at RM 5.1. The stream heads in a meadow area (RM 7.3-7.8). Flow from the lake to the meadow is intermittent. The flow regime below the diversion structure at RM 4.6 is very well regulated. The stream's ability to flush itself of sand and silt is poor. Moss covered hummocks have developed where sediment deposition has occurred. These hummocks have been further stabilized by the dense thickets of tag alder.

c. Reach Descriptions

Four reaches were identified along the mainstem and one for Tributary B. Differences are subtle and based primarily on substrate composition, amounts of silt deposition, and flow. Channel braiding was common to all reaches.

D. Fisheries

The overall rating of the fisheries habitat is fair to good (6.7 HCR). Pools are dominant in all reaches, with pool-to-riffle ratios between 6:4 and 7:3. On 85 percent of the survey, pools are 2 to 4 square yards with shallow depth (<12") and high effective cover provided by overhanging brush, aquatic vegetation, and instream woody debris. Spawning gravels

total 1070 square yards with 65 percent suitable for utilization by resident trout and 35 percent potentially suitable for anadromous salmonids. Spawning gravel concentration is highest in Reach I (45 percent), where gravel beds range from 1 to 5 square yards in area (see Table III). Spawning beds in other reaches are generally less than one square yard. Very high sediment loading and moss growth on gravels greatly reduce available spawning habitat in Reach II, below the diversion. The influence of large woody debris (LWD) is extremely high in the Frog Creek system. Ninety-five percent of the pool formation and gravel retention appears dependent on incorporated LWD.

Fish habitat appears potentially well suited for coho salmon and steelhead production. Migration obstructions include a diversion structure (RM 4.6) and 3 culverts on the mainstem (RM 0.8, 3.6 and 6.8) and a log ford stream crossing on Tributary B. The diversion structure blocks access to 4.0 miles of stream.

The Oregon Department of Fish and Wildlife stocks Frog Lake with rainbow trout annually (6,000 legal-size trout in 1982). Resident trout stocks are reported to be brook and rainbow species.

#### E. Riparian Area

The riparian habitat is rated moderate (5.7 RCR). Positive factors influencing the rating are high number of habitat units (4-51, a large

meadow in the upper reach, a generally wide floodplain and high levels of bank and channel stability. Negative factors include the lack of deciduous tree species, low coniferous species diversity, and flow reduction due to an irrigation diversion.

F. Rehabilitation and Enhancement

Rehabilitation and enhancement opportunities should likely center on improving passage conditions at the diversion structure and culverts, increasing spawning habitat in the upper reaches of the mainstem, and increasing riparian habitat diversity.

## FROG CREEK

### Reach Summary

#### Reach I; RM 0.0 - 1.7:

1. Valley configuration narrows from a very wide (greater than 200 feet) flat-bottom V-shaped valley at the confluence with Clear Creek to a narrow (60 feet) flat-bottom V-shaped valley by the upper end of the reach. Channel braiding is common.
2. Gradient is low (2 percent).
3. Substrate is primarily sand and gravel (75 percent).
4. Pools dominate the stream area (P:R = 7:3).
5. Stream shading is high (90 percent).

#### Reach II; RM 1.7 - 4.6:

1. Valley configuration continues to be a flat-bottom V, with a floodplain width increasing from narrow (50 feet) at the lower end to very wide (greater than 200 feet) at the upper end of the reach. Stream braiding across the full width of the floodplain is common.

2. Gradient continues to be low (2 percent).
3. Substrate size decreases and is heavily dominated by the gravel-sand size classes (95 percent).
4. Pool-to-riffle ratio decreases slightly (P:R = 6:4).
5. Stream shading continues to be high (90 percent).

Reach III; RM 4.6 - 6.7:

1. The valley configuration continues to be a flat-bottom V, with a floodplain width ranging between 30 feet to greater than 200 feet.
2. Gradient remains low (2 percent).
3. Substrate size classes continue to decrease. Nearly 100 percent are below 6 inches in diameter.
4. Pool-to-riffle ratio shows a slight increase (P:R = 7:3).
5. Stream shading continues to be high (90 percent).

Reach IV; RM 6.7 - 7.8:

1. Floodplain width continues to fluctuate between 30 and greater than 200 feet.
2. Gradient remains low (2 percent).
3. The dominant substrate size class is gravel (40 percent).
4. Pool-to-riffle ratio remains 7:3.
5. Stream shading decreases to 75 percent.

Tributary A; RM.0.0 - 0.2:

1. Valley configuration is narrow (floodplain 60 feet) with gentle (less than 30 percent) sideslopes.
2. Gradient is low (2 percent).
3. Substrate is rubble dominated (80 percent).
4. Pools cover half the stream area (P:R = 5:5).
5. Stream shading is 100 percent.

Tributary B; RM 0.0 - 0.8:

1. Valley configuration is a flat-bottom V with a moderately wide (80 feet) floodplain.
2. Gradient is low (3 percent).
3. Substrates are gravel dominated (70 percent).
4. Pools dominate the stream area (P:R = 6:4).
5. Stream shading is high (80 percent).

## EROG CREEK

### Fish Habitat Summary

#### Reach I; RM 0.0 - 1.7:

1. The fish habitat quality is rated good (HCR = 7.5).
2. A total of 496 square yards of spawning gravels were counted in this reach, 307 of which are good quality. Approximately 60 percent (298 square yards) of the total gravels are in the 0.5 to 1.0 inch size class, with the remaining 40 percent (198 yards) in the 1.5 to 3 inch size class. LWD influences retention of 80 percent of the total gravels and 90 percent of those considered high quality. Spawning beds of five square yards in size are common.
3. Rearing habitat is fair in this reach, which is dominated (P:R = 6:4) by shallow (generally less than 12 inches deep) pools with moderate to high effective cover. Pool size averages four square yards. Eighty percent are dependent on large woody debris.
4. A single partial barrier to fish migration in this reach is the Forest Service Road 2130 culvert at RM 0.8. It is 40 feet long with a 4.5 percent gradient. Velocity at the time surveyed (low-flow) was 5 feet/second.

Reach II; RM 1.7 - 4.6:

1. The fish habitat quality increases somewhat, remaining good (HCR = 6.7). Flow is greatly reduced from RM 3.0-4.6 due to the irrigation diversion.
2. An important factor contributing to the lower HCR is a decrease in spawning habitat. Two-hundred and twenty square yards were counted, 125 good and 95 marginal; 90 percent are in the 0.5 to 1 inch size class. Ninety percent are dependent on LWD. The substrate in this reach is predominantly gravel (75 percent); extremely high sediment loading and moss growth on the gravels (due to flow reduction from the diversion) prevents them from being utilized as spawning habitat.
3. Rearing habitat is similar to that in Reach I except for a slight decrease in pool size (average size is 3 square yards).
4. A partial high flow barrier to fish migration is the Forest Service Road 43 culvert at RM 3.5. The structure is 90 feet long. Stream velocity through it was measured at 2 ft./sec, (low flow).

Reach III: RM 4.6 - 6.7:

1. The fish habitat remains good (HCR = 6.9).

2. Spawning habitat remains moderate in quality, with a total of 138 square yards counted. Ninety percent are in the 0.5 to 1 inch size class. LWD remains important in 90 percent of gravel retention.
3. Rearing habitat remains fair, with abundant shallow pools (12 inches deep, P:R = 7:3) and high effective cover.
4. The Frog Creek Ditch diversion at the lower end of this reach (RM 4.6) is a complete barrier to anadromous migration. A 10 foot long concrete chute below the structure carries only a trickle of water (less than 1-inch deep) during summer flows. No jump pool is provided for jump required to clear this structure.

Reach IV; RM 6.7 - 7.8:

1. The Fish Habitat Condition Rating decreases to fair (HCR = 5.4).
2. Although pools are abundant (P:R = 7:3), rearing habitat is poor to fair. Pools are small (1 square yard) and shallow (<12 inches), with high effective cover. Pool development is completely dependent on LWD.
3. Spawning habitat is good, with 129 square yards of gravel. Seventy percent (93 sq. yd.) favor utilization by trout.
4. No barriers to fish migration were observed.

Tributary A; RM 0.0 - 0.2:

1. The Fish Habitat Condition Rating is fair (HCR = 4.8).
2. Although the pool-to-riffle ratio is excellent (P:R = 5:5), shallow pool depths (averaging 4 inches) significantly reduce the quality of rearing habitat.
3. Six yards of good quality spawning gravels occur in the lower 0.1 mile.
4. No barriers to fish migration were identified.

Tributary B, RM 0.0 - 0.8:

1. The fish habitat is rated good (HCR = 6.6).
2. Rearing habitat is fair. Pools dominate (P:R = 6:4) the stream area, and are shallow (8 inches deep) with high effective cover.
3. Eighty-seven yards of spawning gravels were counted. Approximately 95 percent of these are in the 0.5 to 1 inch size class.
4. The log ford at RM 0.2 may be a partial velocity barrier, restricting access to about 0.5 miles of habitat. Logs have been placed in the channel parallel to stream flow and covered with dirt and gravel.

## FROG CREEK

### Riparian Habitat Summary

Riparian habitat quality generally rates moderate along Frog Creek, varying widely in and between reaches. Below the diversion ditch (RM 4.6), a typical cross section of the floodplain is composed of two or three channel braids constricted by tag alder thickets growing from decomposing moss-covered log hummocks. The alder is replaced by Pacific yew thickets and red-osier dogwood immediately upslope of the stream channel. Located between channels are numerous, small (less than one yard) pools and potholes surrounded by herbaceous ground cover. The overstory is hemlock and cedar dominated. Flows appear extremely well-regulated.

Above the diversion ditch, the channel is less braided and the tag alder-Pacific yew thickets mentioned above only occur along 30 percent of stream length.

Although much of this drainage has been logged (see map), full retention buffer strip areas averaging 100 feet on either bank are characteristic.

#### Reach I: RM 0.0 - 1.7:

1. The Riparian Condition Rating is high (RCR = 6.7).

2. The floodplain width decreases from very wide (greater than 200 feet) at the mouth to narrow (60 feet) by the end of the reach. The flat-bottom, V-shaped valley has abundant (70 percent of stream length) small wetlands occurring around and between channel braids.
3. Five habitat units are present (grass-forb, shrub-seedling-sapling, poles, small sawtimber, and large sawtimber).
4. The coniferous overstory (averaging four species per transect) is predominately western hemlock, red cedar, and Englemann spruce, with occasional Douglas , grand, and noble fir. No deciduous overstory species were observed.
5. The abundant small wetlands are a high quality special habitat unit in this reach. Channel braiding is very common, with an average of two to three braids meandering through very old (moss and sapling-covered) decomposing debris accumulations (local source). These hummocks cover approximately 30 percent of the stream surface, and result in numerous small (less than one yard) ponds and potholes.
6. Beaver bank colonies are very active over the entire stream. Recent coniferous (hemlock, cedar) and deciduous (tag alder) cutting is common.

Reach II; RM 4.7 - 4.6:

1. The riparian habitat decreases to moderate quality (RCR = 5.9).
2. The floodplain width increases from narrow (50 feet) at the lower end of this reach to very wide (greater than 200 feet) at the upper end.
3. Four habitat units are present, one less (poles) than for Reach I.
4. The coniferous overstory (averaging three species per transect) is dominated by hemlock and cedar, with lesser amounts of spruce than found in Reach I.
5. Less braiding and wetland development occur in this reach than in Reach I, resulting in a decrease of small wetlands to only 10 percent of stream length.

Reach III; RM 4.6 - 6.7:

1. Riparian habitat continues to rate moderate (RCR = 5.2).
2. The floodplain width continues to fluctuate, ranging from greater than 200 feet at the downstream end to 30 feet at RM 6.0 back up to 200 feet by RM 6.5.

3. The same four habitat units present in Reach II occur in this reach.
4. The coniferous overstory continues to be predominately hemlock, cedar, and some spruce.
5. The lack of wetland development is an important factor contributing to the lower RCR of this reach.

Reach IV; RM 6.7 - 7.8:

1. The Riparian Condition Rating increases to high (RCR = 6.2).
2. The floodplain width averages wide (140 feet), increasing from 25 feet to greater than 200 feet.
3. All five habitat units are present.
4. The coniferous overstory (three species) is hemlock dominated. Coniferous understory diversity increases in the alder meadow above RM 7.3, which includes mountain hemlock, white pine, silver fir, Douglas-fir, and noble fir.
5. Two special habitats, the tag alder meadow mentioned above (RM 7.3 - 7.5), and a rock outcrop (RM 6.7), occur in this reach.

Tributary A; RM 0.0 = 0.2:

1. The Riparian Habitat Condition Rating is poor (RCR = 3.2).
2. The floodplain width is narrow (60 feet).
3. Two habitat units, shrub-seedling-sapling and small sawtimber, are present.
4. The coniferous overstory is composed of cedar and hemlock. Pacific yew overhangs the stream channel and areas immediately upslope.

Tributary B; RM 0.0 - 0.8.

1. The Riparian Condition Rating is moderate (RCR = 4.6).
2. The floodplain width is moderate (80 feet).
3. All five habitat units are present.
4. The coniferous overstory is composed of hemlock and cedar.

## FROG CREEK

### Rehabilitation and Enhancement Summary

#### Passage Enhancement; RM 0.8; 3.55; 4.6; 6.8; Trib B 0.2:

Fish migration obstructions include the three culverts and the diversion structure on the mainstem, and a log ford on Tributary B.

Culvert #1 (RM 0.8) is a partial barrier with a gradient of 4.5 percent. Low flow velocity is 5 ft/sec. It is approximately 40 feet long. Baffling may be required. Culvert #2 (RM 3.55) is a partial barrier. Stream velocity through the 90-foot structure was measured at 2 ft./sec. Baffling, again, may be required. A jump pool below Culvert #3 (RM 6.8) would likely enhance fish passage through it. The diversion structure (RM 4.6) is a complete barrier to fish migration. At the time of this survey, flow to Frog Creek below RM 4.6 was primarily from subsurface flow through the earth berm of the Frog Creek Ditch. Flow in the ditch was estimated between 12 and 15 cfs. Establishing minimum stream flow requirements below the dam and improving jump pool conditions at the dam would open up an additional 3.9 RM of habitat to migrating fish species. Screening the ditch intake to prevent diversion of smolts into the ditch would appear to be a high priority if anadromous fish are introduced above the dam. The log ford across Tributary B (RM 0.2) is covered with soil and rock fill. This structure should be monitored to ensure that it does not become a stream stability or fish passage problem.

Spawning Habitat Development; RM 1.7 - 7.8:

Suitable spawning habitat for potential anadromous fish species above Reach I (RX 0.0-1.7) is limited. Increasing stream flow from RM 1.7-4.6 may improve spawning habitat conditions, by lowering sediment loading and levels of aquatic vegetation. Installing channel structures for gravel retention may improve spawning areas above RM 4.6. Introducing gravels may be required at gravel catchment sites due to the low bedload movement throughout the stream length.

Rearing Habitat Development; RM 0.0 - 4.6:

Pool rearing habitat in Reaches I and II could be improved with increased flow below the diversion structure during low flow periods. Presently, shallow pool depth in this area is a major limiting factor to salmonid production. In-channel structures to raise pool level and promote pool scour are also an option. Log or gabion sills may be most appropriate due to the availability of logs and gravel fill material available on-site.

Riparian Habitat Enhancement; RM 0.0 - 7.8:

Generally, coniferous species diversity is low and deciduous tree species are absent in the riparian zone overstory. Selective cutting in small patches (1-2 acres) on the north bank (to allow additional light penetration in the riparian zone), coupled with planting of deciduous species, could increase the overall habitat diversity.

FROG CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM					POOLS				RIFFLES (%)				
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D
I (0.0-1.7)	7.5	90	7:3	2	L	4	H	-	5	20	35	30	10	4
II (1.7-4.6)	6.7	90	6:4	2	L	3	H	-	*	10	40	35	15	3
III (4.6-6.7)	6.9	80	7:3	2	L	3.5	H	-	-	*	40	40	20	3
IV (6.7-7.8)	5.4	75	7:3	2	L	1	H	-	*	15	40	20	15	1

Tributaries

Tributary A (0.0-0.2)	4.8	100	5:5	2	L	1	H	-	*	40	40	10	10	2
Tributary B (0.0-0.8)	6.6	80	6:4	3	L	1	H	-	10	10	35	35	10	2

LEGEND: HCR: Habitat Condition Rating  
 S: Percent of stream shaded  
 P:R: Ratio of pool length:riffle length  
 G: Average gradient (%)  
 d: Average maximum depth (L <12", M = 12 - 29", H ≥30")  
 A: Average pool area (sq. yards)  
 EC: Effective cover (L <40%, M = 40-60%, H ≥60%)  
 BR: Bedrock  
 SD: Sand  
 D: Average depth (inches)  
 \*: Present, but less than 5%

FROG CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>				<u>TRIBUTARIES</u>	
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>Tributary A</u>	<u>Tributary B</u>
Trout	M	M-H	H	L-M		( )

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.

( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0-1.7)	496	307	189
II (1.7-4.6)	220	125	95
III (4.6-6.7)	138	69	69
IV (6.7-7.8)	129	77	52
Tributary A (0.0-0.2)	6	6	0
Tributary B (0.0-0.8)	87	47	40
<b>TOTAL</b>	<b>1076</b>	<b>631</b>	<b>445</b>

FROG CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM</u>	<u>(R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
Frog Creek	0.8	Culvert	C1	P	Velocity barrier (length 40 ft., 4.5% gradient, low flow velocity 5 ft./sec.), baffle.
Frog Creek	3.55	Culvert	C2*	P	Partial high flow barrier, (length 90 ft., 1.5% gradient, low flow velocity 2 ft./sec.), baffle.
Frog Creek	4.6	Diversion Structure	D1	N	Improve jump pool.
Frog Creek	6.8	Culvert	c3	F	Create jump pool
Tributary B	0.28	Log ford	L1	F	Monitor passage; structure is 7-8 large logs lying in the stream parallel to the flow.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Trout migration barrier only, anadromous fish could pass obstacle.

**FROG CREEK**

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (0.0-1.7)	1.7	0.0	7:3	4	1	160	26	
II (1.7-4.6)	2.9	0.0	6:4	3	0.5	31	0	
III (4.6-6.7)	0	2.1	7:3	3.5	1	17	0	Diversion structure at RM 4.6.
IV (6.7-7.8)	0	1.1	7:3	1	0.5	35	0	
Trib. A (0.0-0.2)	0.2	0	5:5	0.5	0.5	0	0	
Trib. B (0.0-0.8)	0	0.8	6:4	1	0.5	<u>4</u>	<u>0</u>	
TOTAL	4.8	4.0				247	26	

LEGEND: Avail: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R.: Ratio of pool length:riffle length.  
 Area : Average pool area (sq. yds.).  
 Depth:. Average pool depth (feet).  
 Spawning: Number of sq. yds. of gravels observed in the 1"-3" and 3"-6" size classes.

FROG CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		LWD CHARACTERISTICS	<u>LWD CHARACTERISTICS</u>			
	Total (%)	HQ (%)	Total (%)	HQ*(%)		OR	#	L	Dia
I (0.0-1.7)	80	90	85	0	Perp	S-M	1-2	1-2	L
II (1.7-4.6)	90	95	95	0	Perp	S-M	1-2	1-2	L
III (4.6-6.7)	95	100	95	0	Perp	S-M	1-2	1-2	L
IV (6.7-7.8)	100	100	100	0	Perp	S-M	1-2	1-2	L
Tributary A.	100	100	100	0	Perp	S-M	1-2	1-2	L
Tributary B.	100	100	100	0	Perp	S-M	1-2	1-2	L

LEGEND:

Total = % of total habitat area dependant on LWD  
 HQ = % of high quality habitat area dependent on LWD  
 OR = angle of orientation to flow; Perp = perpendicular, Var = variable  
 # = number of logs/structure; S = single log, M = multi-log  
 L = average length of logs, expressed in channel widths  
 Dia = diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = mixture of local and transported  
 \* No high quality pools present in the system, based on criteria of the Habitat Condition Rating model.

FROG CREEK

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

<u>Reach (R.M.)</u>	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>q</u>	<u>W</u>	<u>D</u>	
I (0.0-1.7)	11	.4	1.5	7	14	.6	60-200 +
II (1.7-4.6)	12	.5	1	6	11	.6	50-200 +
III (4.6-6.7)	12	.7	1.5	13	14	1	30-200
IV (6.7-7.8)	4	.3	1	1	8	.5	25-200
Tributary B	20	.3	1	6	15	0.8	80

LEGEND: W,w = Stream width (ft)  
D,d = Stream depth (ft)  
V = Velocity (feet/second)  
Q = Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (0.0-1.7)	7/20/83	6	90	SE	55/49-58/51		1530-1845
II (1.7-4.6)	7/21,26/83	3	90	SE	58/46-64/49		1130-1700
III (4.6-6.7)	7/26-27/83	8	80	SE	57/42-61/44		1230-1815
IV (6.7-7.8)	7/27/83	1	75	SE	57/46		1400-1500
Tributary B.	7/28/83	3	80	S	64/43		1300

FROG CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			<u>Special Habitat</u>
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>		
			<u>Con.</u>	<u>Dec.</u>					
I(0.0-1.7)	6.7	120	5	4	0	2	M	S	1
II(1.7-4.6)	5.8	125	4	3	0	2	L	S	1
III(4.6-6.7)	5.2	140	4	3	0	2	--	--	0
IV(6.7-7.8)	6.2	140	5	4	0	2	M	L	2
<b>Tributary A.</b>									
(0.0-0.2)	3.2	60	2	2	0	3	--	--	0
<b>Tributary B.</b>									
(0.0-0.8)	4.6	80	5	2	0	2	--	--	0

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: # Habitat Units H  $\geq 4$ ; M 2-3; L  $\leq 1$   
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H  $\geq 50\%$ ; M = 25-50%;  
 L  $\leq 25\%$   
 Size: Size of wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5204N)



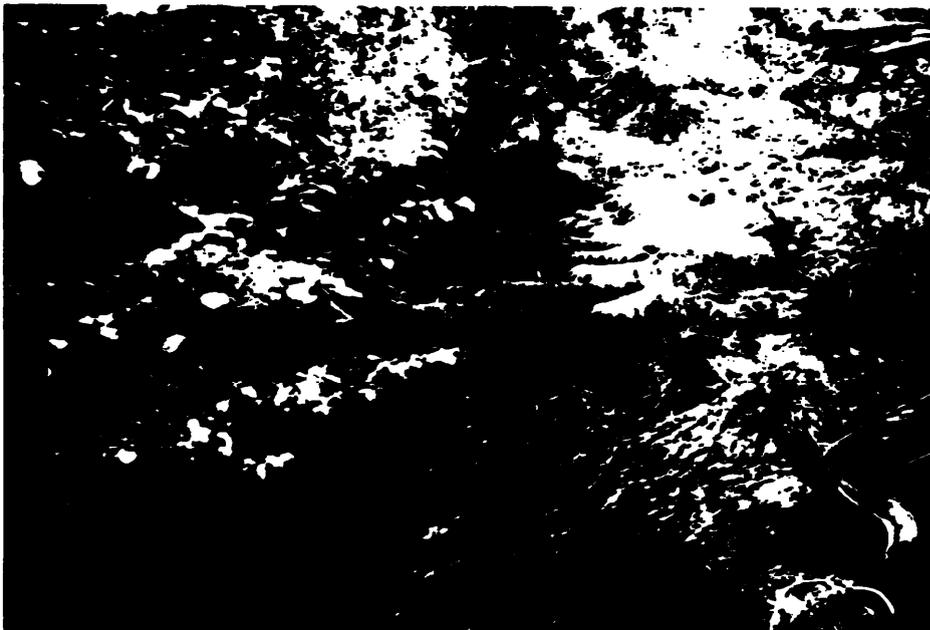
True riparian vegetation is dominated by dense tag alder and Pacific yew along much of the stream in Reach III (above the ditch diversion at RM 4,6\). Channel structure is provided by moss covered hummocks of decaying logs, often supporting neq growth. Channel braiding is very common.



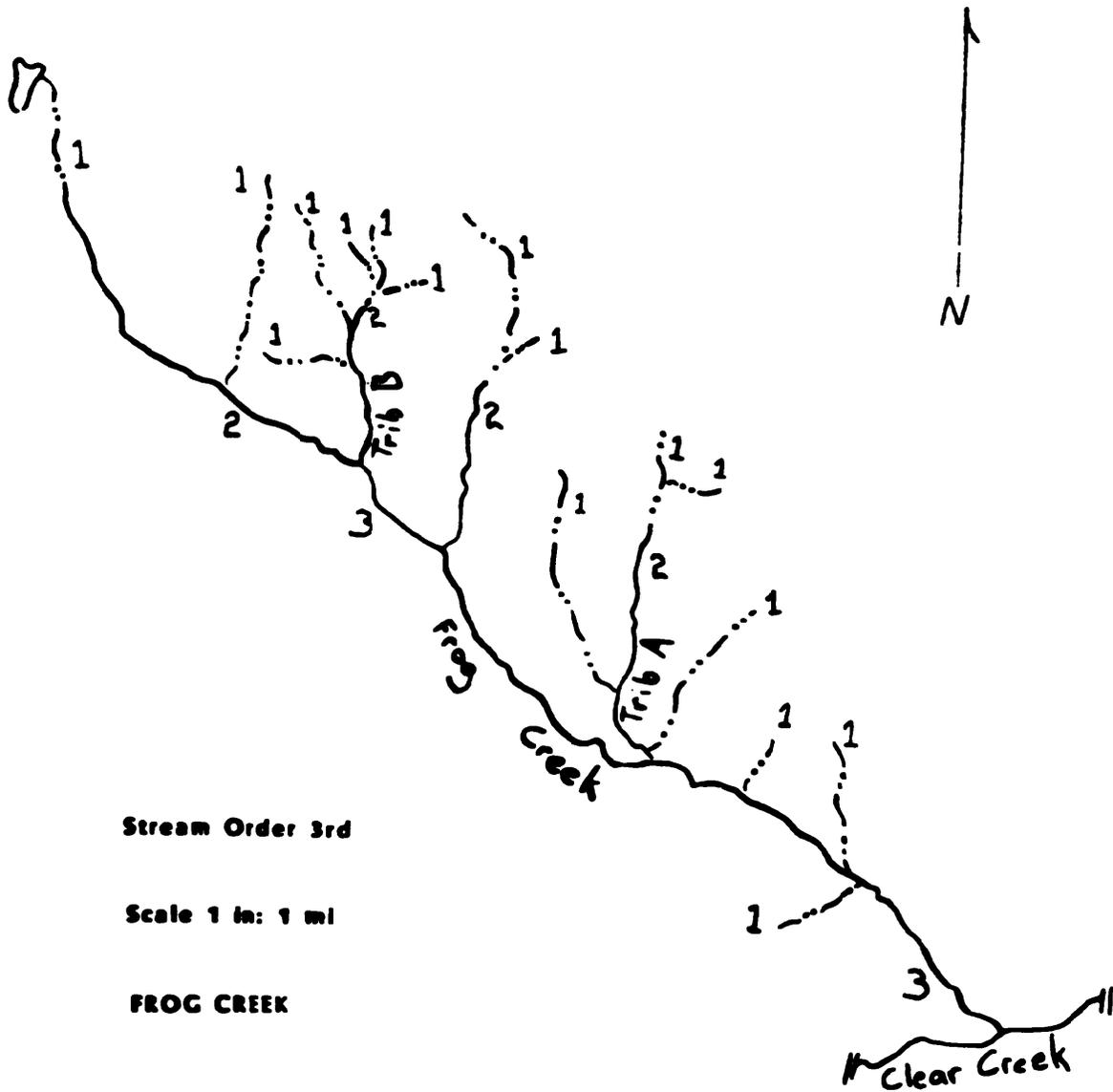
The influence of LWD continues to be high in Reach IV (photo at R.M. 7.3) although channel braiding is reduced. **Average** pools are one square yard in area with shallow depths and high effective cover.



Typical view of Frog Creek In Reach I (R.M. 0.51. The influence of large woody debris (LWD) on pool formation and spawning gravel retention is high (80). Rearing habitat is fair. Pools are shallow and average 4 square yards. Effective cover is high. Spawning habitat is abundant with approximately 500 square yards of spawning gravels observed within this reach.



Channel braiding In Reach II Is common and is highly influenced by LWD. The gradient is low (2%), and the channel substrate is comprised of small-size gravel and sand. Eighty-five percent of the spawning gravels (189 sq. yd.) are suited for resident trout utilization.



Stream Order 3rd

Scale 1 in: 1 mi

FROG CREEK



- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

R<sub>I,II,III</sub> REACH # and SECTION

T<sub>1</sub> 1.0 TRANSECT # and RIVERMILE

★ OBSTRUCTION

★ BARRIER

J<sub>1,2,3</sub> JAM and #  
 F( )<sub>1,2,3</sub> FALLS, HEIGHT, and #  
 C<sub>1,2,3</sub> CULVERT and #  
 B<sub>1,2,3</sub> CHUTE and #

 DIVERSION STRUCTURE (I = water is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUMP

 DEBRIS TORRENT TRACK

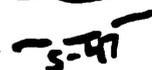
 SPRING

 UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)

 BANK EROSION (EXTENSIVE/SEVERE)

\* 1,2,3, :MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

BARLOW CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar County: Hood River  
Doug Kinzey Wasco

Dates Surveyed: August 9-11, 1983 Mouth Location:  
T.4S, R.9E., Sec. 24

Tributary to: White River Watershed Acres: 6,692 acres  
10.5 sq. mi.

Drainage: Deschutes

TRI Compartments: Stream Length: 7.1 miles  
Bonney 2201  
Grinds tone 2203  
Bird 2204 Distance Surveyed:  
Mainstem: 6.8 miles

Gamefish: Rainbow trout  
Brook trout Low Flow Width (Avg.) 10 feet

Potential Anadromous Species: Stream Order: III  
Coho Salmon  
Steelhead trout  
Chinook Salmon

Average Fish Habitat Condition Rating: 7.3 (Good)

Average Riparian Condition Rating: 7.1 (High)

## BARLOW CREEK

### Survey Summary

#### A. Stream Summary

Barlow Creek is a third order tributary of White River, providing approximately 20 percent (12 cfs) of the low flow at their confluence. Barlow Ridge parallels the stream on the northeast side of the drainage. Access to the stream is provided by the old pioneer Barlow Road (Forest Service Road 3530) which closely parallels the creek for most of its length. Oregon State Highway 35 crosses the headwaters at Barlow Pass and Forest Service Road 43 passes near the mouth. Four Forest Service campgrounds are located along Barlow Creek. These include Barlow crossing near the mouth, Barlow Creek Campground at RM 2.0, Grindstone Campground at RM 3.7 and Devil's Half-Acre at RM 6.4. Numerous dispersed campsites are also heavily used along the stream. Rainbow and brook trout were observed to RM 6.0.

#### B. Watershed Characteristics and Geomorphology

The lower two and a half miles of Barlow Creek flow in the very broad, glaciated White River floodplain. Above RM 2.5 Barlow Ridge separates the two watersheds and the valley takes on a wide (200+ ft.), V-notch configuration. Stream adjacent side-slopes are gentle (0-30 percent).

Valley walls are moderately steep to steep (60-90 percent). Stream gradient is low throughout the stream's length (2-4 percent), flowing through a wide floodplain (120-200 ft.). Several sub-alpine lakes drain into Barlow Creek. Flow from outlet streams of Green Lake and Lower Twin Lake appear to be perennial. Palmateer Creek provides approximately 40 percent (3 cfs) of the flow at its confluence with Barlow Creek (RM 4.9). Numerous ephemeral streams drain the highly dissected west slope of Barlow Ridge. Large meadows bordering the stream occur at RM 2.3, Palmateer Meadows at RM 4.5, and Devils Half-Acre Meadow at RM 6.0. The flow regime of Barlow Creek appears moderately flashy.

c. ReachDescriptions

Four reaches were identified along the mainstem of Barlow Creek. Differences are based primarily on substrate composition, pool-to-riffle ratio and gradient. Rubble and gravel are the predominant substrate material along 85 percent of the survey length. Pools dominate the stream surface area in three of the reaches. Reach III has more channel structure than the other reaches. The stream gradient is low (2-4 percent) through Reaches I - III (RM 0.0 - 6.4).

D. Fisheries

The overall rating of the fish habitat is good (HCR=7.3). Rainbow and brook trout were observed in moderate numbers (5-50/100 feet) from the

mouth to RM 6.0. The Oregon Department of Fisheries and Wildlife annually stocks Upper and Lower Twin Lakes (which drain into Barlow Creek) with juvenile brook trout. Pools are large (>10 square yards) on most of the stream's length. Pool depths are shallow to moderate with moderate effective cover. Spawning gravels total 893 square yards, with 80 percent potentially suitable for utilization by anadromous salmonids. Seventy percent of the gravels are located in Reach I (RM 0.0-2.7). Good-size gravel beds (5 square yards) in this reach are common. Gravel beds in the upper reaches are smaller.

The importance of large woody debris (LWD) in overall pool formation and spawning gravel catchment is moderate in Reaches I and II and increases to high in the upper reaches. High quality pool formation is heavily dependent on LWD (70-90 percent) in all reaches. Eight logjams (debris accumulations) were identified along the mainstem. Three are considered partial barriers; Logjam #2 (RM 1.05), Logjam #4 (RM 2.8), and Logjam #7 (RM 4.0). The fish habitat in Barlow Creek appears well-suited for and steelhead trout, chinook, and coho salmon.

#### E. Riparian Area

The riparian habitat conditions are rated high (RCR = 7.1). Positive factors include a wide floodplain, high number of habitat units, presence of deciduous species, and special habitats (wetlands, rock outcrops and snag patches). Negative factors are four campgrounds located along the

stream channel and the close proximity of the Barlow Road to the stream. Loss of riparian vegetation and decreased bank stability in these areas appear to be a direct impact of the heavy recreational use.

F. Rehabilitation and Enhancement

Rehabilitation efforts should be directed at lessening the effects of the campgrounds on the riparian area. This would include re-establishing riparian vegetation and bank stability. Enhancement opportunities also exist for increasing gravel retention above RM 4.0, where spawning habitat may be a potential limiting factor.

3. Substrate materials are predominantly rubble and gravel with boulder structure in some sections and LWD in others.
4. Stream surface area is dominated slightly by riffles (P:R = 4:6).
5. Stream shading is the same as Reach I (60 percent).

Reach III; RM 5.4 - 6.4:

1. Valley shape continues as a wide, flat bottom V. Floodplain is moderately wide (80 ft.) and deeply incised in the valley floor below RM 6.0. At RM 6.0 the stream braids into a large meadow.
2. Gradient is low (2 percent).
3. Gravel and sand are the predominant channel substrate.
4. The stream area is dominated by pools (P:R = 7:3).
5. Stream shading is moderate (50 percent).

Reach IV; RM 6.4 - 6.8:

1. Valley configuration is V-notched with steep (>70 percent) sideslopes. Floodplain width averages 25 feet.

2. Gradient is stepped and highly influenced by LWD; the gradient ranges from 7-17 percent.
3. Rubble and boulders dominate the channel substrate.
4. Stream surface area is dominated slightly by pools (P:R = 6:4).
5. Shading is high (95 percent).

### Tributaries

Four tributaries of Barlow Creek were surveyed. Palmateer Creek is the only one that appears to contain fish habitat; however, its high gradient (11 percent) would preclude the introduction of any anadromous species. It is a major water source for Barlow Creek, providing approximately 40 percent of the flow (3 cfs) at their confluence (RM 4.9).

Green Lake Creek (RM 0.7) had 0.5 cfs flowing in a 4-foot wide channel. Substrate is small woody debris, leaf litter, and algae.

Tributary A, draining Lower Twin Lake, enters Barlow Creek at RM 3.5 with a 12-foot high rock face falls at the mouth. Flow is approximately 2 cfs.

Tributary B provides 30 percent of the flow (1.5 cfs) at its confluence with Barlow Creek (RM 5.5). Stream banks are high (>4 ft.) and highly susceptible to erosion, the channel width is 4 feet wide and the flow regime is flashy.

## BARLOW CREEK

### Fish Habitat Summary

The overall Fish Habitat Condition Rating is good (HCR =7.3). Positive components of the score include good baseflow, ample spawning habitat in Reaches I and II (RM 0.0 - 5.4), high quality riffle and pool development in Reach II (RM 2.7 - 5.4) and low flow braids and high flow side channels offering diversified rearing habitat. Negative factors include reduction in bank cover and bank stability in areas impacted by recreation use. Rainbow and brook trout were observed from RM 0.0 - 6.0.

#### Reach I; 0.0 - 2.7:

1. The fish habitat quality is rated excellent (HCR = 8.2). Fish species observed were rainbow and brook trout.
2. Spawning gravels total 642 square yards, of which 50 percent (343 sq. yd.) are good quality. Approximately 50 percent of the total are in the 1.5-3 inch size class and 45 percent in the 3-6 inch size class. Spawning beds of 5+ square yards are common. LWD influences formation of 60 percent of all the beds and 70 percent of those considered high quality.
3. Rearing habitat is good in this reach. Pools dominate the stream area (P:R = 7:3). Pool size averages 14 square yards with moderate depths

(1.5 ft.) and moderate effective cover. Small, shallow pools (<1 sq. yd.) and low velocity riffles are common along the mainstem where low flow braids have developed. Effective cover in these braids is low. In the upper part of this reach high flow side channels offer similar habitat. LWD influences only 30 percent of all pool formation; however, 90 percent of the high quality pools are associated with LWD.

4. Logjams #1 2, 3, occur at RM 0.95, 1.05, and 1.65, respectively. Logjam #2 is a partial barrier, measuring 5 feet high. Stream velocity above the jam is 4-5 ft./sec.

Reach II; RM 2.7 - 5.4:

1. The fish habitat quality is rated good (HCR = 7.6). Rainbow and brook trout were observed in moderate numbers.
2. Spawning gravels total 175 square yards with most (80 percent) found below RM 4.0. The gravel beds are smaller (1-3 sq. yd.) than those in Reach I. Eighty-five percent (149 sq. yd.) of the spawning gravels are of a size-class suited for use by anadromous salmonids. Incorporated LWD was associated with 75 percent of the beds and 80 percent of those considered high quality.
3. Riffles have a slight dominance in stream surface area (P:R = 4:6). Average pool size decreases from Reach I to 7 square yards. Pool depths

range from shallow to moderate. Effective cover is moderate. Fifty percent of all the pools present are influenced by LWD, and 70 percent of the high quality pools. Between RM 3.6 and 4.1 high flow channels are present. They had little or no flow through them at the time of this survey.

4. Five debris accumulations in this reach would impede fish migration. Four of the five are low flow barriers, while Logjam #7 (RM 4.0) is a partial barrier based on the height (4 ft.), length (6 ft.) and shallow jump pool development.

Reach III: RM 5.4 - 6.4:

1. The quality of the fish habitat is rated fair (HCR = 5.0). Trout were seen below a meadow complex (RM 6.0 - 6.3) but none were observed above it.
2. LWD is highly influential on pool development in this reach. As a consequence, the pool-to-riffle ratio increases (P:R = 7:3). Pool size averages 6 square yards with depths in the low to moderate range and moderate effective cover.
3. Spawning gravels total 58 square yards. Eighty percent are in the trout-sized 0.5 - 1 inch size class.

4. A 3-foot diameter culvert is located at RM 6.3. It appears passable in all flows.

Reach IV; RM 6.4 - 6.8:

1. The fish habitat quality is rated fair (HCR = 4.8). No fish were seen in this reach.
2. Pool development is dependent on LWD for creating a stair-step profile in the overall high gradient (>7 percent). Pool-to-riffle ratio is 6:4. Pools average one square yard with shallow depths and moderate effective cover.
3. Spawning gravels total 18 square yards. Eighty percent are in the 0.5 - 1 inch size class.
4. Fish migration is impeded at RM 6.7 by a boulder cascade with 17 percent gradient.

BARLOW CREEK

Riparian Habitat Summary

Reach I; RM 0.0 - 2.7:

1. The riparian habitat is rated high (RCR = 6.8)
2. The floodplain forms the western edge of the White River floodplain. It is located in the very wide (greater than 200 feet), flat-bottom U-shaped valley.
3. All five habitat units (grass-forb, shrub-seedling-sapling, poles, small saw timber, and large saw timber) were observed.
4. The coniferous overstory is very diverse, with up to six species (lodgepole pine, Douglas-fir, western red cedar, western hemlock, noble fir, and western larch) present at a single transect. One deciduous species, cottonwood, is common throughout the reach.
5. A special habitat, the large (3 to 4 acres) alder meadow at RM 2.2, is associated with increased channel braiding and higher levels of large woody debris input than occurs below this point.

6. Two campgrounds are located in this reach. Barlow Crossing is situated near the mouth and Barlow Creek is at RM 2.0. Heavy recreational impacts include bank instability and lack of groundcover in the riparian area, litter along the banks and streambed, and off-road recreational vehicle use in the stream channel.

Reach II; RM 2.7 - 5.4:

1. The Riparian Condition Rating remains high, increasing slightly to 7.6.
2. The floodplain width fluctuates between greater than 200 feet at the start of the reach and 60 feet by the end, forming a flat-bottom U-shaped valley.
3. All five habitat units are present.
4. The coniferous overstory is dominated by cedar, hemlock, and true fir (noble and silver), with lesser amounts of Douglas-fir and lodgepole pine. Red alder is the only overstory deciduous species and was observed only in the upper mile of this reach.
5. Two special habitats occurring in this reach are the rocky outcrops at RM 2.7, and the dry alder meadow (4 to 5 acres) at RM 4.5.

Reach III; RM 5.4 - 6.4:

1. The Riparian Condition Rating increases to very high (8.2).
2. The floodplain width ranges from 60 feet at the start of the reach to greater than 200 feet by river mile 6.0, forming a flat-bottom, U-shaped valley throughout.
3. Four habitat units are present, with large saw timber generally lacking. The area appears to have burned within the last 100 years.
4. Coniferous overstory diversity is limited in this reach; spruce and noble fir dominate. Red alder comprises the deciduous overstory.
5. Two special habitats are the large (about 20 acres) sedge meadow present from RM 6.0 to 6.3, and a snag patch at RM 6.0. A beaver lodge and numerous channels are found in the meadow.

Reach IV; RM 6.4 - 6.8:

1. The riparian habitat rates poor (RCR = 3.7).
2. Two factors contributing to the poor rating are the narrow (30 feet wide) V-notch valley configuration, and a lack of special habitats.

3. Four habitat units are present, with the shrub-seedling-sapling unit generally lacking.
  
4. The coniferous overstory is hemlock dominated, with a silver fir understory at 20-30 feet high. Cedar and a few large (greater than 150 feet high) broken-topped, Douglas-fir are also present. Red alder comprises the deciduous overstory.

## BARLOW CREEK

### Rehabilitation/Enhancement Summary

#### Riparian Enhancement, RM 0.0-2.0, 6.4:

Rehabilitation efforts directed at lessening streamside impacts of the Barlow Road and its associated campgrounds and undeveloped sites could benefit this system. Presently, degradation of streambanks and vegetation are evident at Forest Service campgrounds at RM 0.4, 2.0, and 6.4 (Barlow Crossing, Barlow Creek, and Devil's Half Acre respectively). Additionally, the potential exists for harassment of spawning salmonids in these areas and along the Barlow Road.

Relocation of campgrounds to at least 200 feet away from the stream along with a reduction in off-road recreational vehicle use could allow heavily impacted areas to revegetate. Planting a visual screen of natively occurring species such as willow, high hush cranberry, and red-osier dogwood in locations at which the streambed is directly visible from the Barlow Road would also help counter negative effects of recreational use.

#### Spawning Habitat and Rearing Pool Development, RM 0.0-2.2, 4.0-6.0:

Placement of gravel retaining devices to create additional spawning habitat between RM 4.0 and 6.0 may improve fish production.

Increasing pool rearing habitat from RM 0.0 to 2.2 through the construction of log or boulder berm pools could also improve salmonid habitat.

Passage Enhancement, RM 1.05, 2.8, 4.0:

Eight debris accumulations were noted on the stream (see map). While none appear to be completely impassable, three of them (RM 1.05, 2.8, and 4.0) may be partial low-flow barriers. Monitoring passage at these structures, and subsequent alteration (easily accessed by the Barlow Road) may be required.

BARLOW CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM			POOLS					RIFFLES (%)					
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D
I(0.0-2.7)	8.2	60	7:3	2	M	14	M	-	5	25	40	20	10	4
II(.2.7-5.4)	7.6	60	4:6	3	L-M	7	M	*	15	35	30	10	5	4
III(5.4-6.4)	5.0	50	7:3	3	L-M	6	M	-	5	20	35	30	10	3
IV(6.4-6.8)	4.8	100	6:4	7	L-M	1	M	-	15	35	25	15	10	1

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R.: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq 12"$ , M = 12 - 29", H  $\geq 30"$ )  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq 40\%$ , M = 40-60%, H  $\geq 60\%$ )  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

**BARLOW CREEK**

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>			
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>
Trout fry	H	H	M	( )
Trout - j	M	M	L	( )
Trout - a	M	<b>M</b>	L	( )
Rainbow trout - a	*	( )	L	( )

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable, . may not be present

**TABLE III - SPAWNING GRAVEL (SQUARE YARDS)**

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0 - 2.7)	642	343	299
II (2.7 - 5.4)	175	103	72
III (5.4 - 6.4)	58	29	29
IV (6.4 - 6.8)	<u>18</u>	<u>9</u>	<u>9</u>
<b>TOTAL</b>	<b>893</b>	<b>484</b>	<b>409</b>

BARLOW CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
0.95	Log jam	J1	F	Low priority
1.05	Logjam	J2	P	Monitor for passage, possible removal required.
1.65	Logjam	J3	F	Low priority
2.8	Logjam	J4	P	Monitor for passage
3.15	Logjam	J5	F	Lowflow barrier, monitor for passage
3.17	Logjam	J6	F	Monitor for passage
4.0	Logjam	J7	P	Monitor for passage
4.9	Logjam	J8	F	Monitor for passage
6.3	Culvert	C1	F	Low priority

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles		P:R	Rearing		Spawning		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (0.0-2.7)	2.7	0.0	7:3	14	1.0	331	242	
II (2.7-5.4)	2.7	0.0	4:6	7	1.0	75	74	
111(5.4-6.4)	1.0	0.0	7:3	6	1.0	11	1	
IV (6.4-6.8)	<u>0.4</u>	<u>0.0</u>	6:4	<b>1</b>	0.5	<u>4</u>	<u>0</u>	
Total	<b>6.8</b>	<b>0.0</b>				<b>421</b>	<b>317</b>	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length : riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

BARLOW CREEK  
TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (0.0-2.7)	60	70	30	90	Perp	S+M	L-2	L-2	M
II (2.7-5.4)	75	80	50	70	Perp	S+M	1-2	L-2	M
III (5.4-6.4)	90	85	80	75	Perp	S	1-2	1-2	L
IV (6.4-6.8)	100	100	90	0	Perp	S	1-2	1-2	L

LEGEND: Total: percent of total habitat area dependant on LWD  
 HQ: percent of high quality habitat area dependent on LWD  
 OR: angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: number of logs/structure, S = single log, M = multi-log  
 L: average length of logs, expressed in channel widths  
 Dia: diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	SUMMER				BANKFULL		Floodplain Width (Ft.)
	W	d	v	q	W	D	
I (0.0-2.7)	12	.6	1	8	16	1.5	40 - 100
II (2.7-5.4)	10	.5	1.5	8	10	1.5	80 - 200
III (5.4-6.4)	8	.6	1.5	4	12	1.5	40 - 200+
IV (6.4-6.8)	4	.2	2	1.5	6	1	30

LEGEND: W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

BARLOW CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

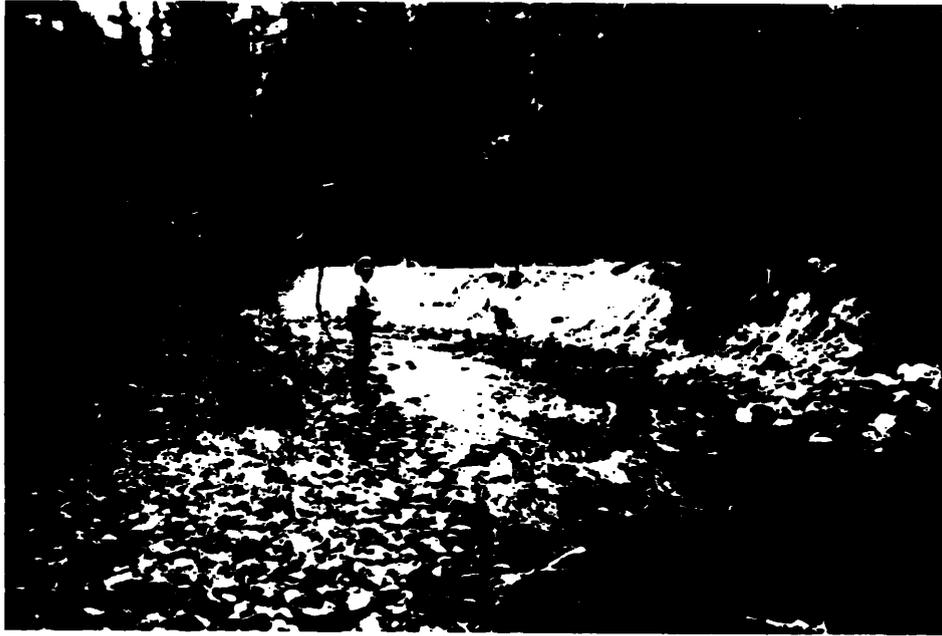
<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u>		
					<u>A/W</u>	<u>A/W</u>	
I (0.0-2.7)	8/9-10/83	12-7	60	SE	61/54-78/59		1400-1900
II (2.7-5.4)	8/10-11/83	10-4	70	SE	56/50-62/54		1220-1820
III (5.4-6.4)	8/11/83	4	40	SE	54-57/50		1420-1530
IV (6.4-6.8)	8/11/83	1.5	100	SE	54/45		1800

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Con.</u>	<u>Dec.</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>
I(0.0.-2.7)	7.1	200	5	5	1	II	L	L	1
11(2.7-5.4)	7.6	150	5	3	1	II	M	<b>L, S</b>	2
111(5.4-6.4)	8.2	130	3	2	1	II	H	<b>L, S</b>	3
IV(6.4-6.8)	3.8	30	4	4	1	II		---	0

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: # Habitat Units: H **>4**; M 2-3; L **<1**  
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H >50%; M: 25-50%;  
 L <25%  
 Size: Size of Wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5196N)



Barlow Creek In Reach I (shown at R.M. 2.0) flows through the broad White River floodplain. The stream gradient is low (2%) over a gravel and rubble substrate. Pools dominate the stream surface area (P:R = 7:3). Spawning habitat is abundant with over 600 square yards of spawning gravels counted (95% are suitable for anadromous salmonids utilization).



Riffle area increases in Reach II (P:R4:6L Small boulders are the predominant channel structural component in this area. Average pool area decreases **50%** from Reach I to Reach II (7 sq. yd.). Pool depths are shallow to moderate and effective cover is moderate. Photo is at R.M. 3.1. 25



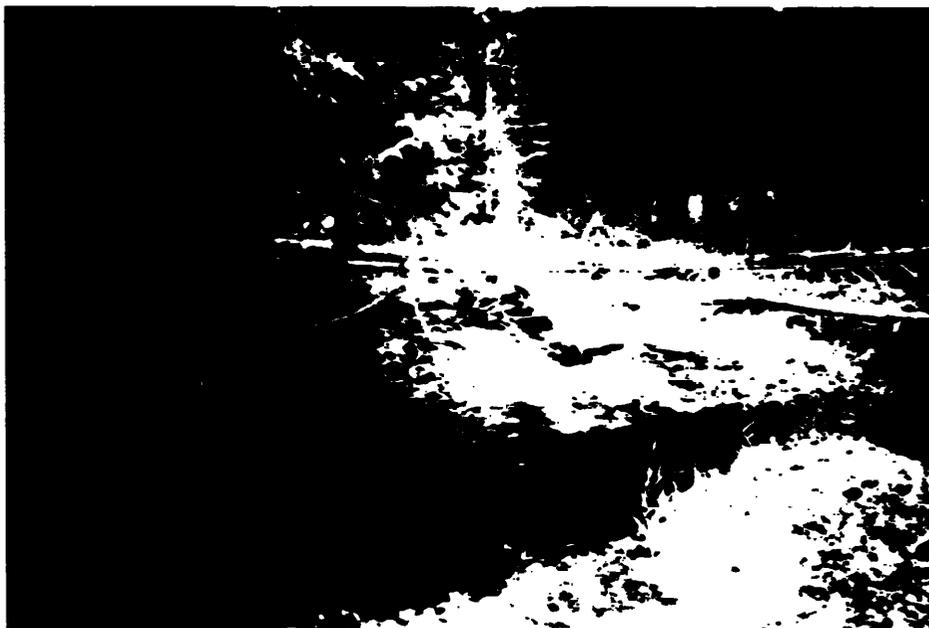
At RM 6.0 Barlow Creek braids out into a large sedge meadow. Numerous beaver channels are present. The Old Barlow Road parallels the east side of the area, and Devil's Half Acre Campground is also adjacent. Although riparian habitat is very high quality, wildlife utilization (especially big game) may be affected by the apparently heavy recreational usage of the area.



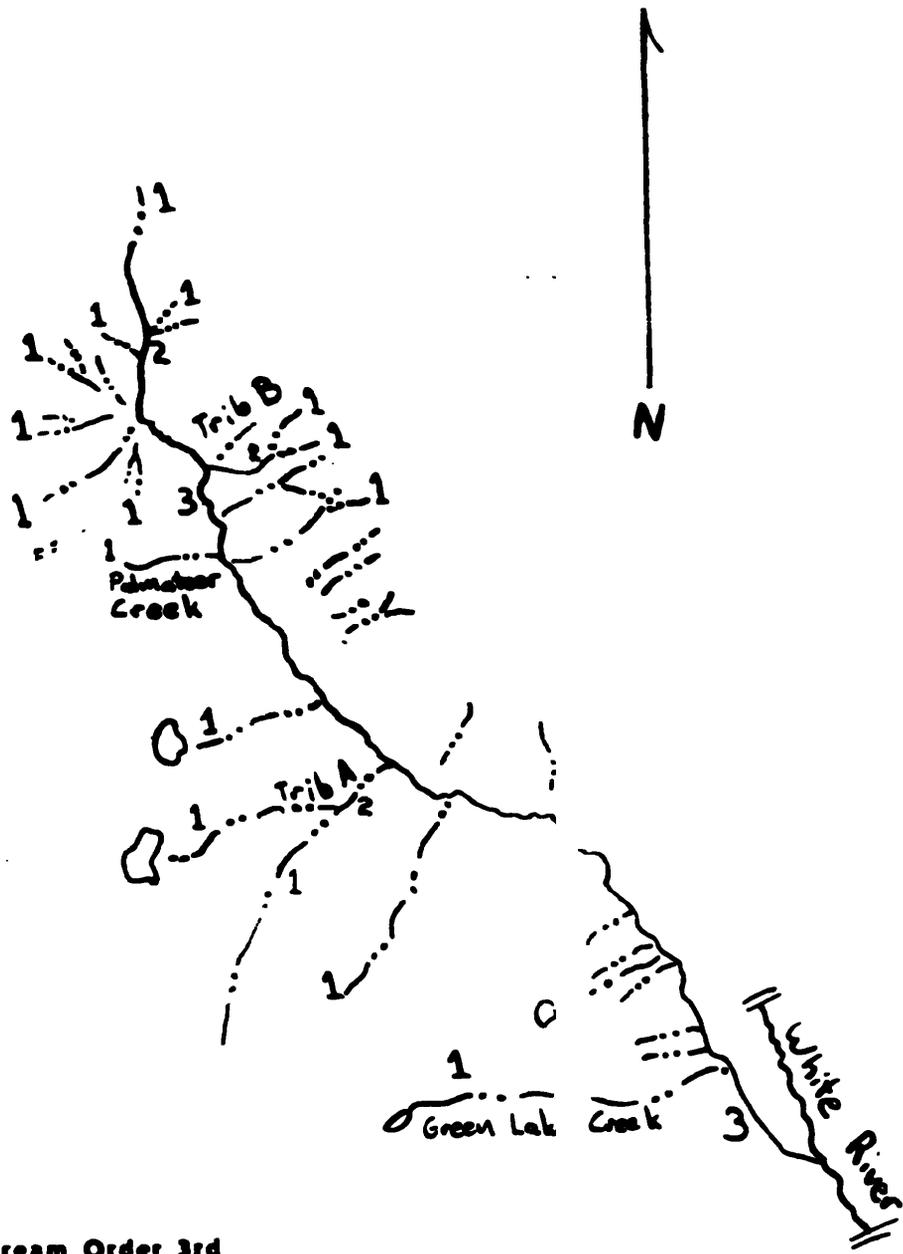
The presence of large woody debris, moderate gradient (7%) and high shading characterize Reach IV (photo at R.M. 6.5). The channel substrate is dominated by boulder and rubble. Rearing habitat is fair; pools are small with shallow to moderate depth.



Palmateer Creek provides about 40% (3 cfs) of the flow at its confluence with Barlow Creek (R.M. 4.B). It has a high gradient (11%), and fish habitat appears marginal. Pools are small with shallow depths, and channel structure is largely from locally introduced large woody debris.



Four Forest Service campgrounds are located along Barlow Creek. Loss of riparian vegetation and high levels of bank instability in these areas appear to be a direct result of the heavy localized recreational use. Rehabilitation efforts in these areas should likely be a high priority for maintaining the existing high quality fish habitat. This site is at RM 1.9.



**Stream Order 3rd**

**BARLOW CREEK**

**Scale 1 in : 1 mi**



- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

R<sub>I,II,III</sub> REACH # and SECTION

T<sub>1</sub> 1.0 TRANSECT # and RIVERMILE

★ OBSTRUCTION                      ★ BARRIER

J<sub>1,2,3</sub> JAM and #  
 F( )<sub>1,2,3</sub> FALLS, HEIGHT, and #  
 C<sub>1,2,3</sub> CULVERT and #  
 B<sub>1,2,3</sub> CHUTE and #

 DIVERSION STRUCTURE (I = water is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUMP

 DEBRIS TORRENT BLOCK

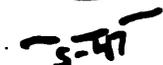
 SPRING

 UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)

 BANK EROSION (EXTENSIVE/SEVERE)

\*  
 1,2,3 : MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

BUCK CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: Jeff Uebel, Tom Cain	County: Wasco
Date Surveyed: August 16, 1983	Mouth Location: T4S, R10E, Sec. 19
Tributary To: White River	Watershed Area: 3.0 sq. mi. 1,938 acres
Drainage: Deschutes	Stream Length: 2.0 miles
TRI Compartment: Bonney, 2201	Distance Surveyed: 2.0 miles
Game Fish: Rainbow & Brook Trout	Avg. Low Flow Width: 4 ft.
Potential Anadromous Species: Coho Steelhead	Stream Order: II

Average Fish Habitat Condition Rating: 4.9 (Fair)

Average Riparian Condition Rating: 5.3 (Moderate)

## BUCK CREEK

### Survey Summary

#### A. Stream Survey

Buck Creek is a minor second order tributary to White River, providing 1.5 cfs (low flow) at their confluence (RM 36.9 of White River). The entire drainage area (1,938 acres) lies on National Forest System Land. Access is good with road crossings at RM 0.3 (Spur 071), RM 0.7 (S-48), RM 1.6 (Spur 011), and RM 1.9 (S-4890). A total of two miles were surveyed August 16, 1983. Low numbers of rainbow and brook trout were observed between the mouth and RM 1.5.

#### B. Watershed Characteristics and Geomorphology

The valley configuration is typically a narrow, flat-bottom "V" with a floodplain width ranging between 20-50 feet. An exception to this is the one-tenth of a mile section above the mouth which traverses the White River floodplain and has a wide (200 foot) floodplain. Sideslopes are generally gentle to moderately steep with an atypical section (RM 0.5-1.2) having steep sideslopes. Tributaries are small first and second order streams, flowing less than 1 cfs during low flow. Groundwater is apparently supplementing flows in the vicinity of RM 1.0. Flows in this area are noticeably increased without a significant addition from surface

sources. Water temperatures observed in this area were quite low (**49°F**), which likely indicates groundwater recharge. The surface flow regime appears to be moderately flashy.

c. Reach Descriptions

Two reaches were identified. These are primarily distinguished by pool to riffle ratio, streamflow discharge, and gradient. Reach I (RM 0.0 - 1.0) is riffle dominated (60 percent) and lower gradient (5 percent) than Reach II (RM 1.0 - 2.0) which is pool dominated (60 percent) with a higher average gradient (10 percent). The average flow in Reach I (1.5 cfs) is more than twice that of Reach II. An atypical wetland area (RM 0.0-0.1) occurs in Reach I where the stream enters the White River floodplain.

D. Fisheries

The overall habitat condition rating is poor to fair (HCR = 4.9). Low numbers of rainbow and brook trout were observed from the mouth to RM 1.5. Approximately one mile of potential anadromous fish habitat exists on the mainstem including potential coho habitat in the lower 0.7 miles and winter steelhead habitat to RM 1.0. Low flow rearing habitat is poor with 70 percent of the pools less than 12 inches deep. Although Reach I is riffle dominated, pool development is better than in Reach II due to the recruitment of flows from Trib B and spring activity near RM 1.0. Pools are slightly larger and deeper (50 percent are 1 -

2.5 ft. deep) in Reach I than the small, shallow pools of Reach II. Spawning habitat is good in Reach I which contains 75 percent (180 sq. yds.) of the total stream gravels counted. Seventy percent of these are of a size class suitable for anadromous utilization.

E. Riparian Areas

The overall riparian condition rating is 5.3 (moderate). Negative factors influencing this score are found primarily in Reach II, including the predominantly dense coniferous overstory, limited floodplain width, and lack of special habitat units. Positive factors (primarily in Reach I) include the presence of cottonwood in the overstory, an increased floodplain width, all five habitat units, and two special habitats, including a large wetland located between the mouth and RM 0.1. An active timber sale (408 Tie) lies within the drainage and 65 percent of the surveyed area (RM 0.0-0.7 and 1.1-1.7) is within the sale boundary.

F. Rehabilitation and Enhancement

Rehab/enhancement possibilities include pool development throughout the stream, passage enhancement at a debris jam (RM 0.6) and a trash rack (RM 0.7), and increasing the riparian overstory diversity. Road access is good along much of the stream with crossings at RM 0.3, 0.7, 1.6, and 1.9.

## BUCK CREEK

### Reach Summary

#### Reach I: RM 0.0 - 1.0:

1. The valley configuration decreases from a broad, shallow U-shape with a floodplain width greater than 200 ft. in the White River floodplain (RM 0.0-0.1) to a narrow, flat-bottom "V" with a 50 foot wide floodplain and steep sideslopes (RM 1.0). The transitional area is typically a moderate to narrow flat bottom "V" with gentle sideslopes.
2. The gradient averages 5 percent.
3. The riffle bottom composition is predominantly small boulder/rubble (65 percent).
4. Riffles dominate the stream area (60 percent).
5. Shading is high (85 percent).

#### Reach II; RM 1.0 - 2.0:

1. The valley configuration changes from a "V" notch with a floodplain width of 20 feet to a broad "U" shape with a 50 foot floodplain moving upstream.

2. The average gradient increases to 10 percent with a range of 6 - 14 percent.
3. The bottom composition is similar to Reach I.
4. Pool area increases to 60 percent.
5. Shading decreases slightly (75 percent).

#### Tributary A:

Tributary A is a major tributary to Buck Creek contributing 0.25 cfs, more than twice the flow of Buck Creek (0.1 cfs) at their confluence (RM 1.5). At the confluence, Trib A is 1.5 feet wide with a mean highwater width of five feet and a gradient of 7 percent. Marginal trout habitat is present for approximately the lower 0.2 miles.

#### Tributary B:

Trib B contributes approximately 30 percent (0.3 cfs) of the flow in Buck Creek at their confluence (RM 1.0). The gradient is high (30 percent) and no fish habitat appears to be present.

BUCK CREEK

Fish Habitat Summary

Reach I; RM 0.0 - 1.0:

1. The fish habitat is rated 5.8 (fair).
2. Pool rearing habitat is fair in the small, shallow pools present (3 sq. yds. and 1 - 2.5 ft. deep). Effective cover is moderate to high and is provided by LWD, the boulder/rubble substrate, and water turbulence.
3. Spawning habitat is good with 70 percent of the 180 sq. yds. of gravel in a size class suitable for anadromous utilization. Fifty percent of the gravels are rated good quality.
4. A trash rack associated with culvert C3 (RM 0.7) forms a partial passage barrier due to a steep chute of boulders at its base.
5. Potential anadromous habitat appears to end at RM 1.0.

Reach II; RM 1.0 - 2.0:

1. The habitat condition rating decreases to 4.0 (poor).

2. Pool rearing habitat is poor. Pools are typically smaller (1 sq. yd.) and shallower (less than 12") than the previous reach. Effective cover decreases and is primarily provided by LWD. No high quality pools were observed.
3. Spawning habitat is poor as gravels decreased in quantity (57 sq. yds.) and size (55 percent less than 1" in diameter). Fifty percent are rated as good quality.
4. The upper limit of resident trout habitat appears to end at approximately RM 1.5.

Tributary A:

Trib. A has approximately 0.2 miles of marginal resident trout habitat. Low summer flows and poor pool development appear to limit fish production.

## BUCK CREEK

### Riparian Habitat Summary

#### Reach I; RM 0.0 - 1.3:

1. The riparian condition rating is 6.2 (high).
2. The floodplain width averages 100 feet.
3. All five habitat units are present.
4. The overstory is primarily composed of 3 - 6 conifer species (including cedar, hemlock, Douglas-fir, white pine, noble fir, larch, spruce, and lodgepole pine) and one deciduous species (cottonwood).
5. Special habitat units observed were large and small wetlands, particularly RM 0.0-0.1, and a small talus slope (RM 1.0).

#### Reach II; RM 1.0 - 2.0:

1. The riparian condition rating decreases to 4.3 (moderate).
2. The average floodplain width decreases to 35 feet.

3. All five habitat units are present. Large saw timber is reduced in some areas due to past fires and recent logging.
4. The coniferous overstory is structurally similar to Reach I. No deciduous species are included in the overstory.
5. No special habitat units were observed.

## BUCK CREEK

### Rehabilitation and Enhancement Summary

#### Pool Rearing Habitat Enhancement: RM 0.0-1.5.

Pool rearing habitat is generally poor in terms of quantity and quality (depth, area) throughout the stream. Enlarging existing pools and creating additional pools could increase fish production. Access is good to many sites in both reaches, and project implementation could utilize either heavy equipment or hand tools.

#### Passage Enhancement: RM 0.6 and 0.7.

A small debris jam acts as a partial barrier at RM 0.6. Partial removal could enhance passage. A trash rack at RM 0.7 also appears to be a partial passage barrier to potential anadromous fish migration. Boulders either used during construction of the trash rack OR trapped from bedload movement have formed a small boulder catatract at the base of the rack. Passage could be enhanced by the development of a jump pool below the trash rack and/or the removal of some boulders to consolidate flows. Access is good from S-48 and the work could be accomplished with hand tools.

Two culverts, C1 (RM 1.9) and C2 (RM 1.6) are above the apparent limit of resident and potential anadromous fish habitat so no modifications are needed.

At the time of the survey, Spur Road 071 forded the stream (RM 0.3) and was a source of sediment introduction (20 sq. yds. of surface erosion). Since then a culvert has reportedly been installed at this site. An inspection for fish passage problems and soil instability should likely be made.

Riparian Enhancement: RM 0.5-2.0.

A dense coniferous overstory apparently reduces riparian diversity as evidenced by the lack of deciduous species in the riparian overstory (RM 0.5-2.0). Planting deciduous species in the riparian area of recently harvested clearcuts could increase the riparian diversity.

The large wetland at RM 0.0-0.1 is becoming dominated by densely stocked "tag" alder. Small patch burns to create grass/sedge openings could improve structural habitat diversity in the wetland.

Stream Monitoring Opportunities:

Four units in an active timber sale (Tie 408 - Units 1, 2, 8, and 10) provide opportunities to assess and monitor any changes in stream temperature and sediment loading associated with the removal of the overstory in the riparian zone. The opportunity also exists in these areas to establish deciduous species in the overstory by planting cottonwood and alder on disturbed riparian sites.

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>		<u>POOLS</u>							<u>RIFFLES (%)</u>				
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I (0.0-1.0)	5.8	85	4:6	5	M	3	M-H	0	30	35	25	5	*	5
II (1.0-2.0)	4.0	75	6:4	10	L	1	M	0	35	35	25	5	0	1

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq$  12", M = 12 - 29" , H  $\geq$  30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq$  40%. M = 40-60%, H > 60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>		<u>TRIBUTARIES</u>
	<u>I</u>	<u>II</u>	<u>A</u>
Rainbow trout - a	L	L	L
Brook trout - a	L	-	

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable\*, presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQuARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0 - 1.0)	180	90	90
II (1.0 - 2.0)	57	27	30
TOTAL	<u>237</u>	<u>117</u>	<u>120</u>

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
0.6	Debris jam	None	P	Partial removal.
0.7	Trash rack	c3	P	Remove boulder obstructions.
1.6	Culvert	c2	N	None; above fish habitat.
1.9	Culvert	C1	N	None; above fish habitat.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	MILES		P:R	REARING		SPAWNING		Comments
	Avail.	Pot.		Area	Depth	1"-3"	3"-6"	
I (0.0 - 1.0)	0.6	0.4	4:6	3	1	82	41	Potential anadromous habitat ends at RM 1.0.
<b>II (1.0 - 2.0)</b>	<b>--</b>	<b>--</b>	<b>6:4</b>	<b>1</b>	<b>1</b>	<b>23</b>	<b>3</b>	
Total	0.6	0.4				105	44	

Legend: i l . : Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Miles of habitat potentially available with passage enhancement.  
 P:R: Ratio of pool length : riffle length.  
 Area: Average pool area (sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (0.0 - 1.0)	65	85	60	90	Perp.	S-M	1-2	1-2	M
II (1.0 - 2.0)	70	95	60	<b>N/A</b>	Perp.	S-M	1-2	1-2	M

LEGEND: Total: % of total habitat area dependent on LWD  
 HQ: % of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet.  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

<u>Reach (R.M. )</u>	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>Q</u>	<u>w</u>	<u>D</u>	
I (0.0 - 1.0)	6	.5	1	1.5	10	1	100'
II (1.0 - 2.0)	2.5	.2	.75	.4	6	.9	35'

LEGEND: W,w: Stream width (ft)  
D,d: Stream depth (ft)  
v: Velocity (feet/second)  
Q: Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

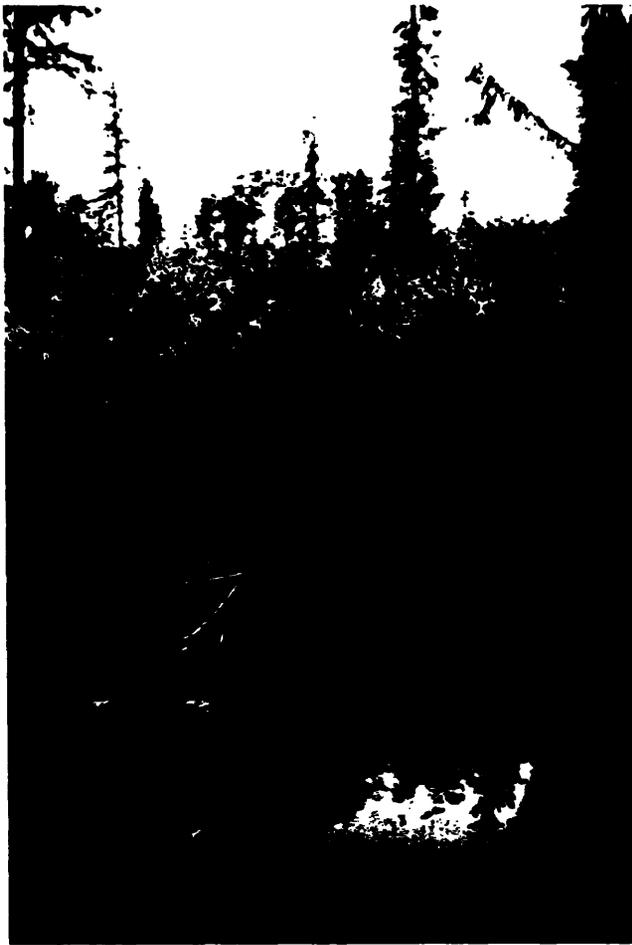
<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ORIENTATION</u>	<u>AIR/WATER TEMP. °F</u>		<u>TIME</u>
					<u>A/W</u>	<u>A/W</u>	
I (0.0 - 1.0)	8/16/83	1.5	85	S	71/53	72/53	1550-1745
II (1.0 -2.0)	8/16/83	0.4	75	S	66/49	71/53	1215-1400

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH RM</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>		<u>AQUATIC</u>				
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>	
			<u>Con.</u>	<u>Dec.</u>					
I (0.0-1.0)	6.2	100	5	5	1	II	10	S-L	1
II(1.0-2.0)	4.3	35	5	5	0	II	0	--	0

LEGEND: RCR: Riparian Condition Rating  
F.P.: Floodplain  
H.U.: Habitat Units H  $\geq$  4; M 2-3; L  $\leq$  1  
Con: # Conifer Species  
DecL # Deciduous Species  
Wetland: % stream length with adjacent wetlands;  
H  $\geq$ 50%; M 25-50%; L  $\leq$ 25%  
Size: Size of Wetlands  
S = Small (less than 1 acre)  
L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5273N)



**This large wetland (RM 0.0-0.1) occurs where Buck Creek enters the broad White River floodplain. High quality wildlife and fish habitat are found within this wetland. Wetland development is low on the rest of Buck Creek and the overall riparian quality is moderate (RCR=5.3).**



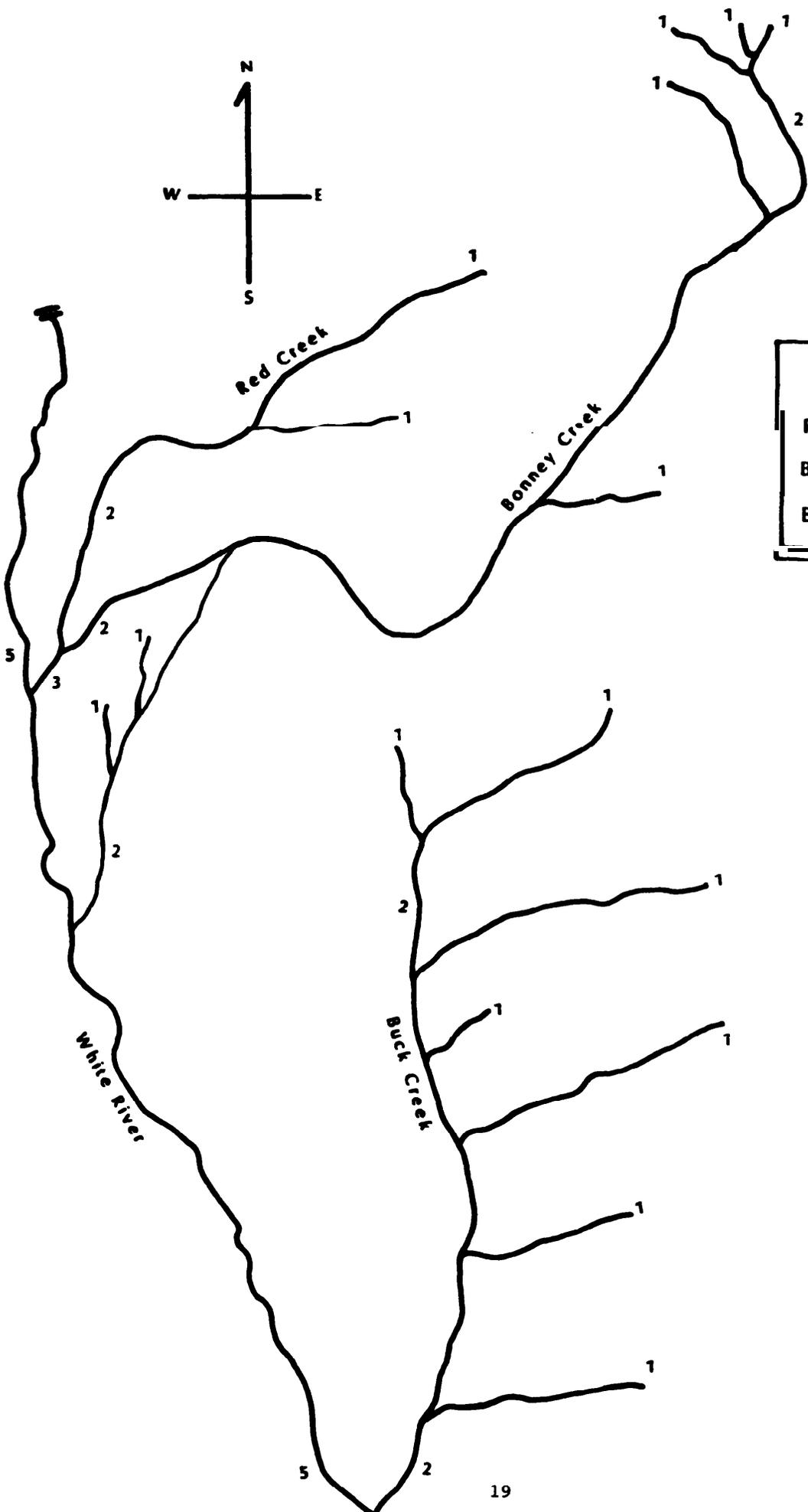
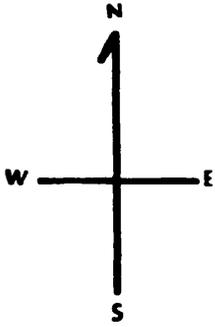
**Passage is generally good throughout the potential anadromous habitat (RM 0.0-1.0). This trash rack (RM 0.7), which has created a boulder chute, and a debris jam (RM 0.6) could act as partial passage barriers. Minor modifications could enhance passage at both sites.**



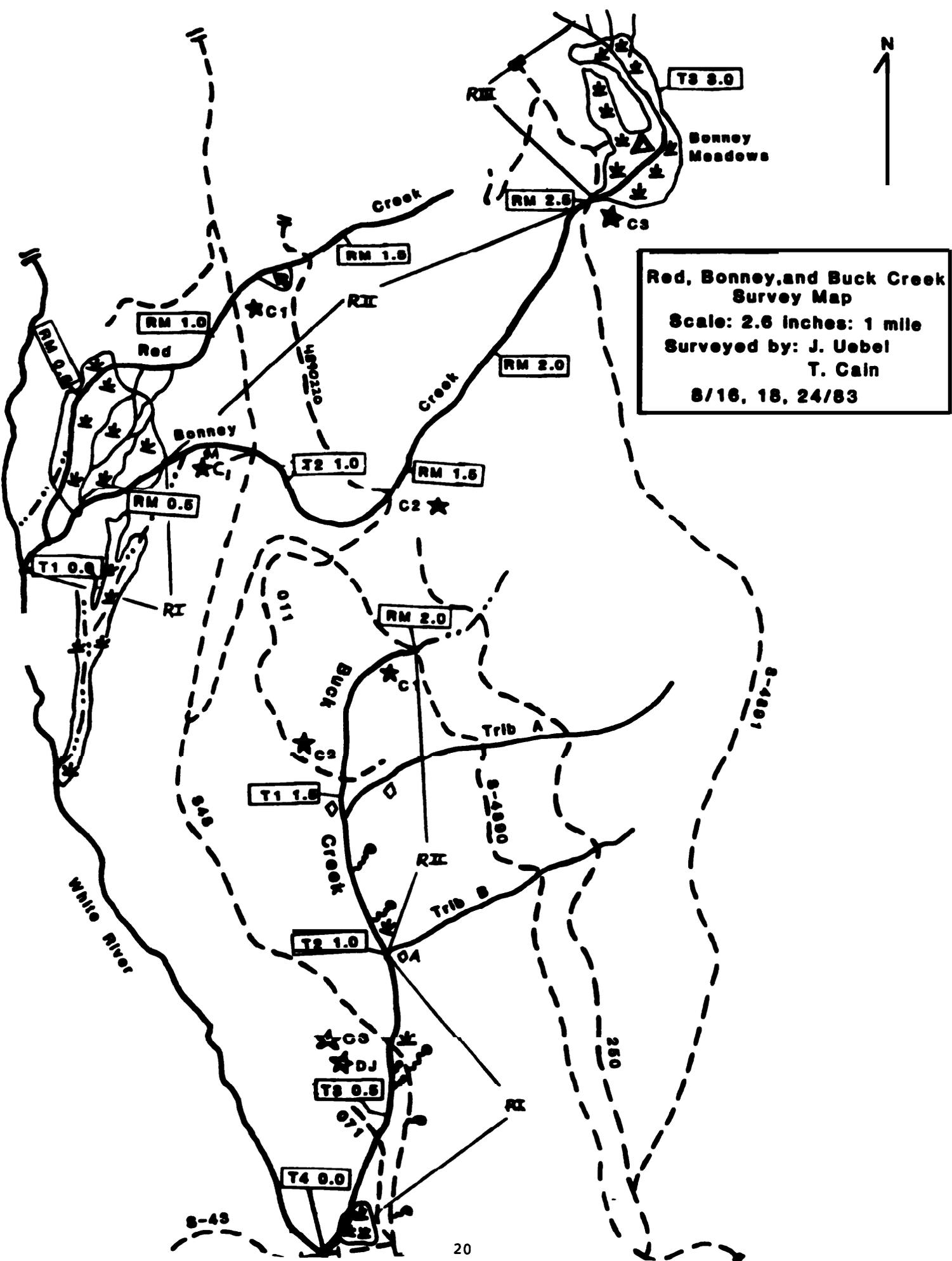
Large woody debris (LWD) plays an important role in habitat development throughout Reach I. Ninety percent of the high quality pools observed and 85% (100 sq.yds.) of the high quality gravels counted in this reach are associated with LWD. Although no high quality pools were observed in Reach II, LWD accounted for 60% of the pools present and 95% (25 sq. yds.) of the high quality gravels observed.



A dense coniferous overstory is present 1 mm RN 0.5 to 2.0. An active timber sale (408 Tie, units 1, 2, 8, and 10) provides an opportunity to supplement revegetation of the stream banks with deciduous canopy species to increase the riparian diversity. Stream shading has been reduced as a result of harvest in these areas, and streamside planting may also help speed regeneration of vegetative cover.



**STREAM ORDERS**  
Red Creek - 2nd  
Bonney Creek - 3rd  
Buck Creek - 2nd



**Red, Bonney, and Buck Creek Survey Map**  
 Scale: 2.6 inches: 1 mile  
 Surveyed by: J. Uebel  
 T. Cain  
 8/16, 18, 24/83

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

**R<sub>I,II,III</sub>** REACH # and SECTION

**T<sub>1</sub> 1.0** TRANSECT # and RIVERMILE

 OBSTRUCTION       BARRIER

**J<sub>1,2,3</sub>**      **JAM and #**  
**F( )<sub>1,2,3</sub>**      **FALLS, HEIGHT, and #**  
**C<sub>1,2,3</sub>**      **CULVERT and #**  
**B<sub>1,2,3</sub>**      **CHUTE and #**

 DIVERSION STRUCTURE (1 = water is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUM?

 DEBRIS TORRENT TRACK

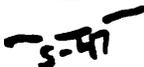
 SPRING

 UPPER LIMIT OF FISH PRESENT (A limit of potential anadromous fish habitat)

 BANK EROSION (EXTENSIVE/SEVERE)

 1.2.3, : MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

BONNEY/RED CREEKS

BEAR SPRINGS RANGER DISTRICT

Surveyors: Jeff Uebel, Tom Cain County: Wasco

Dates Surveyed: August 16, 18, Mouth Location:  
and 24, 1983 Bonney - T.4S., R.9E., Sec. 1  
Red - T.4S., R.9E., Sec. 1

Tributary to: White River Watershed Area:  
Bonney - 1458 acres, 2.3 sq. mi.  
Red - 426 acres, 0.7 sq. mi.

Drainage: Deschutes Stream Length.  
Bonney - 3.5 miles  
Red - 1.5 miles

TRI Compartments: Bonney 2200 Distance Surveyed:  
Iron 2202 Bonney 3.3 - miles  
Red - 1.3 miles

Game Fish: Rainbow trout Low Flow Width:  
Brook trout Bonney - 3 feet  
Red - 2 feet

Stream Order:  
Bonney - III  
Red - II

Potential Anadromous Species: Winter Steelhead  
Coho Salmon

Average Fish Habitat Condition Rating: Bonney - 5.9 (fair)  
Red - No low flow habitat

Average Riparian Condition Rating: Bonney - 6.3 (high)  
Red - 7.0 (high)

## BONNEY/RED CREEKS

### Survey Summary

#### A. Stream Summary

Bonney Creek is a minor tributary of the White River, contributing about 2 percent (1.5 cfs) of low flows at their confluence (RM 39.5 of the White River). The stream has apparently undergone channel realignment recently, likely due to winter flood conditions and flow diversion by debris jams. The stream now flows generally west in the lower mile. The present location of the mouth is about 0.7 miles north of the location shown on USGS and Forest Service maps (see survey map). The old channel appears to flow only intermittently, although perennial springs and seeps are present. The Red Creek channel is also incorrectly shown on printed maps; the stream is not a direct tributary to White River. The lower mile of the stream is heavily braided, and most of the flow (0.5 cfs) is contributed to Bonney Creek in a large wetland complex at their confluence (RM 0.2 of Bonney Creek).

These streams drain the south and east slopes of Bonney Butte. Bonney Creek heads in the large (125 acre) wetland complex of Bonney Meadows. Both drainages lie entirely within National Forest System land. Access to Red Creek is difficult except at the 48 road crossing (RM 1.1). Access to Bonney Creek is better with road crossings at RM 0.9 (48), 1.4 (4890220), 2.5 (4891),

and 2.8 (4891120) at Bonney Meadows Campground. The Bonney Creek Trail (471) roughly parallels the entire length (including the old channel). On August 16, 1.3 miles of Red Creek were surveyed. Bonney Creek (3.3 miles) was surveyed on August 18 and 24.

#### B. Watershed and Geomorphic Characteristics

Red and Bonney Creeks are small second and third order drainages issuing from narrow valleys with very high gradients (15 percent+) and steep, heavily forested sideslopes (70 percent+). Both flow out about 0.8 miles onto the broad valley floor of the White River, with heavily braided channels and high wetland development. They differ in their headwater characteristics: Red Creek heads in a small, steep (70 percent+) springs/wet area on the west slope of Bonney Butte, while Bonney Creek heads in the broad level basin of Bonney Meadows lying to the east of the Butte. Both creeks have good perennial base flows as a result of the wetland areas, but the flow regimes are heavily influenced by snowmelt and appear quite flashy in the mid and lower reaches.

#### c. Reach Description

Three reaches were delineated on Bonney Creek based on changes in gradient, valley configuration, and riparian and channel characteristics. Reach I, RM 0.0-0.6, is very low gradient (1-2 percent), and the channel is heavily braided in a large (100 acres) alder/sedge wetland in the broad, flat White River valley bottom. Reach II, RM 0.6-2.5, has high to very high gradient

(10-20 percent) increasing moving upstream, and the stream is entrenched in a single channel in a narrow, heavily-forested valley with steep sideslopes and narrow floodplain (50 feet wide). Reach III, RM 2.5-3.5, lies entirely within Bonney Meadows, it is a large, open, wet sedge/rush meadow, with a low stream gradient (2 percent).

Red Creek has two general reach areas, very similar in characteristics to the lower reaches on Bonney Creek. RM 0.0-1.0 is quite similar to Reach I of Bonney Creek. RM 1.0-1.5 is similar to Reach II of Bonney Creek. The small size of Red Creek (0.5 cfs) limits fish habitat development; no low flow fish habitat was observed on Red Creek. Elevated flows in winter and spring run-off periods may allow fish to utilize the lower mile as refuge habitat.

#### D. Fisheries

Moderate to high numbers of brook and rainbow trout were observed in Reaches I and II of Bonney Creek, while moderate numbers of brook trout were seen in Reach III. Fish habitat from RM 0.0-0.8 appears potentially suitable for winter steelhead and coho salmon utilization. Fish habitat quality was rated fair overall (5.9). Rearing habitat is highly variable over the stream length. Pools and riffles in the wetland Reaches I and III are well balanced (5:5). The high gradient in Reach I creates a continuous stepped cascading stream profile, with pools comprising only 30 percent of the stream area. Spawning habitat is limited overall and patchy in distribution. Over 50 percent of the 255 square yards observed were rated marginal due to their

placement in the channel. About 85 sq. yards of fair to excellent quality gravels are potentially suitable for and available to anadromous fish. Numerous passage barriers are present in Reach II (jams, culverts), but do not appear to limit resident trout or potential anadromous fish production.

#### E. Riparian Area

Riparian conditions on both streams are rated high quality overall (6.3), primarily due to the large wetlands present in Reaches I and III of Bonney Creek and Reach I of Red Creek. Dense conifer cover and a narrow floodplain limit riparian development in Reach II of both streams, which were rated moderate. Wildlife use appeared very heavy around the wetland areas, with abundant deer, elk, beaver, and some bear sign observed.

#### F. Rehabilitation/Enhancement Opportunities

Opportunities for habitat improvement appear to center on bank and channel stabilization, particularly in the area of the new Bonney Creek channel, RM 0.6-0.8. Also, a large recent landslide, apparently triggered by collapse of road sidecast material, has entered the Red Creek channel at RM 1.2. Stabilization of the streambank and slidetrack could lower sediment introduction to the stream, although sediment loading appears relatively low and this is, therefore, likely a low priority project. Pool size and depth in the Bonney Meadows area may limit large trout production. Increasing pool

quality, particularly near the campground, could enhance recreational opportunities. Pool and bank stabilization improvement work in the campground area could potentially be coupled with an educational display on fish habitat management.

## BONNEY CREEK

### Reach Summary

#### Reach I; RM 0.0 - 0.6:

1. Stream has entrenched itself in a new channel in this section (see survey map). Valley configuration is flat in the broad (1000 feet wide) valley bottom of the White River. The stream is entrenched in a shallow V-notch channel (5-10 feet deep) RM 0.0-0.2. The stream braids out extensively in a large wetland RM 0.2-0.6.
2. Stream gradient averages 2 percent.
3. Substrate composition varies from the small boulder/rubble of RM 0.0-0.2 to the mud/silt/woody debris substrate of the wetland area RM 0.2-0.6.
4. Pools dominate the stream area (60 percent), particularly in the wetland section.
5. Stream shading is high (95 percent).

Reach II; RM 0.6 - 2.5:

1. Stream has entrenched itself in a new channel, RM 0.6-0.8. Valley configuration becomes a narrow, flat bottom V with low floodplain development (50 feet) and moderate to steep sideslopes (40-70 percent).
2. Stream gradient is high (10 percent+).
3. Substrate is predominantly boulder (70 percent).
4. Pool area decreases, and cascades and riffles dominate the stream area (70 percent).
5. Stream shading remains high (90 percent).

Reach III; RM 2.5 - 3.5:

1. Valley configuration broadens to the very wide, flat-bottom headwater basin (1200 feet wide) of Bonney Meadows.
2. Stream gradient lowers to 2 percent.
3. Substrate becomes gravel dominated (70 percent).
4. Pools and riffles are evenly balanced (P:R=5:5).

5. Stream shading becomes low in the open meadow (30 percent).

Red Creek: RM 0.0 - 1.3:

1. Valley configuration of RM 0.0-1.0 is similar to Reach I of Bonney Creek. RM 0.0-0.6 is heavily braided and lies in the large wetland complex with Bonney Creek. Braiding and lack of channel definition continues in dense coniferous forest to RM 1.0. Above RM 1.0, the channel is well entrenched in a very narrow V-notch valley with steep sideslopes (70 percent+) and no floodplain development. A recent landslide (one to two years old), triggered by a mass failure of road sidecast, has entered the channel at RM 1.2 and ran out to RM 1.1. Slide volume appeared to be about 2,000 cubic yards.
2. Stream gradient RM 0.0-0.6 is 1-2 percent. RM 0.6-1.0, gradient varies between 5 and 15 percent. Above RM 1.0, gradient increases from 15 to 20 percent+.
3. Substrate varies from the mud/silt/woody debris of the braided reach (RM 0.1-1.0) to boulder/rubble dominated above RM 1.0.
4. Pool development is very low, with riffle and cascades dominant above RM 1.0 (80 percent) and shallow riffle below that point.
5. Stream shading was high throughout (95 percent+).

## BONNEY CREEK

### Fish Habitat Summary

#### Reach I; RM 0.0 - 0.6:

1. Fish habitat is rated fair to good (6.8) for both resident and anadromous fish.
2. Rearing habitat is fair-good throughout the reach. Pools compose 60 percent of the surface area. Although small (4 sq. yards surface area), the pools are of moderate depth (12-20 inches) and have high effective cover from LWD and overhanging banks. Average pool size and depth are lower in the wetland area (0.2-0.6) due to extensive channel braiding. RM 0.0-0.2 has exceptionally high quality pool habitat for a small stream (2 cfs). Both pool and spawning gravel quality appear to be highly dependent on LWD.
3. Spawning habitat is patchy in distribution. Approximately 50 sq. yards of gravels are present below the wetland area (RM 0.0-0.2). Virtually no spawning habitat is present within the wetland. Approximately 50 percent of the 50 sq. yards available are of a size class suitable for anadromous fish and 50 percent were rated marginal due to channel placement.

4. Low flow conditions in the heavily braided channels of the wetland restrict upstream passage over several small debris jams. These debris accumulations are easily passable during higher flow conditions.

Reach II: RM 0.6 - 2.5:

1. Fish habitat is rated fair overall (5.4 HCR).
2. Pool rearing habitat conditions are similar to RM 0.0-0.2 in Reach I. Stream gradient is increased (10 percent average), but abundant LWD input results in a highly "stepped" channel morphology with fair to good pool development. Stream gradient continues to increase and both pool and riffle quality decrease moving upstream through this reach. True riffle rearing habitat is limited throughout.
3. Spawning habitat is patchy in distribution. A large volume of gravel/rubble material has been deposited in the braided area above the wetland due to recent channel downcutting below the Road 48 culvert (RM 0.7-0.8). Most of the 130 sq. yards of spawning habitat observed in the reach are located there. Approximately 50 percent of the gravels are of a size class suitable for anadromous fish, and 50 percent of the total gravels were rated marginal due to channel placement. Both spawning and rearing habitat quality are heavily dependent on LWD structure.

4. No anadromous fish habitat is present above RM 0.7. A series of small debris jams combined with high gradient (15 percent+) block upstream fish passage above RM 0.7. The culvert C1 (RM 0.8) also is impassable to salmonids.

Reach III; RM 2.5 - 3.5:

1. Fish habitat is rated fair to good (6.4) for the resident brook trout present. The reach lies entirely within the Bonney Meadows area.
2. Rearing habitat quality is good. Pools are small in surface area (3 sq. yards) but have moderate depth (2 feet) and high effective cover from overhanging vegetation.
3. Spawning habitat is very good in quality and quantity. Eighty sq. yards of gravels are present. Approximately 50 percent were rated marginal due to channel placement. Spawning habitat quality is higher at the upper end of the reach.
4. Habitat quality has been seriously degraded in the area of Bonney Meadows Campground. Heavy bank erosion, channel widening, and loss of pool depth and cover have occurred due to high recreational and livestock use (RM 2.8-3.0).

Red Creek; (RM 0.0 - 1.2):

No low flow fish habitat exists on Red Creek. The area of the wetland (RM 0.0-0.6) probably provides over-wintering habitat for resident trout present in White River and Bonney Creek, and potentially for introduced anadromous fish.

## BONNEY CREEK

### Riparian Summary

Riparian habitat quality in the Bonney/Red Creek drainage is greatly increased by the large (100 acre +) wetland development in Reach I (confluence of Red and Bonney Creeks) and III (Bonney Meadows). These two areas provide a complex of wildlife habitat types unusual on the Forest. The extent and quality of the wetland in Reach I (RM 0.2-0.6) has likely been greatly increased due to the addition of surface flow from Bonney Creek following its recent channel realignment (see survey map).

#### Reach I; RM 0.0 - 0.6:

1. Riparian habitat conditions are rated very high quality (8.6).
2. This reach lies in the very wide valley bottom of the glacial-scoured White River valley. Floodplain development is greater than 250 feet.
3. Structural diversity is high, with all five habitat units well-represented.
4. Overstory composition is exceptionally diverse, with six coniferous and two deciduous species present.

5. A large wetland is present at RM 0.2-0.6. Snags are abundant in this area, and vegetational types range from pond plants, through small wet and dry meadow areas, to shrub/cedar/cottonwood wetland areas. Deer, elk, bear, beaver, and other wildlife sign was abundant in this area.
6. The old intermittent Bonney Creek channel and associated springs and small tributaries now form a narrow wetland complex 0.8 miles long, on the south margin of the major wetland in Reach I (see survey map).

Reach II; RM 0.6 - 2.5:

1. Riparian habitat condition is rated moderate (4.9).
2. Floodplain development is very limited (50 feet) in the narrow V-notch valley.
3. Four habitat units are present. The shrub/seedling/sapling unit is absent in this area. Dense canopy dominated by pole and small sawtimber limits understory development.
4. The overstory is conifer dominated (four species); scattered cottonwood are present.
5. Limited small wetland development is present 2.7-2.8. No other special habitats were observed.

Reach III: RM 2.5 - 3.5 (Bonnev Meadows):

1. Riparian conditions are rated high quality (7.5).
2. True floodplain development is low due to the small size and very well-regulated flows of Bonney Creek in this headwater area. However, the valley bottom area and riparian wetland development is extensive (100 acres) along the entire reach in the Bonney Meadows area.
3. Only three habitat units are present in this wet meadow dominated reach (grass/forb, pole, and sparse small sawtimber).
4. The limited overstory is composed of scattered mountain hemlock, sub-alpine fir, and lodgepole pine.
5. The whole reach lies within the large wetland complex of Bonney Meadows.
6. Road 4891 and the Bonney Meadows Campground receive heavy seasonal recreational use, which likely affects big game utilization of the high quality habitat available. Big game forage conditions appear good in the old bum area adjacent to the west on Bonney Butte (huckleberry/young fir dominated), and excellent cover is available in the gently sloping, heavily forested slopes to the north and east.

Red Creek; (RM 0.0 - 1.5):

RM 0.0-0.7: Riparian habitat conditions are identical in the wetland area of Reach I, Bonney Creek.

RM 0.7-1.0: Heavy channel braiding creates numerous small wet areas, but densely stocked conifers with heavy canopy (cedar/hemlock dominated) limit riparian habitat development. Due to lack of channel entrenchment, the floodplain area is large, and the channels are actively meandering.

RM 1.0-1.5: The single channel is sharply entrenched in a narrow V-notch valley with very steep sideslopes (70 percent+). Floodplain development is minimal (25 feet). Riparian habitat development is limited by heavy shading from the dense coniferous canopy. Small springs and seeps are present on the southeast slopes. Mass failure of new road sidecast over a spring area has caused a 2000 cu. yd. landslide. The slide entered Red Creek channel at RM 1.2 and "ran-out" to RM 1.1 (see special case form).

## BONNEY CREEK

### Rehabilitation/Enhancement Summary

#### Bank Stabilization; RM 0.1, 0.6-0.8, 1.4, 2.8-3.0:

A log stringer bridge at an old spur road crossing at RM 0.1 has collapsed, and the bridge footing area is revelling and eroding into the stream channel. Pulling back the road fill and seeding the area (1000 sq. feet) would decrease sediment introduction at this site. Heavy equipment access appears fair through the network of CAT trails in the White River floodplain.

Channel downgrading of 4-8 feet has occurred at RM 0.6-0.8 following establishment of the new channel. Banks throughout this area are raw and actively eroding. Planting of shrubs and deciduous canopy species (possibly coupled with creation of riparian openings - see below) could help stabilize banks, prevent channel widening, and increase riparian diversity in this area. Access is remote.

Construction of the spur road 4890220 channel crossing at RM 1.4 required a large amount of fill. The downstream fill slope (about 400 sq. feet) has not revegetated, and erosion of both soil and boulder/rubble is evident, particularly along the east streambank. This condition could possibly be alleviated through some planting and reworking of the fill.

Heavy recreational and livestock use along the streamchannel RM 2.8-3.0 adjacent to the Bonney Meadows Campground has eliminated bankside vegetation and is promoting channel widening, bank erosion, and a loss of pool depth and effective cover. Heavy sedimentation of spawning gravels was also observed. Streamside planting, combined with fencing and possibly some educational exhibits, may help to rehabilitate trout habitat conditions in this area. Access to the area is excellent through the campground. All of the projects listed above are relatively low priority, although the work at the campground area will likely have multi-resource benefits.

Bank and Valley Sideslope Stabilization, Red Creek RM 1.2:

A 2000 cu. yd. landslide triggered by mass failure of road sidecast has entered the channel at RM 1.2. Surface erosion is occurring on the exposed soil of both the slide track and streambank of Red Creek. Seeding and/or planting hydrophytic shrubs may help stabilize the area (approximately 13,000 sq. feet). Access to the site is excellent from the spur road 4890220. (This project is a relatively low priority.)

Channel Stabilization - Bonney Creek RM 0.6-0.7; Red Creek 0.7-1.0:

The stream channel in these areas is not well entrenched or defined. Streamflow is braided out into ephemeral channels, and fish habitat is virtually non-existent. Reducing the braiding and forming a single channel where possible would likely improve fish habitat conditions. This could

apparently be accomplished using log or rock deflectors. This channellization work could be coupled with in-channel structural pool habitat enhancement (area, depth, and cover) to further enhance fish habitat. With this improvement work, both areas could be potentially utilized by anadromous fish. Almost 150 sq. yards of fair to good quality anadromous spawning gravels lie above the braided area on Bonney Creek, and project work in that area is therefore a higher priority. Access is remote, although old CAT trails are present throughout the area.

Riparian Habitat Enhancement - Bonney Creek RM 0.5-2.0; Red Creek RM 0.6-1.0:

Canopy closure is near 100 percent and the riparian understory vegetation development appears limited by the dense shading in these areas. Small patch cutting or burning (1-2 acres) on the north bank could increase light levels and stimulate plant species diversity and growth. Deciduous canopy species are also limited in the area; planting cottonwood and/or alder could be coupled with canopy opening to increase habitat diversity. Localized small wet areas and seeps and stream channel braids will complicate heavy equipment access and operation in these areas. Road access is remote to most sites, although some of the numerous CAT trails in the area could be rehabilitated and utilized.

BONNEY CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM					POOLS				RIFFLES (%)				
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D
I (0.0-0.6)	6.8	95	6:4	2	L-M	4	H	0	50	40	10	0	0	4
II (0.6-2.5)	5.4	90	3:7	10	L-M	4	H	0	70	20	10	0	0	4
III (2.5-3.5)	6.4	30	5:5	2	M	3	H	0	*	15	40	30	15	1

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq$  12", M = 12 - 29", H  $\geq$  30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq$  40%, M = 40-60%, H  $\geq$  60 %)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5 percent

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

Species	<u>REACH</u>			<u>TRIBUTARIES</u>	
	I	II	III	Red Creek	
Trout - j	H	M	M	--	
Rb - a	M	L	( )	--	
BT - a	L	L	M	--	

LEGEND: L = Low (0-5), M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile  
\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

BONNEY CREEK

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0-0.6)	45	20	25
II (0.6-2.5)	130	60	70
III (2.5-3.0)	<b><u>80</u></b>	<b><u>40</u></b>	<b><u>40</u></b>
TOTAL	255	120	135

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM</u>	<u>(R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
0.3		Debris jam	None	P	None
0.8		Debris jam/ gradient	None	N	None
0.9		Culvert	C1	N	None
1.3		Culvert	c2	N	None
2.6		Culvert	c3	N	None

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

BONNEY CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

<u>REACH (RM)</u>	<u>Miles</u>		<u>P:R</u>	<u>Rearing</u>		<u>Spawning</u>		<u>Comments</u>
	<u>Avail.</u>	<u>Pot.</u>		<u>Area</u>	<u>Depth</u>	<u>1"-3"</u>	<u>3"-6"</u>	
I (0.0-0.6)	0.6	--	4:6	4	1	20	0	Small Creek (1-2 cfs)
II (0.6-2.5)	0.1	0	3:7	4	1	40	25	Small Creek (1-2 cfs)
III (2.5-3.0)	0	0	--	--	--	--	--	
TOTAL	0.7	0.0				60	25	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
 Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
 P:R: Ratio of pool length:riffle length.  
 Area: Average pool area (Sq. yds.).  
 Depth: Average pool depth (feet).  
 Spawning: Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

<u>Reach (R.M.)</u>	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	<u>Total (%)</u>	<u>HQ (%)</u>	<u>Total (%)</u>	<u>HQ (%)</u>	<u>OR</u>	<u>#</u>	<u>L</u>	<u>Dia</u>	<u>Source</u>
I (0.0-0.6)	70	90	70	90	Var	S/M	2+	1-2	M
II (0.6-2.5)	80	80	80	80	Perp	S/M	2+	2	M
III (2.5-3.0)	30	30	50	70	Var	S	2+	1	L

LEGEND: Total: Percent of total habitat area dependent on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow, Perp = perpendicular, Var = variable  
 I: Number of logs/structure, S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

BONNEY CREEK

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

<u>Reach (R.M.)</u>	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>q</u>	<u>W</u>	<u>D</u>	
I (0.0-0.6)	4	0.3	1	1.3	8	1	8-500
II (0.6-2.5)	3	0.3	1	1	8	1.5	50
III (2.5-3.0)	1	0.2	2	0.4	1.5	0.5	500+

LEGEND: W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 V: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. °F</u> <u>A/W</u>	<u>A/W</u>	
I (0.0-0.6)	8/18/83	1.3	95	E-W	66/50		1100
II (0.6-2.5)	8/24/83	1.0	90	E-W	68/50		1445
III (2.5-3.0)	8/24/83	0.4	30	N-S	56/57		1700

BONNEY CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>		<u>VEGETATION</u>		<u>AQUATIC</u>				
		F.P. (ft.)	H.U.	Overstory Con. Dec.	Streamclass	Wetland%	Size	Special Habitat		
I (0.0-0.6)	8.6	300	5	6	2	II	50	S+L	2	
II (0.6-2.5)	4.9	50	4	4	1	II	10	S	1	
III (2.5-3.5)	7.5	500	3	3	0	II	100	L	2	
<u>Red Creek</u>										
(0.0-1.0)	8.6	300	5	6	2	III	60	L	1	
(1.0-1.5)	3.8	25	3	4	0	III	10	S	1	

LEGEND:

RCR: Riparian Condition Rating

F.P.: Floodplain Width, in feet

H.U.: # Habitat Units (H  $\geq$  4; M = 2-3; L  $\leq$  1)

Con: # Conifer Species

Dec: # Deciduous Species

Wetland: % stream length with adjacent wetlands; H **>50%**; M = 25-50%;  
L (25%)

Size: Size of Wetlands  
S = Small (less than 1 acre)  
L = Large (greater than 1 acre)

KAnderson:paw (WP-PJS-5217N)



Reach I (RM 0.0 - 0.6) of Bonney Creek is quite diverse in fish habitat and riparian conditions. This view (RM 0.1) shows the high quality fish habitat and moderate quality riparian development present RM 0.0-0.2. The following two photos illustrate the changes in habitat moving upstream through the reach. Large woody debris is a very important element of channel structure throughout the stream, with 70% of spawning and rearing habitat development dependent on incorporated LWD.



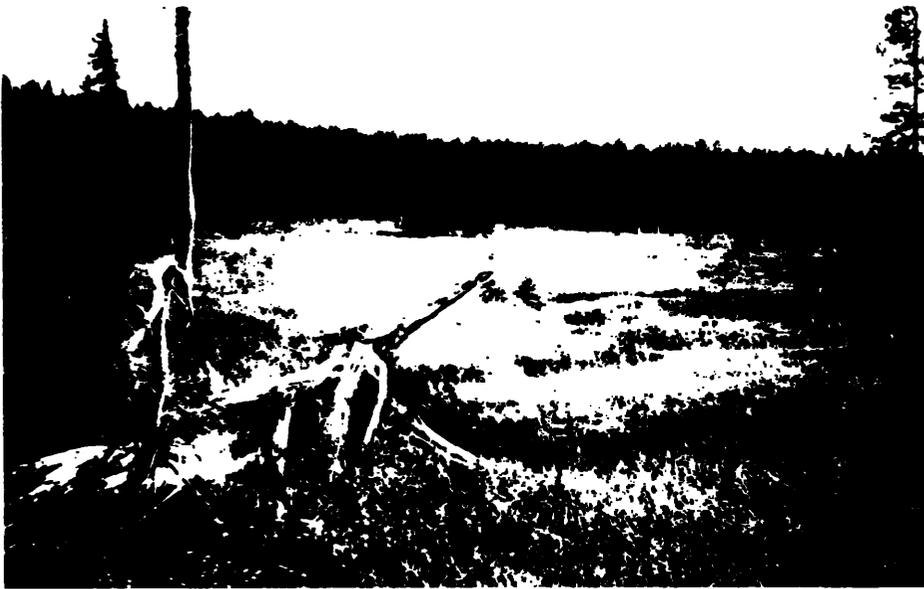
A large wetland complex (100 acres) is located at the Red Creek confluence (RM 0.2 Bonney Creek). Excellent wildlife habitat development is found throughout Reaches I and III of Bonney Creek in the high quality wetlands present. Channel braiding is abundant in this wetland (RM 0.2 - 06), and salmonid rearing habitat conditions are excellent.



This view at RM 0.6 is near the upper end of the large wetland in Reach I of Bonney Creek. Channel downgrading and bank erosion following the establishment of a new channel at RM 0.7 - 0.8 has resulted in the development of a large sediment plain RM 0.5 - 0.6. Potential anadromous spawning habitat conditions are very good in this area, with over 125 square yards of gravels available.



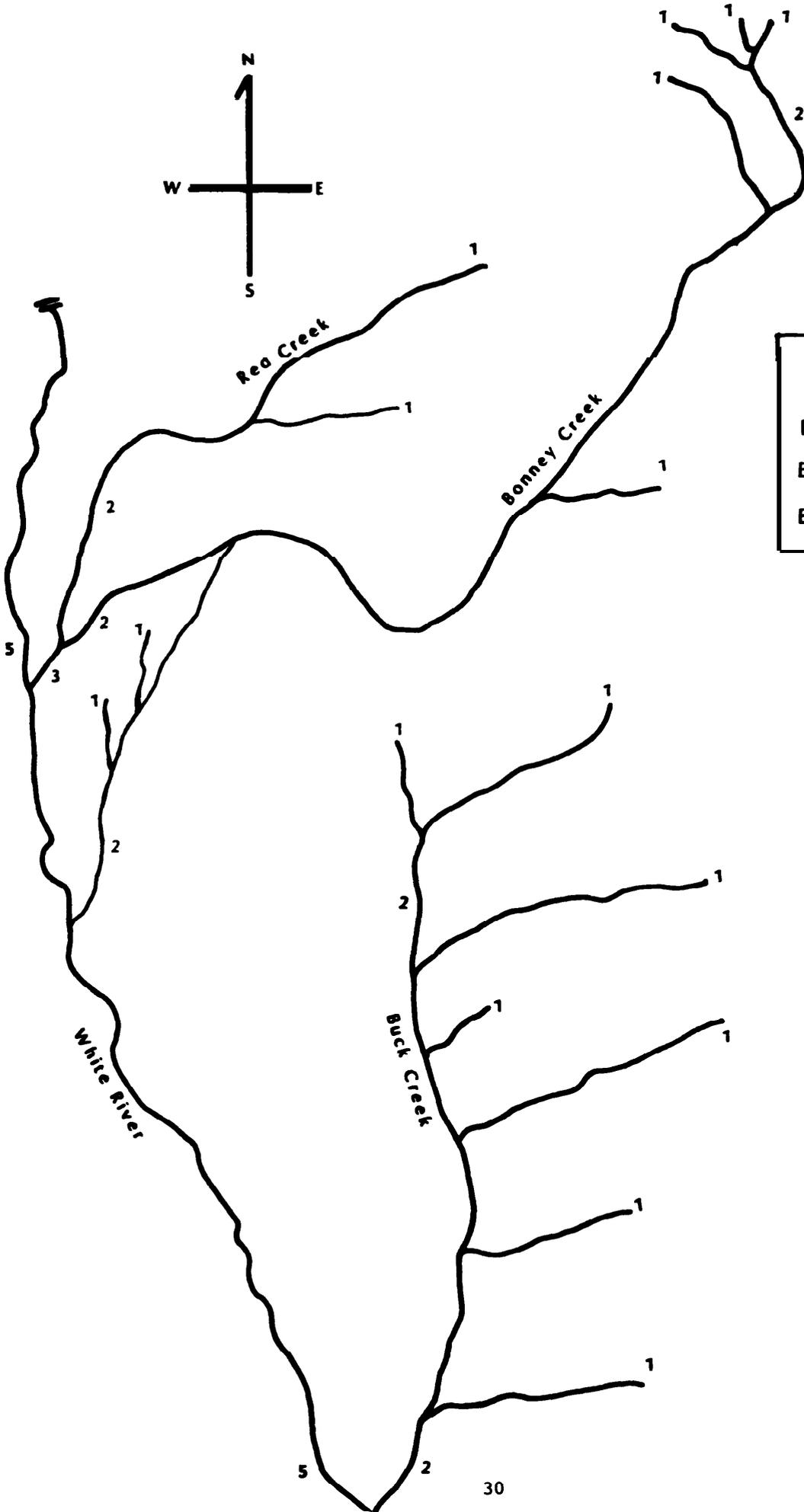
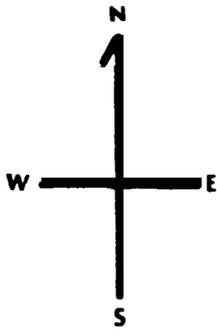
Reach II (RM 0.6-2.5) composes over half of the length of Bonney Creek. This view (RM 0.7) is near the limit of potential anadromous fish habitat, where continuous high gradient cascades (**15-20%**) present impassable migration barriers. Resident trout habitat quality is fair in this reach and good in Reaches I and III; moderate numbers of resident trout are found all the way up to the headwater springs (RM 3.5). Red Creek is very similar to Reach II throughout most of its length, but fish habitat development is very poor due to low summer flows (**1/2** cfs). Note the dense canopy and low understory development typical of Reach II and Red Creek.



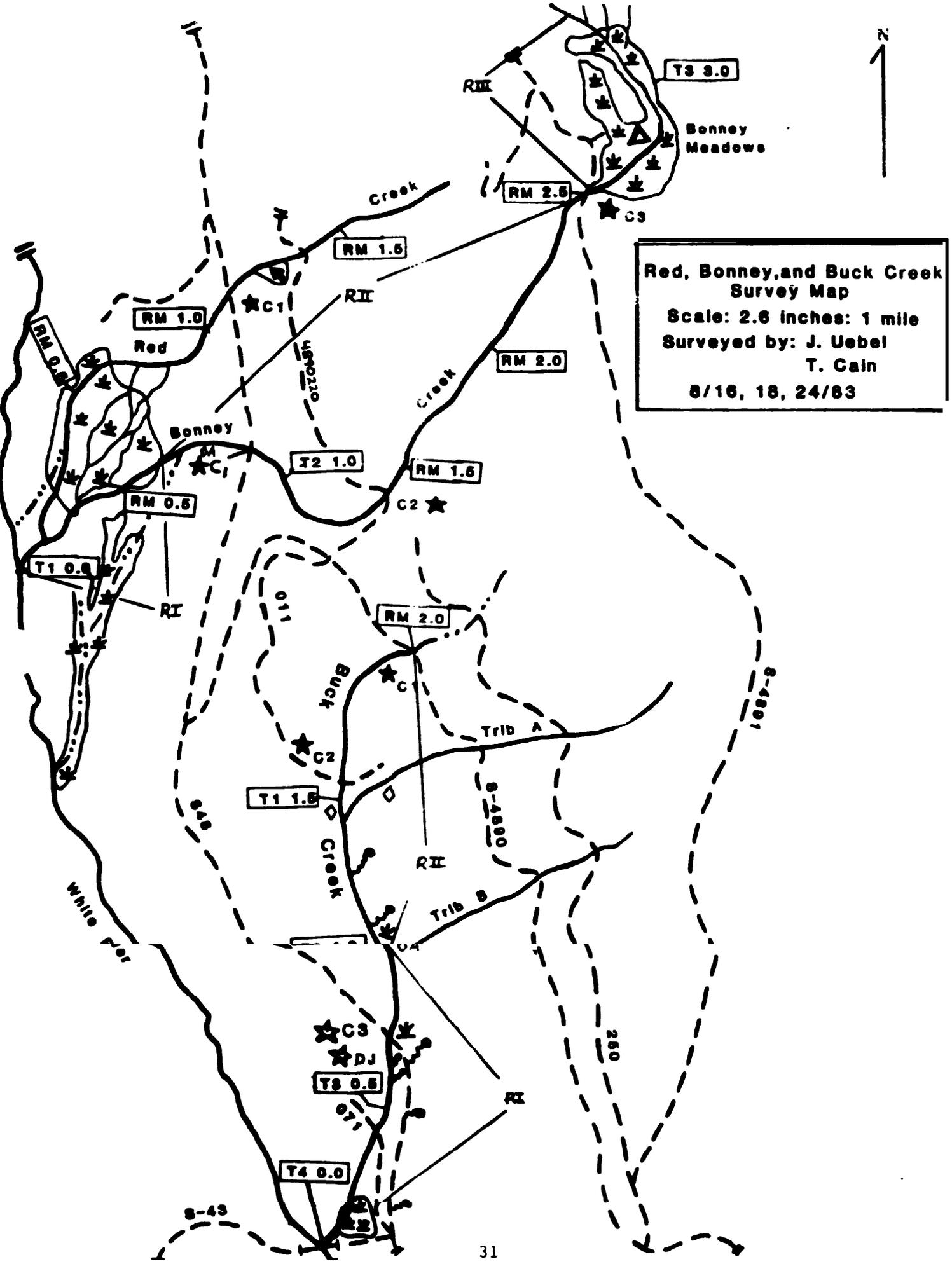
Bonney Creek flows through the extensive Bonney Meadows wetland area (125 acres) in Reach III (RM 2.5 - 3.3). The channel is very narrow and sharply entrenched (2-3 ft. deep). In much of this reach, as can be noted in this typical view at RM 2.7 (center and right middleground) Trout habitat is good quality in this reach, with very high effective cover from overhanging banks and vegetation. Habitat quality is deteriorated RM 2.7 - 2.9, near the Bonney Meadows Campground, where high recreational use by humans and livestock have contributed to bank erosion and channel widening.



At RM 1.3 on Red Creek, a very large landslide (2000 cu. yards.) has entered the channel (right and center middleground). The slide was apparently triggered by underlying springs and the collapse of sidecast material from road construction (background). Rehabilitation opportunities at the site include stabilization of the eroding sideslope and streambanks in this area to reduce sediment loading of the stream.



**STREAM ORDERS**  
Red Creek - 2nd  
Bonney Creek - 3rd  
Buck Creek - 2nd



Red, Bonney, and Buck Creek  
 Survey Map  
 Scale: 2.5 inches: 1 mile  
 Surveyed by: J. Uebel  
 T. Cain  
 8/16, 18, 24/83

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

**R<sub>1,II,III</sub>** REACH # and SECTION

**T<sub>1</sub> 1.0** TRANSECT # AND RIVER MILE

**★ OBSTRUCTION**                      **★ BARRIER**

**J<sub>1,2,3</sub>** JAM and #  
**F( )<sub>1,2,3</sub>** FALLS, HEIGHT, and #  
**C<sub>1,2,3</sub>** CULVERT and #  
**B<sub>1,2,3</sub>** CHUTE and #

 DIVERSION STRUCTURE (If water is used for irrigation purposes)

 MINE or ROCK PIT SITE

 BRIDGE

 LANDSLIDE, SLUMP

 DEBRIS TORRENT TRACK

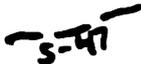
 SPRING

 UPPER LIMIT OF FISH PRESENT (A limit of potential anadromous fish habitat)

 BANK EROSION (EXTENSIVE/SEVERE)

 1.2.3, MISCELLANEOUS

 WETLAND HABITAT

 ROAD AND ID NUMBER

 EARTHFLOW

IRON CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar County: Hood River  
Doug Kinzey  
Dates Surveyed. July 7-8 and 11-12, 1983 Mouth Location.  
T.3S., R.9E., Sec. 36  
Tributary to: White River Watershed Area: 5200 acres  
8.1 sq. miles  
Drainage: Deschutes Stream Length: 4.3 miles  
TRI Compartments: Iron 2202 Distance Surveyed  
Gamefish: Rainbow trout 4.3 miles mainstem  
0.8 miles Carp Creek  
Potential Anadromous Species: 0.4 miles South Fork  
Steelhead trout Iron Creek  
Coho salmon 0.1 miles North Fork  
Chinook salmon Iron Creek  
1.5 miles Upper  
Tributary Creek  
Low Flow Width (Avg.): 14 ft.  
Stream Order: IV

Average Fish Habitat Condition Rating: 4.6 (Fair)

Average Riparian Rating: 7.0 (High)

## IRON CREEK

### Survey Summary

#### A. Stream Summary

Iron Creek is a fourth order tributary of the White River providing approximately 50 percent of the flow (30 cfs) to the White River at their confluence (RM 2.7. of Iron Creek). At RM 2.7 a new channel (approximately 5 years old) of White River has captured the established Iron Creek channel. The only major tributary drainage, known locally as Carp Creek, enters Iron Creek at RM 1.7 contributing 4 cfs at low flows. Oregon State Highway 35 crosses the northern headwaters of Iron Creek and Forest Service Road 48 parallels the stream on its eastern slope. Rainbow trout were observed above RM 3.9 of the mainstem and up to RM 0.1 on Carp Creek.

#### B. Watershed Characteristics

Iron Creek runs along the east side of the wide (1/2-1 mile) White River glacial valley. The gradient of the mainstem is between 3 and 5 percent. The flow regime is flashy below RM 2.7 where the White River channel influences the system, and well regulated above this point. Numerous first and second order intermittent streams drain the east slope and flow

into Iron Creek. Wetland areas include a pond (1 acre) on the eastern floodplain at RM 0.3, several large (1 to 4 acres) and many small sedge meadows above RM 3.0.

c. Gemorphology

The floodplain width over the entire mainstem is greater than 200 feet. Sideslope gradients are 60 to 70 percent on the east side and less than 20 percent on the west. The floodplains of the tributaries narrow to less than 70 feet wide above the White River valley bottom, with sideslope gradients greater than 70 percent.

D. Reach Description

Three reaches were identified along the mainstem. Reach I is flashy and influenced by flow from the channel of the White River; whereas Reaches II and III are well regulated. All are characterized by a boulder/rubble substrate and are riffle dominated. Reach III is also influenced significantly by the presence of large woody debris (LWD).

E. Fisheries

The overall rating of the fisheries habitat is fair with a Habitat Condition Rating (HCR) of 5.6. Rainbow trout were observed in Reach III (RM 3.9-4.3) and the lower section of Carp Creek in low numbers. Riffles and runs dominate the stream area. The pool-to-riffle ration (P:R) is 2:8

in the lower reach and 4:8 in the upper stream reaches. Pools are generally small (one square yard) in Reaches I and II with moderate depths, good effective cover and fast velocities (3 to 5 feet/sec). Pools in Reach III average 6 square yards and are influenced by LWD. High quality pools are formed by boulders in Reach II and LWD in Reach III.

Spawning habitat is extremely limited. Spawning gravels total 76 square yards. Most (70 percent) were rated marginal due to extremely high sand/sediment loading and usually occurred in small beds (<1 yard). The lower sections of the North Fork Iron Creek and Carp Creek have the highest gravel concentrations (see Table III). No barriers are present on the mainstem. Fish habitat appears suitable for chinook salmon, coho salmon, and steelhead trout in Reaches II and III, North Fork Iron Creek, and lower Carp Creek.

F. Riparian Area

The Riparian Condition Rating (RCR) is rated high (RCR = 7.5). Positive factors are a high number of habitat units (4-5), coniferous species diversity, wetland development, snag patches, and a very wide floodplain (200+ feet). Negative factors include the lack of deciduous species and high levels of bank and channel instability.

#### G. Rehabilitation and Enhancement

Enhancement and rehabilitation opportunities should center on increasing spawning habitat on the mainstem, increasing riparian habitat diversity with deciduous species, increasing channel and bank stability in Reach I, and increasing off-channel rearing and holding pool quality in Reach I and II. Equipment access to RM 1.0 is potentially available through the use of an abandoned road system on the eastside floodplain.

#### H. Special Interest

iron Creek is named for the iron oxide leaching into the system from numerous seeps and small tributaries along the western floodplain from the mouth to RM 3.7. The source may be from the sedge meadows in this area.

Macroinvertebrate populations normally identified with the stream substrate material appear to be sparse in these iron oxide areas. Fish production in these areas may be limited during some periods (i.e., low water) as well.

IRON CREEK

Reach Summary

Reach I; RM 0.0 - 2.7:

1. Valley configuration is a very wide, flat-bottom V-shape with a floodplain greater than 200 feet wide.
2. Gradient is low (3 percent).
3. Substrate is predominantly boulders and rubble (55 percent).
4. Riffles dominate the stream area (P.R = 2:8).
5. Stream shading is low (20 percent).
6. Channel and bank stability are very low. The stream has numerous low flow braids and high flow side channels.

Reach II; RM 2.7 - 3.9:

1. Valley configuration and floodplain width are the same as Reach I.
2. Average gradient increases to 4.5 percent.

3. Substrate is boulder dominated (55 percent).
4. Percentage of pool surface area increases (P:R = 4:6).
5. Shading increases to 60 percent.
6. Bank and channel stability increases due to decreased flow and increased bank vegetation.\*

\*A channel of White River enters Iron Creek at RM 2.7 flowing approximately 15 cfs.

Reach III; RM 3.9 - 4.3:

1. Previous valley configuration and floodplain width remain constant.
2. Gradient is low (3 percent).
3. Substrate is predominantly small rubble.
4. Pool-to-riffle ratio remains the same as Reach II, however pool size increases.
5. Stream shading is high (80 percent).

6. LWD is the dominant structural element of the stream channel.

Carp Creek; RM 0.0 - 0.8:

1. Valley configuration changes at RM 0.2 from very wide, U-shaped to narrow V-notched.
2. Gradient also changes appreciably at RM 0.2 (from 4 percent to 8 percent). Overall gradient increases (>10 percent) again at RM 0.4 as the stream becomes a series of chutes and falls (12+ feet high).
3. Substrate changes from boulder and rubble dominated to rubble and bedrock at RM 0.4.
4. Stream shading is high throughout (90 percent).
5. Pool area changes from 40 percent of the stream surface area below RM 0.4 to less than 10 percent above. A corresponding decrease in pool quality is also evident.

Upper Tributary C:

Upper Tributary C was surveyed from Oregon State Highway 35 south approximately 2 miles to where it braids into a sedge meadow. The flow was estimated at 7 cfs below the highway. At the confluence of Iron Creek

(RN 2.9), Tributary C had less than 3 cfs, indicating the meadow retains much of the flow. Characteristics are:

1. The tributary channel is within the White River - Iron Creek floodplain.
2. Gradient is constant and moderate (6 percent).
3. Substrate is a gravel/rubble/sand mixture.
4. Riffles dominate the stream area (P:R = 2:8).
5. Stream shading is low (10-20 percent).
6. The mainstem flow is well-regulated. There are numerous braids and side channels filled during increased flows.

North Fork Iron Creek; RM 0.0 - 0.1:

1. Above RM 0.1 valley configuration is V-notched and floodplain width is narrow (<30 ft.).
2. Stream gradient also changes quickly from a low (3 percent), to a high, stepped gradient (>11 percent).
3. Boulders and LWD are the major structural elements.

4. The pool-to-riffle ratio is about even (P:R = 5:5) over the surveyed section.
5. Shading is high (80 percent).

South Fork Iron Creek; RM 0.0 - 0.3:

1. Valley configuration is wide, U-shaped, with gentle side slopes (30 percent gradient).
2. Gradient is high (9 percent).
3. Substrate is rubble, gravel, and sand mixture..
4. Riffles dominate the stream area (P:R = 1:9).
5. Stream shading is high (90 percent).

## IRON CREEK

### Fish Habitat Summary

Fish habitat condition ratings range from poor to good for Iron Creek. The overall Habitat Condition Rating is fair (HCR = 4.6).

Local residents and previous fishing experience indicate rainbow trout utilize at least the lower reach during periods of high sediment loading in White River. Electra-shocking in Reaches I and III during July 1978, did not show fish to be present.

#### Reach I; RM 0.0 - 2.7:

1. The fish habitat is rated fair (HCR = 5.1).
2. Rearing habitat is fair. The stream is predominately fast-flowing riffles (P:R = 2:8). Small pools (average size = 1 square yard) are present behind boulders or along stream edges, with moderate to high effective cover provided by turbulence and instream rubble and boulders.
3. Spawning gravels appear limiting. Only 24 square yards of marginal gravels were observed. Major factors reducing the quality of gravels

are velocity, a high proportion of sand mixed with gravels, and the degree to which gravels are cemented together by a surface crust.

4. No passage barriers were noted.

Reach II; RM 2.7 - 3.9:

Fish habitat quality is rated good (HCR = 6.3), an increase from Reach I.

2. The major single factor contributing to the higher HCR is a greater abundance of pools (P:R = 4:6). Pools, however, are still small (averaging 1 square yard). High quality pools are largely boulder dependent (80 percent).
3. Only two square yards of marginal quality spawning gravels were observed.
4. Fish passage continues unimpaired.

Reach III; RM 3.9 - 4.3:

1. The fish habitat quality rating increases to excellent (HCR = 7.1).

2. Pool-to-riffle ratio remains 4:6. Pools are larger (averaging 6 square yards), resulting in the improved HCR. Large woody debris increases its importance in pool formation (50 percent of high quality pools are LWD dependent).
3. No spawning gravels were observed.
4. No passage barriers were observed.

Carp Creek; RM 0.0 - 0.8:

1. Fish habitat quality is fair (HCR = 5.0). Low numbers of rainbow trout were observed near the mouth.
2. Pools below RM 0.3 are small (1 to 2 square yards), shallow (<12" deep) and have moderate effective cover. Above RM 0.3 the bottom composition is predominantly bedrock. Pools remain small and shallow.
3. Spawning gravels totalling 20 square yards are found near the mouth. These appear suitable for anadromous fish.
4. Migrational obstructions include a log jam at RM 0.25; a 300-foot long culvert at RM 0.3; and a series of chutes and falls (12+ feet high) beginning immediately above the culvert to RM 0.7. All are complete barriers.

Upper Tributary C:

1. Fish habitat quality is poor (HCR = 2.8).
2. Riffles dominate the stream area (P:R = 2:8). Pools are small (<1 square yard), shallow (<8 inches) and have low effective cover.
3. Spawning gravels are absent.
4. Upper Tributary C braids into a large sedge meadow (RM 0.1 - 0.5) before re-establishing a channel and flowing into Iron Creek.

North Fork Iron Creek; RM 0.0 - 0.1:

1. Fish habitat rates fair (HCR = 5.5).
2. The pool-to-riffle ratio is approximately 5:5. Pools are 2 to 3 square yards with shallow (12 inches) to moderate (12-29 inches) depths and good effective cover. LWD and boulders are important in pool formation.
3. Forty percent (30 square yards) of the spawning gravels in the Iron Creek drainage were found near the mouth of the North Fork. Most of these are suitable for anadromous fish.
4. The overall 11 percent gradient shows a stepped profile.

South Fork Iron Creek; RM 0.0 - 0.3:

1. The fish habitat is rated poor (HCR = 3.5).
2. Riffles dominate the stream area (P:R = 1:9). Pools are similar to those described for Upper Tributary C.
3. No spawning gravels were observed.

## IRON CREEK

### Riparian Habitat Summary

Riparian habitat on Iron Creek appears to be greatly influenced by the dynamics of the White River in its floodplain. In some locations the stream channel is very unstable with numerous abandoned braids. These areas tend to be dominated by lodgepole stands.

Associated with sections of stream channel which appeared more stable were hemlock-spruce dominated stands with greater overall tree species diversity than that found in unstable areas.

#### Reach I; RM 0.0 - 2.7:

1. The riparian habitat is rated high (RCR = 7.5).
2. The floodplain width is very wide (200+ feet), forming a flat-bottom, U-shaped valley. Wetlands are present along 10 percent of the reach length.
3. An average of four habitat units were observed per transect, with grass-forb, shrub-seedling-sapling, pole, and small sawtimber predominating.

4. The coniferous overstory is a low-diversity, Lodgepole pine dominated type between RM 0.0 to 1.5, and RM 2.3 to 2.7. A more diverse type composed of western hemlock, Englemann spruce, lodgepole pine, white pine, grand fir, noble fir, and Douglas-fir is found between RM 1.5 and 2.3.
5. Special habitat units observed were a one acre pond at RM 0.2 and a large sedge meadow area between RM 1.5 and 2.0.

Reach II; RM 2.7 - 3.9:

1. The riparian habitat rating continues to be high (RCR = 7.5).
2. The floodplain width is very wide (200+ feet), forming a flat bottom V-shaped valley. Wetlands are present along 20 percent of the reach length.
3. An average of three habitat units per transect were observed, with grass-forb, shrub-seedling-sapling, and small sawtimber predominating.
4. The coniferous overstory is mainly of the diverse, hemlock-spruce type (lodgepole, white pine, Douglas-fir, and noble fir are present). Mountain hemlock is found in this reach in addition to western hemlock. No deciduous species greater than 30-feet in height were observed.

5. One special habitat unit, a sedge-meadow wetland, is located at RM 3.4.

6. Active beaver colonies (bank burrows) are evident after RM 3.3. Numerous western hemlock clippings were found at burrow entrances, with no evidence of deciduous feeding observed.

Reach III; RM 3.9 - 4.3:

1. The riparian habitat continues to rate high (RCR = 6.7).
2. The floodplain width continues to be very wide (200+ feet), forming a flat bottom V-shaped valley. Small wetlands are present along 35 percent of the reach length.
3. The habitat units were the same as noted in Reach I (grass-forb, shrub-seedling-sapling, poles, and small sawtimber).
4. The coniferous overstory is composed of spruce, lodgepole, Douglas-fir, and noble fir.

Carp Creek; RM 0.0 - 0.8:

1. The riparian habitat rates moderate (RCR = 6.0).
2. The floodplain width is moderate (80 feet), forming a narrow V-shaped valley.
3. Four habitat units were observed, grass-forb, shrub-seedling-sapling, poles, and small sawtimber.
4. The coniferous overstory is composed of cedar, silver fir, hemlock, and Douglas-fir.
5. Four waterfalls greater than 10 feet high occur between RM 0.3 and 0.6.

Upper Tributary C; RM 0.0 - 1.5:

1. The riparian habitat rates high (RCR = 6.5).
2. The floodplain width is very wide (200+ feet), forming a flat-bottom V-shaped valley. A large wetland area comprises 10 percent of the tributary length.
3. Three habitat units were observed, shrub-seedling-sapling, poles, and small sawtimber.

4. The coniferous overstory is composed primarily of lodgepole pine, with small amounts of mountain hemlock and white pine.

North Fork Iron Creek; RM 0.0 - 0.1:

1. The riparian habitat rates moderate (RCR = 4.7).
2. The floodplain width is wide (120 feet), forming a flat-bottom V-shaped valley. Small wetlands are present along 10 percent of the tributary length.
3. Four habitat units were observed, grass-forb, shrub-seedling-sapling, small sawtimber, and large sawtimber.
4. The coniferous overstory is composed of cedar, hemlock, spruce, and Douglas-fir.

South Fork Iron Creek; RM 0.0 - 0.3:

1. The riparian habitat rates moderate (RCR = 5.9).
2. The floodplain width is wide (120 feet), forming a flat bottom V-shaped valley. Small wetlands are present along 10 percent of the tributary length.

3. Four habitat units are present (grass-forb, shrub-seedling-sapling, small saw timber, and large saw timber).
  
4. The coniferous overstory is composed of cedar, hemlock, spruce, and Douglas-fir.

## IRON CREEK

### Rehabilitation/Enhancement Summary

#### Spawning Habitat and Rearing Pool Development; RM 0.0 - 4.3:

Lack of suitable spawning gravels is the most apparent habitat deficiency limiting the production capabilities of this stream. Although appropriate gravel sizes for all anadromous species are present, they are cemented by a thin crust at the water/substrate interface. Gravel composition (welded tuff andesite) is porous. Interstitial spaces are heavily filled with sand.

Introduced gravels would probably be subject to the same processes which have impaired the quality of the gravels now present. Working with gravels already in the streambed may be preferable to introducing more. Spawning habitat enhancement may be more successful on stable tributaries such as Carp Creek and the North Fork of Iron Creek.

Pool rearing habitat could also be improved from Rm 2.7 to 3.9 by the construction of log sills or boulder berms across the channel. Below this point, the influence of White River high flows would likely contribute to potential loss of any in-channel structural improvement. Channel and bank instability also preclude the introduction of permanent structures below RM 2.7.

Protection of the active beaver bank colonies from RM 3.3 to 4.3 could enhance pool rearing area by providing additional woody structure to the system.

Riparian Enhancement; RM 0.0 - 4.3:

Deciduous tree species are present (cottonwood and red alder) in Reach I in low amounts and absent from Reaches II and III. Plantings of these species in all reaches would increase riparian diversity.

Passage Enhancement

Fish passage is unobstructed through all sections of suitable habitat in the drainage. Culverts on Carp Creek (RM 0.3) and South Fork Iron Creek (RM 0.3) are impassable, but stream gradients of 9 percent to 11 percent make areas upstream apparently unsuitable as anadromous fish habitat. The culvert on North Fork Iron Creek appears passable.

IRON CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM				POOLS			RIFFLES (%)						
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D
I (0.0-2.7)	5.1	20	2:8	3	M	1	M-H	0	25	30	20	10	15	10
II (2.7-3.9)	6.3	60	4:6	4.5	L-M	1	H	0	55	25	10	5	5	10
III (3.9-4.3)	7.1	80	4:6	3	M	6	H	0	10	10	40	30	10	4
<u>Tributaries</u>														
Carp Creek	5.0	90												
(0.0-0.4)			4:6	4	L	1-2	M	--	--	--	--	--	--	--
(0.4-0.8)			1:9	10+	L	1	L	--	--	--	--	--	--	--
Upper Trib.C.	2.8	20	2:8	6	L	1	L	0	15	15	30	20	20	6
N.F. Iron Cr.														
(0.0-0.1)	5.5	80	5:5	11	L-M	2	M	--	--	--	--	--	--	--
S.F. Iron Cr.														
(0.0-0.3)	3.5	90	1:9	9	L	1	L	--	--	--	--	--	--	--

LEGEND: HCR: Habitat Condition Rating  
 S: Percent of stream shaded  
 P:R: Ratio of pool length:riffle length  
 G: Average gradient (percent)  
 d: Average maximum depth (L <12", M = 12 - 29", H >30")  
 A: Average pool area (sq. yards)  
 EC: Effective cover (L <40 percent, M = 40-60 percent, H > 60 percent)  
 BR: Bedrock  
 SD: Sand  
 D: Average depth (inches)  
 \*: Present, but less than 5 percent

IRON CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/LOO FT.

	REACH			TRIBUTARIES			
	I	II	III	Carp Ck.	Up. Trib.C.	NF Iron Ck.	SF Iron Ck.
Rainbow trout	*	0	L	L	--	( )	( 1

LEGEND: L = Low (0-5), M = Moderate (6-50), H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I(0.0-2.7)	24	0	24
11(2.7-3.9)	2	0	2
111(3.9-4.3)	0	0	0
Carp Cr.	20	10	10
Upper Trib. C.	0	0	0
N.F. Iron Cr.	30	15	15
S.F. Iron Cr.	0	0	0
TOTAL	<u>76</u>	25	<u>51</u>

IROX CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM</u>	<u>(R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS</u>
Carp Creek	0.25	Log jam	J1	N	None
Carp Creek	0.3	Culvert	CI	N	None, 300 ft. long, limited habitat above.
Carp Creek	0.31	Bedrock chute	B1	<b>N</b>	None
Carp Creek	0.32	Falls	F1	<b>P</b>	None
Carp Creek	0.4	Falls	F2	<b>N</b>	None, 20 ft. high.
Carp Creek	0.45	Falls	F3	<b>N</b>	None
NF Iron Cr.	0.1	Culvert	CI	<b>F</b>	None
Upper Trib C		Culvert	CI	<b>N</b>	None

LEGEND: F = full passage  
P = partial passage  
N = no passage

TABLE V - ANADROMOUS HABITAT SUMMARY

<u>REACH</u> <u>(RM)</u>	<u>Miles</u>		<u>P:R</u>	<u>Rearing</u>		<u>Spawning</u>		<u>Comments</u>
	<u>Avail.</u>	<u>Pot.</u>		<u>Area</u>	<u>Depth</u>	<u>1"-3"</u>	<u>3"-6"</u>	
I (0.0-2.7)	2.7	0.0	2:8	1	2	14	5	Cemented, sandy & in small pockets less than 1 sq. Yd.
II (2.7-3.9)	1.2	0.0	4:6	1	2	2	0	
III (3.9-4.3)	0.4	0.0	4:6	6	2	0	0	
Carp Cr.	0.3	0.5	3:7	1	1	4	4	
Up. Trib. C.	0.0	0.0	2:8	1	1	0	0	
NF Iron Cr.	0.1	0.0	4:6	2	1	16	4	
SF Iron Cr.	0.3	0.0	1:9	1	1	0	0	
Total	5.0	0.5				36	<b>13</b>	

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R.: Ratio of pool length:riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of sq. yds. of gravels observed in the 1"-3" and 3"-6" size classes.

IROX CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		OR	<u>LWD CHARACTERISTICS</u>			
	Total (%)	HQ (%)	Total (%)	HQ (%)		#	L	Dia	Source
I (0.0-1.8)	10	0	10	85	Var	M	1-2	1-2	M
II (2.7-3.9)	0	0	5	50	Var	S-M	1-2	L-2	L
III (3.9-3.4)	0	0	50	50	Perp	S	1-2	1-2	L
Carp Cr.	90	0	40	90	Perp	S-M	1-2	1-2	L
Up. Trib. C.	0	0	10	0	Perp	S	1	1	L
NF Iron Cr.	60	100	40	0	--	--	--	--	--
SF Iron Cr.	0	0	0	0	--	--	--	--	--

LEGEND: Total = percent of total habitat area dependant on LWD  
 HQ = percent of high quality habitat area dependent on LWD  
 OR = angle of orientation to flow; Perp = perpendicular, Var = variable  
 # = number of logs/structure; S = single log, M = multi-log  
 L = average length of logs, expressed in channel widths  
 Dia = diameter of average logs in feet.  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

IRON CREEK

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR  
SUMMER AND BANKFULL CONDITIONS

<u>Reach (R.M.)</u>	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	<u>W</u>	<u>d</u>	<u>v</u>	<u>q</u>	<u>W</u>	<u>D</u>	
I (0.0-2.7)	15	1	3	45	25	3	200 +
II (2.7-3.9)	12	1	2.5	30	15	1.5	200 +
III (3.9-4.3)	7	1	2.5	18	10	1	200
Carp Cr.	5	0.5	1.5	4	6	1	50
Up. Trib. C.	5	0.5	2	5	5	0.5	200+

LEGEND: W,w = Stream width (ft)  
D,d = Stream depth (ft)  
v = Velocity (feet/second)  
Q = Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASP</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>A/W</u>	<u>-A/W</u>	
I (0.0-2.7)	7/7,11/83	45	20	S	50/46-54/46		1145-1645
II (2.7-3.9)	7/11/83	30	60	SSE	70/49-71/50		1400-1540
III (3.9-4.3)	7/11/83	18	80	SSE	71/48		1700
Carp Cr. (0.0-0.8)	7/8/83	4	90	S	52/44		1115
Upper Trib. C. (0.0.-1.5)	7/12/83	5	20	S	60/51		1110

IRON CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		F.P. (ft.)	H.U.	Overstory Con.	Dec.	Streamclass	Wetland%	Size	Special Habitat
I(0.0-2.7)	7.5	200+	5	4	2	II	L	S	2
11(2.7-3.9)	7.5	200+	4	4	0	II	L	L	1
111(3.9-4.3)	7.2	200+	4	4	0	II	M	S	1
Carp Creek (0.0-0.8)	6.0	70	4	4	0	II	--	--	0
Upper Trib. C. (0.0-1.5)	6.5	200+	3	3	0	II	L	L	0
NF Iron Creek (0.0-0.1)	4.7	100	3	4	0	II	--	--	0
SF Iron Creek (0.0-0.3)	5.8	130	4	4	0	II	L	S	1

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain  
 H.U.: # Habitat Units: H  $\geq 4$ ; M=2-3; L  $\leq 1$   
 Con: # Conifer Species  
 Dec: # Deciduous Species  
 Wetland: % stream length with adjacent wetlands; H  $\geq 50\%$ ; M = 25-50%; L  $\leq 25$  percent  
 Size: Size of Wetlands  
 S = Small (less than 1 acre)  
 L = Large (greater than 1 acre)

XAnderson:paw (WP-PJS-5195N)



View of a typical section in Reach I (R.M. 1.7). The flow regime in this reach is very flashy. At RM 2.7 a new channel of White River has captured the established Iron Creek channel. Channel and flow characteristics in Reach I are therefore a blend of White River and Iron Creek. Channel and bank stability are low. Fish habitat is fair, with fast flowing riffles and runs dominating the stream surface area. Pool size is small (1 sq. yard).



Bank and channel stability increase in Reach II due to decreased flow and increased bank vegetation. Pool surface area increases (P:R = 4:6) and is attributed to an increase in boulder structure. Rearing habitat is fair. Pools are small (avg. = 1 sq. yd. with shallow to moderate depths and high effective cover (view at R.M. 2.6).



Large woody debris is the dominant structural element of the stream channel in Reach III (photo at R.M. 4.2). Average pool size increases to six square yard with many high quality pools present. The Iron Creek flow regime is more regulated in this upper section.



Carp Creek is a major tributary to Iron Creek at R.M. 1.7. A series of waterfalls greater than 12 feet high are present on Carp Creek above RM 0.4 (shown). They present a total barrier to fish migration. No anadromous fish habitat appears to exist above the falls.



Two large sedge meadows at Rm 1.5 and 3.4 [shown] between the Iron Creek and White River floodplains add diversity to riparian habitat in Reaches I and II. Big game utilization of these areas appears heavy



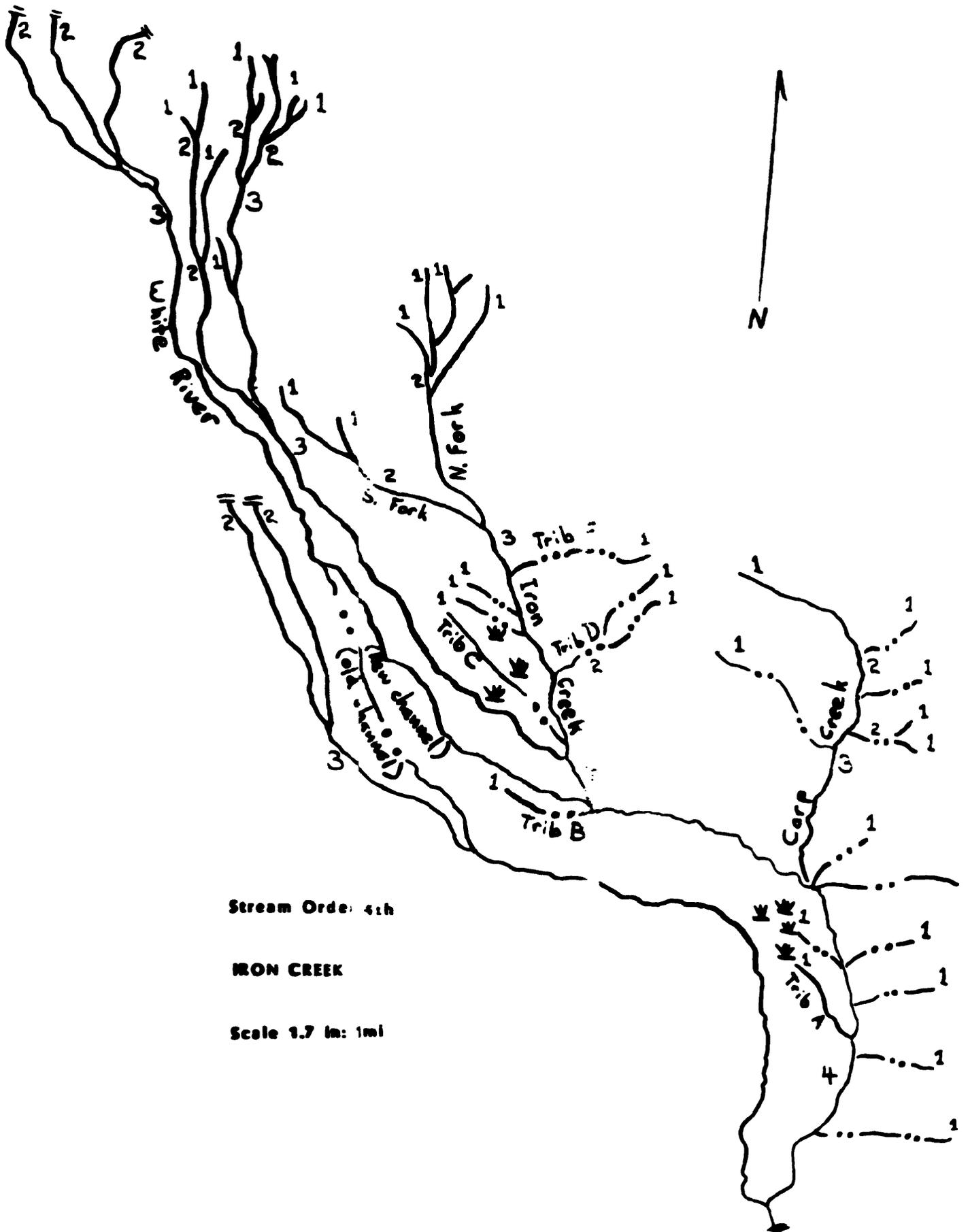
A small pond on the east Side of the floodplain at Rm 0.2 covers about an acre. Riparian wildlife habitat in this area is exceptionally diverse both in **terms** of vegetative structure and number of species. A great blue heron and female smalarld were using the pond at the time of the survey- Deer and elk sign were common also



Upper Tributary C flows within the White River - Iron Creek floodplain. Riffles dominate the stream area (P:R = 3:8). Pools are small (1 sq. .vd) and shallow with low effective cover. The stream braids into a large sedge meadow before re-establishing a channel and flowing into Iron Creek. Photo at R.M. 1.0.



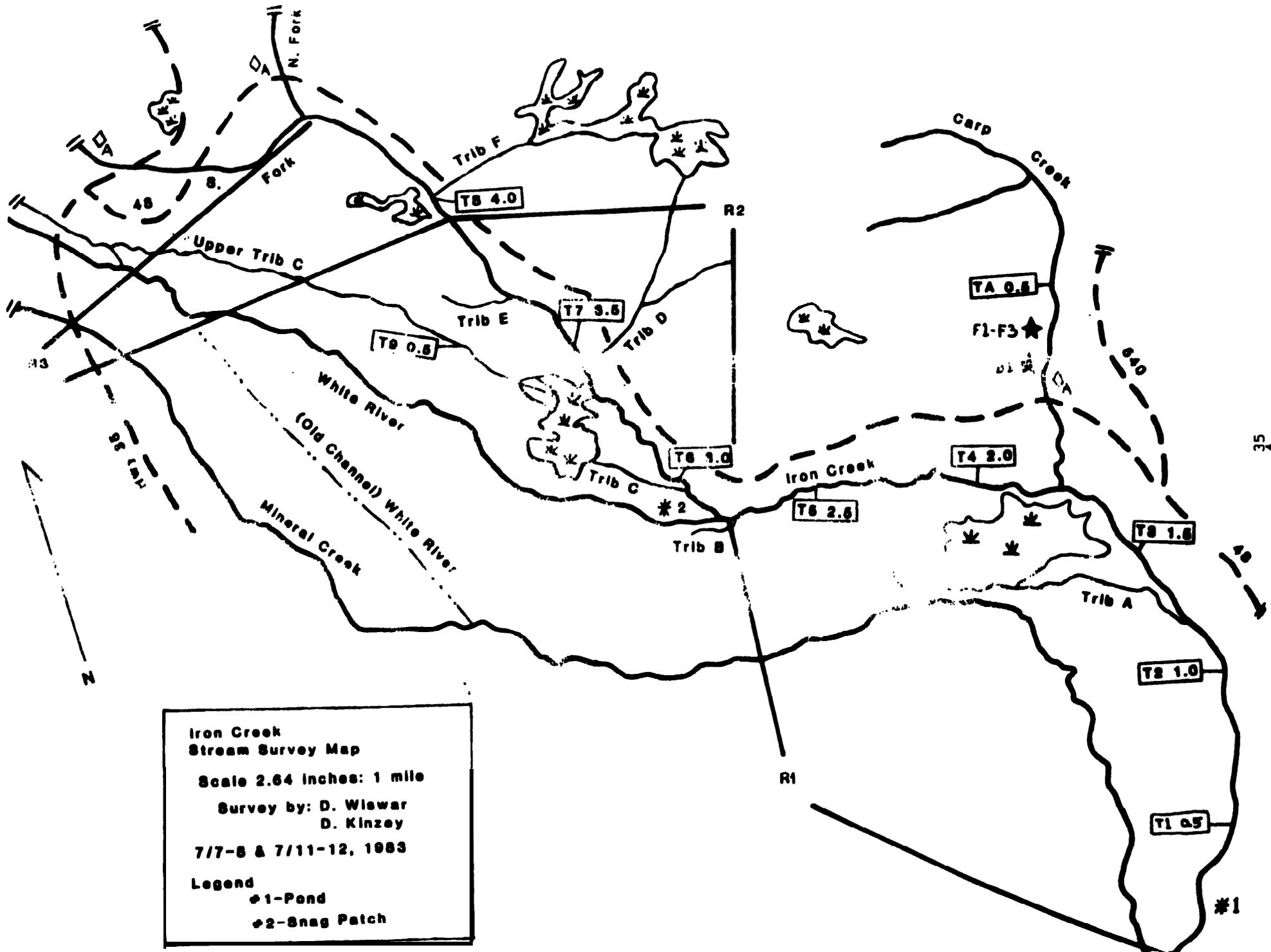
Worth Fork Iron Creek has an overall 11% gradient; large woody debris (LWD) and boulders create a stair-step profile. Pools are 2-3 square yards in area with shallow to moderate depths. This view is at R.M. 0.1,



Stream Order: 4th

**IRON CREEK**

Scale 1.7 in: 1mi



**Iron Creek  
Stream Survey Map**

**Scale 2.64 inches: 1 mile**

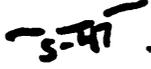
**Survey by: D. Wiswar  
D. Kinzey**

**7/7-8 & 7/11-12, 1983**

**Legend**

- ☉ 1-Pond
- ☉ 2-Snag Patch

**- STREAM SURVEY MAP SYMBOLS -**

	CLEAR CUT BOUNDARY
<b>R<sub>I,II,III</sub></b>	REACH # and SECTION
<b>T<sub>1</sub> 1.0</b>	TRANSECT # and RIVERMILE
 <b>OBSTRUCTION</b>	 <b>BARRIER</b>
<b>J<sub>1,2,3</sub></b>	JAM and #
<b>F( )<sub>1,2,3</sub></b>	<b>FALLS, HEIGHT, and #</b>
<b>C<sub>1,2,3</sub></b>	CULVERT and #
<b>B<sub>1,2,3</sub></b>	CHUTE and #
	DIVERSION STRUCTURE (If water is used for irrigation purposes)
	MINE or ROCK PIT SITE
	BRIDGE
	LANDSLIDE, SLUMP
	DEBRIS TORRENT TRACK
	SPRING
	UPPER LIMIT OF FISH PRESENT (A -limit of potential anadromous fish habitat)
	BANK EROSION (EXTENSIVE/SEVERE)
	1.2.3, :MISCELLANEOUS
	WETLAND HABITAT
	ROAD AND ID NUMBER
	EARTHFLOW

ALPINE CREEK

Bear Springs Ranger District

Surveyors: Tom Cain, Doug Kinzey

county: Hood River

Date Surveyed: July 18, 1984

Mouth Location:  
T3S, R10E, Sec. 36

Tributary to: White River

Watershed Area:  
720 acres  
1.1 sq. miles

Drainage: Deschutes

TRI Compartments:  
Grindstone 2203

Stream Length: 1.7 miles

Game Fish: Rainbow trout

Distance Surveyed:  
0.8 miles

Potential Anadromous Species:  
Coho  
Steelhead

Low Flow Width: 7 ft.

Stream Order: II

Average Fish Habitat Condition Rating: 4.8 (Poor)

Average Riparian Condition Rating: 4.6 (Moderate)

## ALPINE CREEK

### Survey Summary

#### A. Stream Survey

Alpine Creek is a small perennial tributary to White River, contributing approximately 4 cfs (low flow) at their confluence (RM 40.3 of White River). The entire drainage of 720 acres (1.1 sq. mi.) lies within National Forest System land.

Access to Alpine Creek is presently limited to Forest Service road 3530-240 which approaches the stream at RM 0.4. Additional access may be created by the Corporal Timber Sale which is marked along the stream near RM 0.2.

A total of 0.8 miles were surveyed July 18, 1984. Low numbers of trout were observed through RM 0.3. The habitat appears suitable for trout through RM 0.7 and potentially for anadromous fish from the mouth to RM 0.4.

#### B. Watershed and Geomorphology

Alpine Creek heads on the east side of Barlow Ridge and flows in a southeasterly direction to its confluence with White River. The initial 0.3 mile of stream is within the White River floodplain. The floodplain is greater than 200 feet wide along this portion of Alpine Creek.

The channel appears unstable as it passes through the loose glacial soil deposits composing the floodplain. It is also subject to capture by the actively meandering White River channel. Above RM 0.3 the floodplain width narrows to less than 70 feet as the stream drains Barlow Ridge in a narrow V-shaped valley with moderately steep (60 percent) sideslopes. The channel appears very stable and has been scoured to bedrock in some areas. The flow regime appears flashy.

One perennial tributary (Trib. A) was identified in the survey area. It contributed approximately half (2 cfs) of the combined low flows. No fish habitat was observed in the high gradient boulder cascades immediately above its confluence with Alpine Creek. A 20 foot high water fall is located on Tributary A approximately 150 feet upstream of the mouth.

c. Reach Descriptions

Two reaches were delineated in the survey area. These are primarily distinguished by the valley configuration, floodplain width, and gradient. Reach I (RM 0.0-0.3) flows through the broad, U-shaped White River valley with a floodplain width greater than 200 feet and a stream gradient ranging from 1-4 percent. Reach II (RM 0.3-0.8) drains a narrow, flatbottom V valley with a floodplain width of 20-50 feet and a stream gradient of 15 percent.

#### D. Fisheries

The overall fish habitat is rated poor (HCR = 4.8). Low numbers of trout were observed through RM 0.3, with suitable habitat occurring through RM 0.7. Potential anadromous habitat is available from RM 0.0 to 0.4. The habitat appears suitable for steelhead trout and coho salmon.

Low flow pool rearing habitat is fair in Reach I (P:R = 5:5) and poor in the riffle dominated (70 percent) Reach II. Pools are typically small (1-3 sq. yds.) and shallow (12"). Moderate effective cover is provided by large woody debris (LWD), and aquatic and terrestrial vegetation.

More than 80 percent of the total spawning gravels counted occur in Reach I. Fifty percent of these gravels are of a size class suitable for potential anadromous utilization and 45 percent are rated good quality. Ninety percent of the gravels in Reach II are of a size suitable for potential anadromous utilization and 40 percent are rated good quality.

Large woody debris plays an important role in pool development and gravel retention in Reach I. Ninety percent of the high quality gravels and 70 percent of the high quality pools in Reach I are associated with LWD. The importance of LWD decreases in the boulder dominated Reach II.

#### E. Riparian Area

The overall riparian condition rating is 4.6 (moderate). Positive factors influencing this score include the presence of all five habitat types (grass-forbs, shrubs-seedlings-saplings , poles, small and large saw timber) throughout the survey area, and the wide floodplain and small wetlands present in Reach I. Negative factors effecting this score include the reduced floodplain width and absence of special habitats in Reach II.

#### F. Rehabilitation and Enhancement

Rehab./enhancement efforts could center on increasing pool depth and effective cover in Reach I. Unstable banks in this reach could limit enhancement opportunities. Suitable keys for channel structures and avoiding the redirection of flows into the banks could be concerns. Stream shading could also be increased from RM 0.05 to 0.1. Shading is very low (10 percent) along this sparsely vegetated section of stream.

Unstable banks in the area of Corporal Timber Sale unit 3 could be protected by leaving a sufficient streamside buffer strip. Removal of streamside trees could reduce bank stability.

## ALPINE CREEK

### Reach Summary

#### Reach I; RM 0.0-0.3:

1. The stream is within the broad (200+ feet wide) White River floodplain.
2. The gradient is low (2 percent).
3. The substrate material in the White River floodplain is variable but predominantly small (sand/gravel/rubble). Where the stream traverses the White River floodplain near the confluence with White River (RM 0.0-0.1), the substrate is 80 percent sand. Along the base of the west sideslope (RM 0.1-0.3) the stream substrate is 80 percent gravel/rubble.
4. Pools and riffles are evenly balanced (P:R = 5:5).
5. Stream shading is generally high (70 percent). An atypical stretch occurs from RM 0.05 to 0.1 where shading decreases to (10 percent). Riparian vegetation in this area is very sparse.

Reach II; RM 0.3-0.8:

1. The stream above the White River floodplain drains a narrow, flatbottom V valley with a 20 foot wide floodplain. The sideslopes are moderately steep (60 percent).
2. The stream gradient increases to 15 percent.
3. The substrate is boulder dominated (70 percent).
4. Riffles dominate the stream area (70 percent).
5. Stream shading increases to 90 percent.

## ALPINE CREEK

### Fish Habitat Summary

Approximately 0.4 miles of potential anadromous habitat were identified. This habitat appears suitable for steelhead trout and coho salmon. High gradients (15+ percent) and a lack of spawning and rearing habitat precludes potential anadromous usage above RM 0.4

#### Reach I; RM 0-0-0.3:

1. The habitat condition rating is 5.9 (fair).
2. Pool rearing habitat is fair with pools composing 50 percent of the stream area. Pools are typically small (3 sq. yds.) and shallow (12"). Moderate effective cover is provided by LWD and aquatic and bank vegetation. Good rearing habitat is available around RM 0.15 in larger pools (10 sq. yds.) with high effective cover from aquatic vegetation.
3. Spawning habitat is moderate. Nearly half (45 percent) of the 46 sq.yds. of gravel counted were rated good quality. Fifty percent of the gravel is of a size class suitable for potential anadromous utilization.
4. No passage barriers were observed in this reach.

Reach II; RM 0.3-0.8:

1. The habitat condition rating decreases to 4.1 (poor). Potential anadromous habitat ends at RM 0.4. Poor to marginal trout habitat occurs to RM 0.75.
2. Pool rearing habitat decreases. The stream is riffle dominated (70 percent). Pools are typically small (0.5 sq. yds.) pockets located behind boulders. Pool depth is similar to Reach I and effective cover is high from the boulder substrate and water turbulence.
3. Spawning habitat is poor. Ten square yards of gravel were counted with 40 percent rated good quality. Ninety percent of the gravel is of a size class suitable for potential anadromous utilization. Gravels are located in small (1-2 sq. yds.) patches.
4. A small waterfall (F1, 6 ft.) at RM 0.4 could be a partial migration barrier. This occurs at the upstream end of potential anadromous habitat. A large waterfall (F2, 15 ft.) at RM 0.75 is the extent of fish habitat.

ALPINE CREEK

**Riparian Summary**

Reach I; RM 0.0-0.3:

1. The riparian condition rating is high (RCR = 6.3).
2. This reach is within the White River floodplain. The valley configuration is a broad U-shape, with a floodplain greater than 200 feet wide.
3. All five habitat units are present. Balance is low from RM 0.0 to 0.2, where shrub/seedling/sapling and small saw timber predominate.
4. The overstory composition averages three coniferous species. Lodgepole pine predominates from RM 0.0-0.1 with an even mixture of cedar, Douglas-fir, hemlock, and Pacific silver fir above this point.
5. Small wetlands along 10 percent of the stream's length comprise a special habitat for this reach.

Reach II; RM 0.3-0.5:

1. The riparian condition rating decreases to poor (RCR = 3.2).

2. The major negative factor reducing the RCR is a reduction in floodplain width to 20 feet. The valley configuration is a narrow flatbottom "V".
3. All five habitat units remain. Balance improves to high.
4. The overstory composition continues to average three coniferous species. Hemlock dominates, with cedar and Douglas-fir also present.
5. No special habitats were noted.

## ALPINE CREEK

### Rehabilitation and Enhancement Summary

#### Rearing Pool Enhancement; RM 0.15-0.3

Pool depths and cover could be improved in this area by the addition of instream boulders and LWD. Below RM 0.1 the stream appears very unstable, likely limiting the effectiveness of instream work.

#### Stream Stability/Shading; RM 0.05-0.15

The mouth of Alpine Creek flows through sandy substrates in the active portion of the White River floodplain, with poor bank stability and low shading (10 percent). Cottonwood plantings could improve both factors.

ALPINE CREEK

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM				POOLS			RIFFLES (%)						
	<u>HCR</u>	<u>S</u>	P:R	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	<u>BR</u>	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	<u>SD</u>	<u>D</u>
I (0.0-0.3)	5.9	70	5:5	3	<u>L</u>	3	<u>M</u>	-	*	25	55	10	10	3
II (0.3-0.8)	4.1	90	3:7	15	L	0.5	H	5	70	20	5			3

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L  $\leq$  12", M = 12 - 29", H  $\geq$  30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L  $\leq$  40%, M = 40-60%, H  $\geq$  60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

ALPINE CREEK

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>	<u>TRIBUTARIES</u>				
Trout (a)	<table style="margin: auto; border-collapse: collapse;"> <tr> <td style="text-align: center; padding: 0 5px;"><u>I</u></td> <td style="text-align: center; padding: 0 5px;"><u>II</u></td> </tr> <tr> <td style="text-align: center; padding: 0 5px;">L</td> <td style="text-align: center; padding: 0 5px;">( )</td> </tr> </table>	<u>I</u>	<u>II</u>	L	( )	
<u>I</u>	<u>II</u>					
L	( )					

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (0.0-0.3)	46	21	25
II (0.3-0.8)	10	4	6
TOTAL	56	<b>25</b>	<b>31</b>

ALPINE CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
0.4	Falls	FL	P	Marginal trout habitat above falls.
0.75	Falls	F2	N	No habitat above.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles			Rearing		Spawning		Comments
	Avail.	Pot.	P:R	Area	Depth	1"-3"	3"-6"	
I (0.0-0.3)	0.3	-	5:5	3	1	23	-	None
II (0.3-0.8)	0.1	-	3:7	0.5	1	5	4	None
TOTAL	0.4	-				28	4	

Legend: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length : riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of Sq. Yards of gravels observed in the 1"-3" and 3"-6" size classes.

ALPINE CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>			
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR #	L	Dia	Source
I (0-0-0.3)	70	90	50	70	Perp Var.	S-M	2 1	L
II (0.3-0.8)	70	50	10	10	Var.	S-M2	2	T

LEGEND: Total: Percent of total habitat area dependant on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
           T = transported  
           M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	w	d	v	Q	W	D	
I (0.0-0.3)	5	.75	1	3.8	7	2	200+
II (0.3-0.8)	8	0.5	1	4	10	2	20

w,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 V: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

ALPINE CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>	<u>A/W</u>	
I (0.0-0.3)	7/18/84	4	70	- SE	72/52		1240
II (0.3-0.8)	7/18/84	4	90	E	72/52		1400

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Q</u>	<u>Verstory</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>
				<u>Con.</u>	<u>Dec.</u>				
I (0.0-0.3)	6.9	200+	5	3	0	II	10	S	1
II (0.3-0.8)	3.2	20	5	3	0	II	0	0	0

LEGEND: RCR: Riparian Condition Rating  
 F.P. : Floodplain width in feet  
 H.U.: # Habitat units (H  $\geq$  4; M = 2-3; L  $\leq$  1)  
 Con: # Conifer species  
 DecL # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands;  
 (H >50%; M = 25-50%; L  $\leq$  25%)  
 Size: Size of wetlands  
       S = small (less than 1 acre)  
       L = large (greater than 1 acre)

XAnderson:paw (WP-PJS-5267N)



Reach I (RM 0.0-0.3) flows through the glacial soil deposits of the White River floodplain. Banks appear unstable in this reach and the stream course is subject to capture by the actively meandering White River. Shading is generally high (70%) in Reach I except for an atypical stretch (RM 0.0.50.1) pictured here, where the riparian vegetation is sparse.



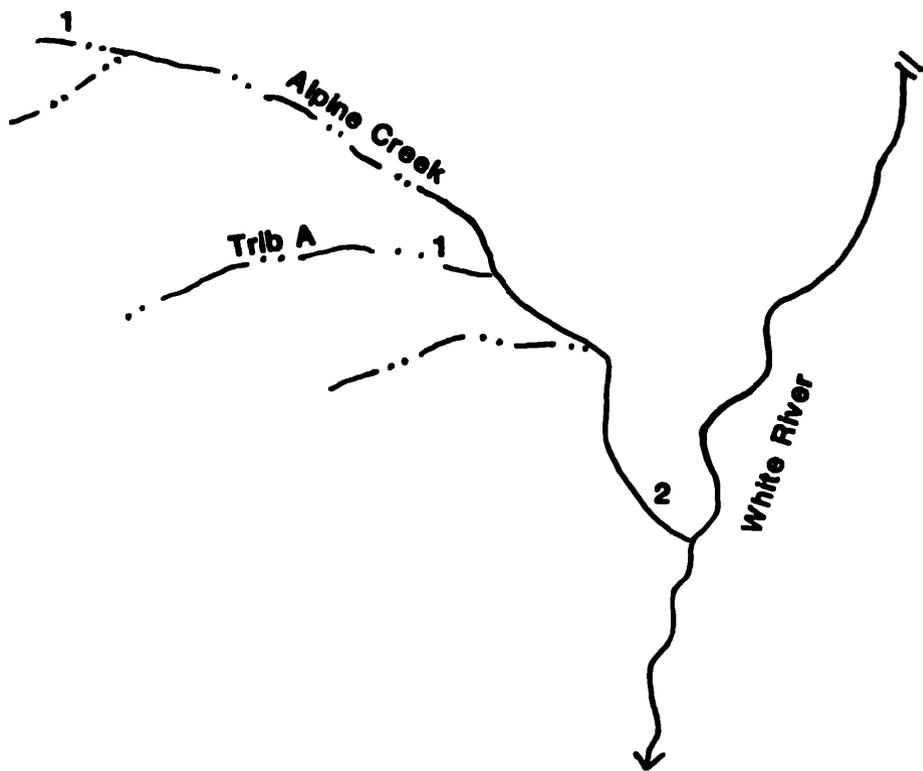
pool development and gravel retention in Reach I is largely dependent on large woody debris. Greater than 70% of the high quality spawning and rearing habitat is associated with LWD. The Fish Habitat Condition Rating for Reach I is 5.9 (fair).



Reach II (RM 0.3-0.8) is typically riffle dominated (70%) with small, shallow pools located behind boulders. By RM 0.4, the stream gradient increases to 8%. Higher stream gradients (15+%) and a lack of spawning and rearing habitat preclude potential anadromous use above this point.

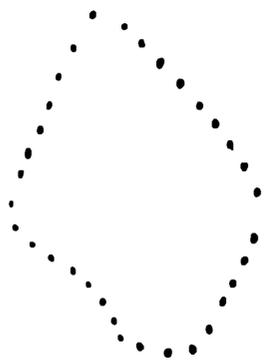


Marginal trout habitat exists to RM 0.75. A waterfall (F2, 15 ft.) at this point marks the extent of habitat. The channel above the falls has been scoured to bedrock.



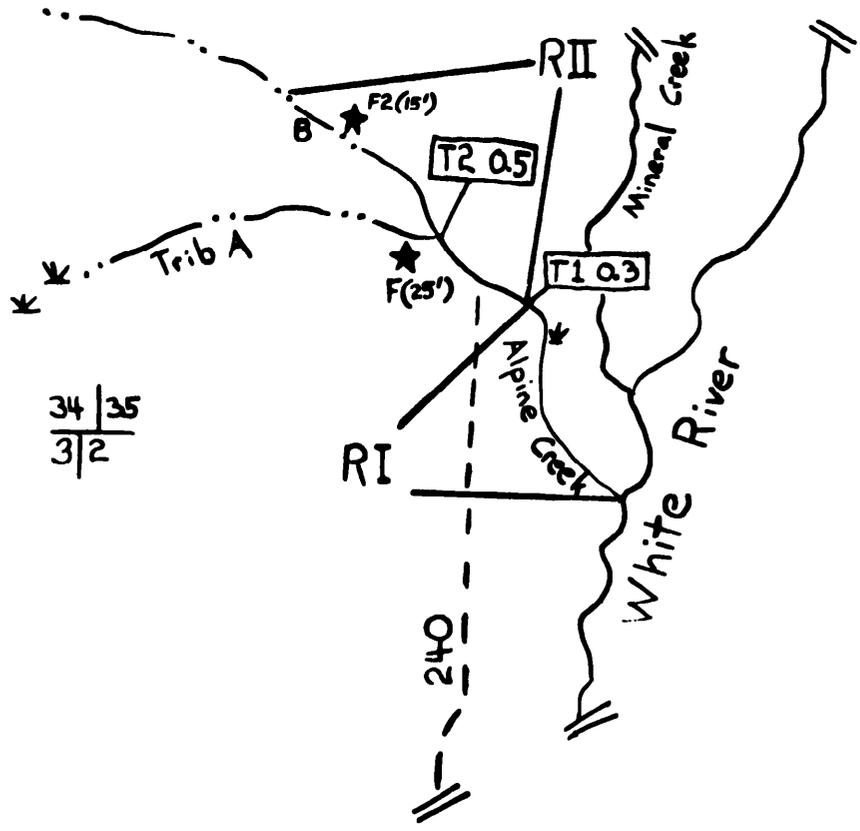
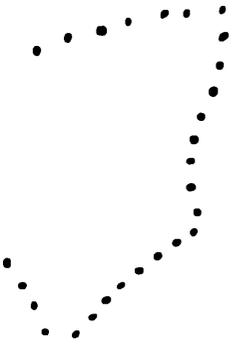
**ALPINE CREEK  
STREAM ORDER: 2nd**

**Scale: 2.64 in.: 1 mL**



27|26  
34|35

26|25  
35|36



34|35  
3|2

Alpine Creek  
Survey Map  
Scale 2.64 in:mi  
Surveyed by: T. Cain  
D. Kinzey  
7/18/84

**- STREAM SURVEY MAP SYMBOLS -**

	CLEAR CUT BOUNDARY
R <sub>I, II, III</sub>	REACH # and SECTION
T <sub>1</sub> 1.0	TRANSECT # and RIVERMILE
★	OBSTRUCTION
★	BARRIER
J <sub>1, 2, 3</sub>	JAM and #
F( ) <sub>1, 2, 3</sub>	FALLS, HEIGHT, and #
C <sub>1, 2, 3</sub>	CULVERT and #
B <sub>1, 2, 3</sub>	CHUTE and #
▲	DIVERSION STRUCTURE (1 - water is used for irrigation purposes)
✂	MINE or ROCK PIT SITE
I	BRIDGE
↪	LANDSLIDE, SLUMP
→	DEBRIS TORRENT TRACK
⋯	SPRING
◇	UPPER LIMIT OF FISH PRESENT (A = limit of potential anadromous fish habitat)
⋯	BANK EROSION (EXTENSIVE/SEVERE)
*	1, 2, 3, : MISCELLANEOUS
☁	WETLAND HABITAT
— 5-47 —	ROAD AND ID NUMBER
⤴	EARTHFLOW

Falls/Chute # F1 Stream Alpine Cr. Date 7/18/84

Location: T. \_\_\_ R. \_\_\_ S. \_\_\_ Stream Survey Mile 0.4

Size: W 3', H 6', L 8' Gradient \_\_\_ Barrier: Yes X No \_\_\_

Is pool present below the falls? Yes X No \_\_\_

Length 5', width 9', depth 9"

Other comments: Two step jump 3' and 2.5'. Probable passage under higher flows. Debris jam at left could be removed.

Falls/Chute # F2 Stream Alpine Date 7/18/84

Location: T. \_\_\_ R. \_\_\_ S. \_\_\_ Stream Survey Mile 0.7

Size: W 5', H 5', L 6' Gradient \_\_\_ Barrier: Yes X No \_\_\_

Is pool present below the falls? Yes \_\_\_ No X

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: No passage via habitat

Falls/Chute # \_\_\_ Stream \_\_\_ Date \_\_\_

Location: T. \_\_\_ R. \_\_\_ S. \_\_\_ Stream Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

Falls/Chute # \_\_\_ Stream \_\_\_ Date \_\_\_

Location: T. \_\_\_ R. \_\_\_ S. \_\_\_ Stream Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

Falls/Chute # \_\_\_ Stream \_\_\_ Date \_\_\_

Location: T. \_\_\_ R. \_\_\_ S. \_\_\_ Stream Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

Falls/Chute # \_\_\_ Stream \_\_\_ Date \_\_\_

Location: T. \_\_\_ R. \_\_\_ S. \_\_\_ Stream Survey Mile \_\_\_

Size: W \_\_\_', H \_\_\_', L \_\_\_' Gradient \_\_\_ Barrier: Yes \_\_\_ No \_\_\_

Is pool present below the falls? Yes \_\_\_ No \_\_\_

Length \_\_\_', width \_\_\_', depth \_\_\_'

Other comments: \_\_\_\_\_

WATER USE FORM - TRIBUTARIES

TRIB I.D. <u>A</u> Stream <u>Alpine</u> Date <u>7/13/84</u> INT <u>✓</u> Gradient <u>40</u> % WIDTH <u>3</u> ft. $\bar{x}$ Depth <u><math>\frac{1}{2}</math></u> ft. $\bar{x}$ VEL <u>3</u> f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q <u>1</u> c.f.s. M.H.W. WIDTH <u>4</u> ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft. Cobble/boulder substrates. * waterfall 20-30' high.	TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.
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TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.	TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.
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TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.	TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.
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TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.	TRIB I.D. _____ Stream _____ Date _____ INT _____ Gradient _____ % WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s. WIDTH _____ ft. $\bar{x}$ Depth _____ ft. $\bar{x}$ VEL _____ f/s Q _____ c.f.s. M.H.W. WIDTH _____ ft. Q _____ c.f.s. M.H.W. WIDTH _____ ft.
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McCUBBINS GULCH

Bear Springs Ranger District

Surveyors: Tom Cain  
Doug Kinzey

County: Wasco

Dates Surveyed: August 23 & 25, 1983

Youth Location:  
T.5S., R.12E., Sec. 7

Tributary to: White River

Drainage: Deschutes

Watershed Area:  
52,480 acres  
82 square miles

TRI Compartment: McCubbin 2102

Gamefish: Rainbow Trout

Stream Length: 12.6 miles

Potential Anadromous Species:

Chinook  
Steelhead

Distance Surveyed: 4.8 miles

Summerflow Width (Avg.): 12 ft.

Stream Order: III

Average Fish Habitat Condition Rating: 6.2 (Fair)

Average Riparian Condition Rating: 6.2 (High)

## McCUBBINS GULCH

### Survey Summary

#### A. Stream Summary

McCubbins Gulch is a third order tributary to White River, draining a watershed of approximately 52,480 acres. About 10 percent of this area lies on National Forest lands. The drainage has been substantially modified from the headwaters downstream to carry irrigation flows diverted from Clear and Frog Creeks, greatly increasing the natural summerflow discharge on Forest lands to about 50 cfs. Flows are rediverted below the Forest boundary, at RM 3.5 and RM 0.9, into the Wapinitia Creek drainage. They are used to irrigate the Juniper Flat area.

This survey was conducted on August 23 and 25, 1984, from the Forest boundary at river mile (RM) 7.8 to the Clear Creek ditchline entrance at RM 12.6. The stream is accessible at river mile 11.0 by the Forest Service road 2110 crossing. Spur 330 parallels the southern bank within 100 feet of the stream from RM 11.2 to 12.6.

#### B. Watershed Characteristics and Geomorphology

The valley configuration is a flat-bottom V, with a floodplain width ranging from an average of 60 feet in Reach I (RM 7.8-10.0) to greater than 200 feet

for some portions of Reach II (RM 10.0-12.6; average width 200 feet for the reach). Extensive channelization up to 8 feet deep in Reach II appears to be an effort to confine irrigation flows to a single channel. Bank instability in this reach appears to be a major sediment source to the stream. Downstream flows and substrates at the time of survey were silty, while water entering the reach from the Clear Creek ditchline was clear. The ditchline, entering at river mile 12.6, is a 10 foot deep V-notch channel with a well-regulated flow regime.

c. Reach Description

Two reaches are identified, on the basis of substrate, floodplain width, and streambed channelization. Reach I (RM 7.8-10.0) is characterized by a narrow (60 feet) floodplain and riffle substrate composed predominantly of rubble (50 percent of substrate). Reach II (RM 10.0-12.6) is characterized by a wider floodplain (200 feet average), smaller substrates (65 percent gravel), and channelization from 3 to 8 feet deep over 70 percent of the reach length.

D. Fisheries

Low numbers of rainbow trout were observed throughout the area surveyed (RM 7.8-12.6). The entire stream length (4.8 miles) surveyed contains habitat suitable for anadromous salmonids (HCR = 6.2, fair), although high stream velocities and heavy sedimentation reduce its quality. The highest quality spawning and rearing habitat is in Reach II (RM 10.0-12.6). The possibility

of greatly improving fish habitat exists in both reaches, however, through rehabilitation and enhancement techniques (See below).

Access into McCubbins Gulch is likely blocked at the mouth by a steep rimrock section into White River (below area surveyed). Utilization of this potential anadromous habitat is further complicated by the present use of McCubbins Gulch for irrigation. The upstream end of the stream is connected to Clear Creek via the Clear Creek ditchline. Downstream, at the time of survey, 100 percent of the flows were being used for irrigation purposes. Anadromous production from McCubbins Gulch would require either release of enough water into White River, or possibly the Deschutes (via Wapinitia Creek), to permit downstream movement of smolts during time of passage, or some other method such as trap and haul. Screening of ditch mouths (RM 0.9, 3.5) would also be required to prevent smolt losses. Upstream migration of adults would likely require trap and haul procedures.

#### E. Riparian Area

Riparian quality rates high (RCR = 6.2). The wide valley bottom and small wetlands along 15 percent of reach length in Reach I are the major positive factors influencing the score.

## F. Rehabilitation and Enhancement

High summer flows (50 cfs) and rubble/gravel substrates create an excellent potential for fisheries production from this stream if the two major negative factors, lack of pool habitat and heavy sedimentation, can be reduced. Both negative factors are aggravated by high stream velocities (5 f/s).

Presently the best quality habitat is LWD-dependent and is generally located along the stream edges. Construction of log and/or boulder wing-deflectors to create additional alcove and edge habitat could improve the overall P:R ratio and reduce bank cutting. Side-channel construction to create spawning and rearing areas, particularly along floodplain terraces in Reach I (RM 7.8-10.0; 60 percent of reach length) could also improve salmonid habitat while minimizing mainstem trade-offs of the system as an irrigation channel. Equipment access is poor in Reach I and very good in Reach II. KV-funding for project work could possibly be obtained from the Pathfinder Timber Sale, presently marked but uncut along Reach I (four clearcuts along northern streambank), and from the Wildhorse Sale (one clearcut and one partial cut along stream edge) in Reach II. Planting fast-growing deciduous species, such as cottonwood, along the stream in these sale areas after timber harvest could reduce temperature and bank instability impacts. Erosion seeding exposed dirt banks of the Clear Creek ditchline could reduce a major source of sediments to the downstream channel.

The Forest Service road 2110 culvert (RN 11.0) is a partial velocity barrier (7 feet/second, 35 feet long) to fish migration, blocking access to at least 1.6 miles of potential anadromous habitat. It could be either baffled (diameter 3x5') or replaced (2' roadfill).

## McCUBBINS GULCH

### Reach Summary

#### Reach I; RM 7.8-10.0:

1. The valley bottom is a narrow (60 feet wide) flat-bottom "V" with moderate (30-50 percent) sideslopes.
2. The gradient is 3 percent.
3. The riffle bottom composition is 50 percent rubble, 30 percent gravel.
4. Riffles dominate the stream area (P:R = 2:8).
5. Shading is moderate (60 percent surface area). Shading will likely be reduced by the Pathfinder Timber Sale, with three clearcuts marked to within 10 feet of the stream edge and one (Unit 4) clearcut across the stream.

#### Reach II; RM 10.0-12.6:

1. The valley bottom widens to an average of 200 feet.
2. The gradient remains 3 percent.

3. The riffle bottom composition decreases in size to predominantly gravel (65 percent), with lesser amounts of rubble (20 percent).
4. Pool to riffle ratio remains 2:8.
5. Stream shading remains 60 percent.
6. Streambed channelization or downcutting from 3 to 8 feet deep occurs along 70 percent of the reach length and appears to be associated with the wider valley bottom. A clearcut and extensive partial cut (Unit 16) associated with the Wildhorse Timber Sale will likely reduce shading and streambank stability.

## McCUBBINS GULCH

### Fish Habitat Summary

#### Reach I; 7.8-10.0:

1. The fish habitat is rated fair (HCR = 6.0).
2. Pool quantity is poor (P:R = 2:8), although quality is good due to moderate depths and high effective cover. Pools are 100 percent dependent upon LWD structure and are located primarily along the stream margins.
3. Spawning gravels are limited, with an average of 18 yards/mile counted. Poor visibility due to suspended sediments at the time of survey likely make these counts conservative. High stream velocities (5 feet/second) and heavy sedimentation reduce the availability of gravels present.
4. No barriers to fish migration were observed.

#### Reach II; 10.0-12.6:

1. The fish habitat improves slightly (HCR = 6.3).
2. Pool habitat is similar to Reach I.

3. Spawning gravels increase to 41 square yards/mile. Heavy sediments and excessive stream velocities continue to reduce availability of gravels present.
  
4. The road 2110 culvert (RM 11.0) is a velocity barrier (7 feet/second for 35 feet) to fish migration.

McCUBBINS GULCH

Riparian Summary

Reach I; RM 7.8-10.0:

1. The riparian habitat is rated moderate (RCR = 5.2).
2. The valley configuration is a narrow, flat-bottom "V" averaging 60 feet wide.
3. All habitat units are well-represented: grass-forb, shrub-seedling-sapling, poles, small sawtimber, and large sawtimber.
4. The coniferous overstory consists of Douglas fir and Ponderosa pine. Low numbers of cottonwoods are also present.
5. A small (1 acre) wetland/snag patch at RM 9.5 is a special habitat for this reach. Small wetlands are present along 15 percent of this reach.

Reach II; RM 10.0-12.6:

1. The riparian condition rating increases to high (RCR = 7.0).

2. A major factor increasing the score is the wider valley bottom (averaging 200 feet) for this reach.
3. All habitat units remain.
4. Three coniferous species, Douglas fir, grand fir, and Ponderosa pine, comprise the overstory. No deciduous overstory species were noted.
5. Small wetland occurrence decreases to 5 percent of reach length.

TABLE I - HABITAT DATA SUMMARY

<u>REACH (R.M.)</u>	<u>STREAM</u>				<u>POOLS</u>			<u>RIFFLES (%)</u>						
	<u>HCR</u>	<u>S</u>	<u>P:R</u>	<u>G</u>	<u>d</u>	<u>A</u>	<u>EC</u>	BR	<u>1'+</u>	<u>6-12"</u>	<u>1-6"</u>	<u>.1-1"</u>	SD	<u>D</u>
I (7.8-10.0)	6.0	60	2.8	3	M4		H		*	50	30	10	10	12
II(10.0-12.6)	6.3	60	2.8	3	M3		H			20	65	5	10	11

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L    12", M = 12 - 29", H    30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L    40%, M = 40-60%, H    60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

<u>Species</u>	<u>REACH</u>		<u>TRIBUTARIES</u>
	<u>I</u>	<u>II</u>	
Rb a	L	L	
Rb j	L	L	

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (7.8-10.0)	39	<b>26</b>	<b>13</b>
II (10.0-12.6)	<b>107</b>	<b>70</b>	<b>37</b>
TOTAL	<b>146</b>	96	50

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
11.0	Culvert	C1	P	Replace or baffle.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

<u>REACH (RM)</u>	<u>Miles</u>		<u>P:R</u>	<u>Rearing</u>		<u>Spawning</u>		<u>Comments</u>
	<u>Avail.</u>	<u>Pot.</u>		<u>Area</u>	<u>Depth</u>	<u>1"-3"</u>	<u>3"-6"</u>	
I (7.8-10.0)	2.2	-	2.8	4	1-2	23	4	
II (10.0-12.6)	2.6	-	2.8	3	1-2	70	16	
TOTAL	<u>4.8</u>	<u>0</u>				<u>93</u>	<u>20</u>	

Legend: i l . : Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length : riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of Sq. Yards of gravels observed in the 1"-3" and 3"-6" size classes.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (7.8-10.0)	100	100	100	100	Perp.-Var.S	2	1-2		L
II (10.0-12.6)	75	75	95	100	Perp.-Var.S	2	1-2		L

LEGEND: Total: Percent of total habitat area dependant on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	Q	W	D	
I (7.8-10.0)	10	1	5	50	10	1	60
II (10.0-12.6)	12	0.8	5	48	12	.8	200

w,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>	<u>- A/W</u>	
I (7.8-10.0)	8/23/84	50	60	E	64/57	- 68/58	1330-1430
II (10.0-12.6)	8/24/84	48	60	SE	53/54	- 60/54	0930-1130

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>	<u>VEGETATION</u>			<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Con. Dec.</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>
1(7.8-10.0)	5.2	60	5	2	1	I	15%	S	1
II(10.0-12.6)	7.0	200	5	3	0	I	5%	S	1

LEGEND:

- RCR: Riparian Condition Rating
- F.P.: Floodplain width in feet
- H.U. : # Habitat units (H \_ 4; M = 2-3; L \_ 1)
- Con: # Conifer species
- Dec: # Deciduous species
- Wetland: Percent of stream length with adjacent wetlands;  
(H 50%; M = 25-50%; L 25%)
- Size: Size of wetlands  
S = small (less than 1 acre)  
L = large (greater than 1 acre)





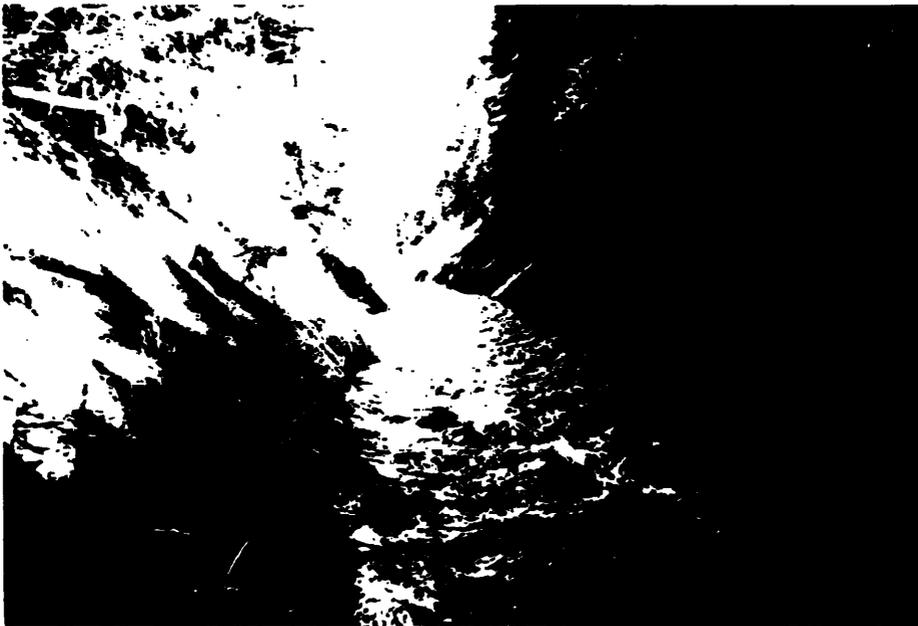
Pool rearing habitat on McCubbins Gulch is low, with riffles dominating the stream area (80%). Rehabilitation and enhancement opportunities include increasing pool habitat, such as this created by naturally occurring large woody debris.



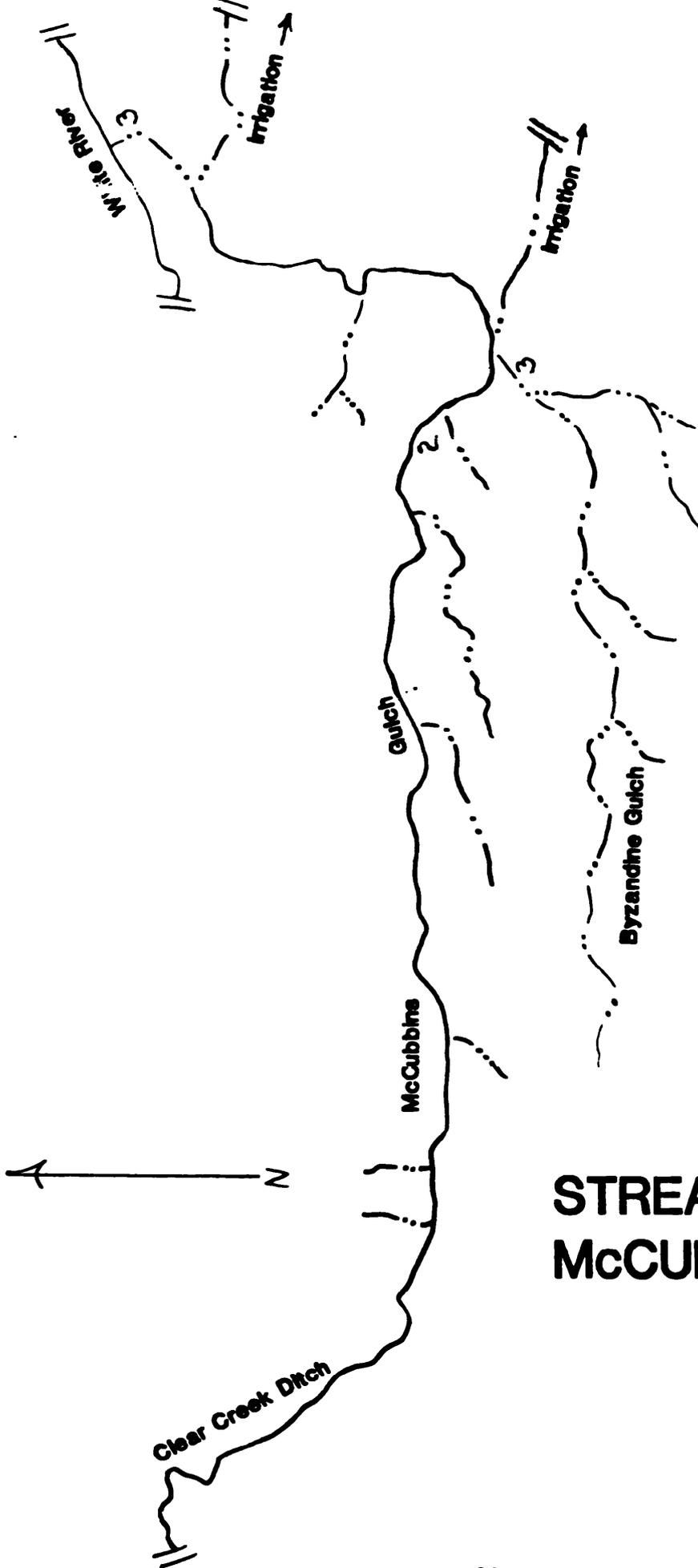
The overall Riparian Condition Rating is 6.2 (high). A wide (200 ft.) floodplain in Reach II and small wetlands in Reach I are positive factors to this score. This small wetland and snag patch is at RM 11.3.



Approximately 70% of Reach II is downcut 3-8 feet. This "ditching" appears to be done to keep flows consolidated in areas with wide valley bottoms. The resulting exposed bank soils add sediments to McCubbins Gulch and may be reducing the quality of potential spawning gravels. Future management in the basin should consider effects of activities which may further reduce bank stability.

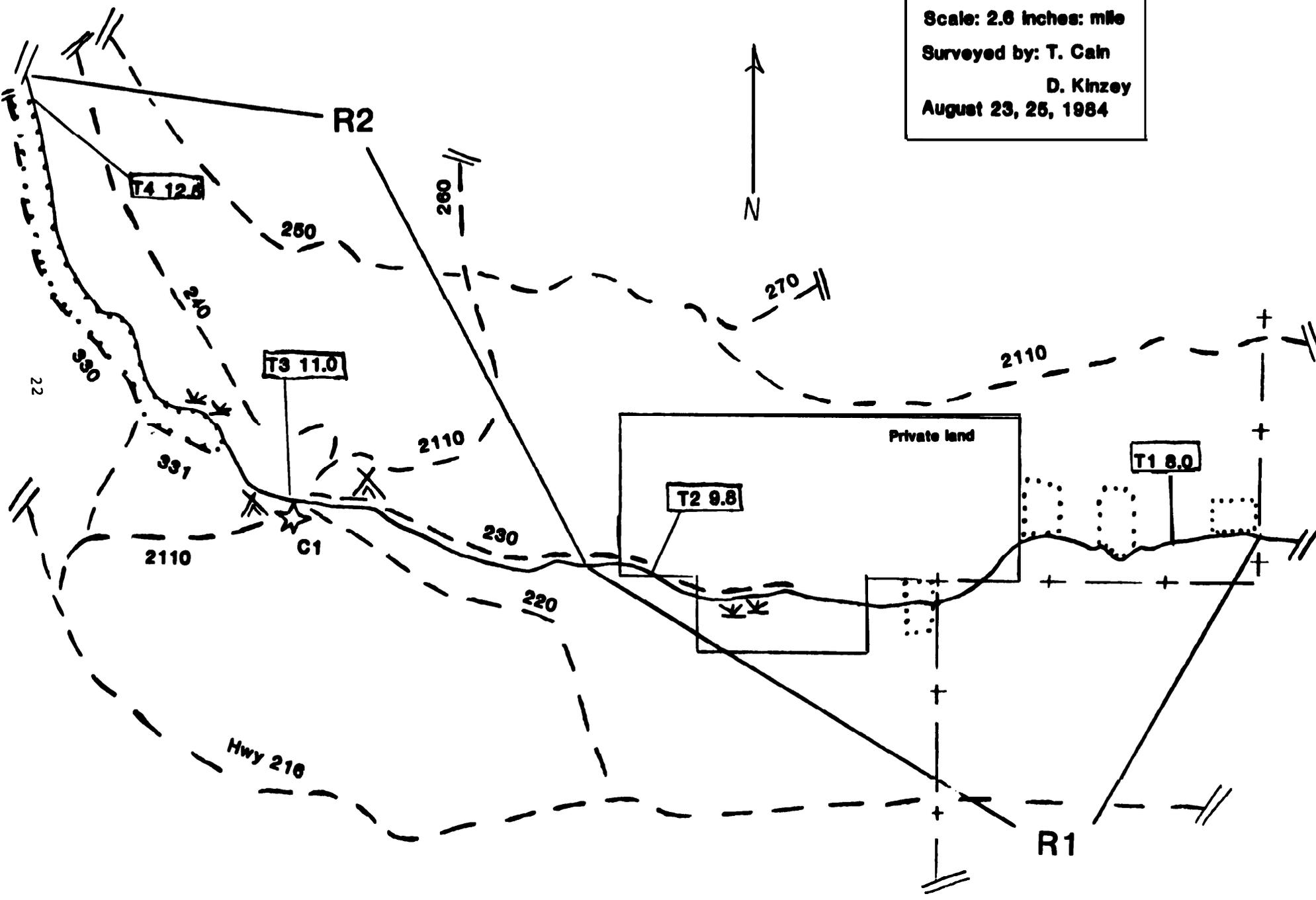


McCubbins Gulch is fed by the Clear Creek Ditch at RM 12.6. The ditchline appears to provide some spawning and rearing habitat. Erosion seeding of exposed banks could reduce sediment inputs to this area and downstream habitat.



**STREAM ORDER: 3rd  
McCUBBINS GULCH**

**McCubbins Gulch**  
**Survey Map**  
**Scale: 2.6 inches: mile**  
**Surveyed by: T. Cain**  
**D. Kinzey**  
**August 23, 25, 1984**



- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY	
<b>R<sub>I,II,III</sub></b>	REACH # and SECTION	
<b>T<sub>1</sub> 1.0</b>	TRANSECT # and RIVERMILE	
 <b>OBSTRUCTION</b>		 <b>BARRIER</b>
<b>J<sub>1,2,3</sub></b>	JAM and#	
<b>F( )<sub>1,2,3</sub></b>	FALLS, HEIGHT, and #	
<b>C<sub>1,2,3</sub></b>	CULVERT and #	
<b>B<sub>1,2,3</sub></b>	CHUTE and #	
	DIVERSION STRUCTURE (I l water Is used for irrigation purposes)	
	MINE or ROCK PIT SITE	
	BRIDGE	
	LANDSLIDE, SLUMP	
	DEBRIS TORRENT TRACK	
	SPRING	
	UPPER LIMIT OF FISH PRESENT (A = <b>limit</b> of <b>potential</b> anadtomous f <b>ish</b> hanitat)	
	BANK EROSION (EXTENSIVE/SEVERE\	
	1.2.3, 1MISCELLANEOUS	
	WETLAND HABITAT	
	ROAD AND ID NUMBER	
	EARTHFLOW	

Culvert # 1 Stream McCubbins Gulch Date 8/25/84

Gradient greater than 14%: Yes 3% No \_\_\_\_\_

Type of structure (check)

Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure 35 ft. Diameter of structure 3x5 ft.

Are baffles present? Yes \_\_\_\_\_ No

Jumping distance into culvert from pool: Height 1

Pool present below culvert: Length 15', width 10', depth 3'

Stream above culvert: Width 20', gradient 4%

Stream flowing water: Yes  No \_\_\_\_\_

Other comments: 5s. 2' fill. Flowing 5' x 9" deep.

Velocity barrier

Culvert # \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Gradient greater than 14%: Yes \_\_\_\_\_ No \_\_\_\_\_

Type of structure (check)

Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure \_\_\_\_\_ ft. Diameter of structure \_\_\_\_\_ ft.

Are baffles present? Yes \_\_\_\_\_ No \_\_\_\_\_

Jumping distance into culvert from pool: Height \_\_\_\_\_

Pool present below culvert: Length \_\_\_\_\_', width \_\_\_\_\_', depth \_\_\_\_\_'

Stream above culvert: Width \_\_\_\_\_', gradient \_\_\_\_\_

Stream flowing water: Yes \_\_\_\_\_ No \_\_\_\_\_

Other comments: \_\_\_\_\_

Culvert # \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Gradient greater than 14%: Yes \_\_\_\_\_ No \_\_\_\_\_

Type of structure (check)

Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure \_\_\_\_\_ ft. Diameter of structure \_\_\_\_\_ ft.

Are baffles present? Yes \_\_\_\_\_ No \_\_\_\_\_

Jumping distance into culvert from pool: Height \_\_\_\_\_

Pool present below culvert: Length \_\_\_\_\_', width \_\_\_\_\_', depth \_\_\_\_\_'

Stream above culvert: Width \_\_\_\_\_', gradient \_\_\_\_\_

Stream flowing water: Yes \_\_\_\_\_ No \_\_\_\_\_

Other comments: \_\_\_\_\_

Culvert # \_\_\_\_\_ Stream \_\_\_\_\_ Date \_\_\_\_\_

Gradient greater than 14%: Yes \_\_\_\_\_ No \_\_\_\_\_

Type of structure (check)

Round Pipe  Box  Arch  Open Arch  Open Box  Elliptical

Length of structure \_\_\_\_\_ ft. Diameter of structure \_\_\_\_\_ ft.

Are baffles present? Yes \_\_\_\_\_ No \_\_\_\_\_

Jumping distance into culvert from pool: Height \_\_\_\_\_

Pool present below culvert: Length \_\_\_\_\_', width \_\_\_\_\_', depth \_\_\_\_\_'

Stream above culvert: Width \_\_\_\_\_', gradient \_\_\_\_\_

Stream flowing water: Yes \_\_\_\_\_ No \_\_\_\_\_

Other comments: \_\_\_\_\_

WHITE RIVER

Bear Springs and Barlow Ranger Districts

Surveyors: Jeff Uebel, County: Hood River  
David Wiswar, Wasco  
Tom Cain, Doug Kinzey

Dates Surveyed: October 12-13 Mouth Location: T4S, R14E, Sec. 9  
and 18-19, 1983

Tributary to: Deschutes River

TRI Compartments: Immigrant 1603  
McCubbin 2102  
Camas 2103  
Rimrock 2104  
Bonney 2201  
Iron 2202  
Grindstone 2203  
Sand 9220

Watershed Area:  
235,520 acres  
368 square miles

Stream Length: 48.9 miles

Distance Surveyed:  
20.3 miles mainstem  
3.0 miles Mineral Creek

Gamefish: Rainbow trout Low Flow Width (Avg.): 20 ft.

Potential Anadromous Species: Chinook  
Steelhead  
Coho

Stream Order: VI

Average Fish Habitat Condition Rating: White River Mainstem: 4.4 (Fair)  
Mineral Creek: 5.3 (Fair)

Average Riparian Condition Rating: White River Mainstem: 7.5 (High)  
Mineral Creek: 6.9 (High)

## WHITE RIVER

### **Survey Summary**

#### A. Stream Summary

White River is a major tributary to the Deschutes River. The confluence is located approximately 3 miles below Maupin (about RM 47). Flow at the mouth varies from a mean low of about 100 cfs, to a mean high of about 1500 cfs, averaging 425 cfs. The stream is utilized by chinook and steelhead below a series of three large impassable falls (140 ft. total) located 2 miles above the mouth. Resident trout species include rainbow and brook trout, distributed throughout the drainage to headwater reaches. Several lakes and streams receiving high recreational use in the drainage are stocked by the Oregon Department of Fish and Wildlife with juvenile and legal-sized trout.

The drainage area is 235,520 acres, with roughly the upper 70 percent located on National Forest System land (the National Forest boundary crosses White River at RM 25.1.) The remainder lies on ODFW, BLM, Warm Springs Indian Reservation and private land holdings. The mainstem is 49 miles long, originating in a glacier near the summit of Mt. Hood. Road access to the mainstem is relatively poor on Mt. Hood National Forest,

with stream crossings limited to road 3530 (RM 34.0), 43 (RM 36.5). and Highway 35 (RM 44.5). Primitive roads 4885 (RM 29.8) and 3530011 (Rm 40.5 ) have low water fords that provide additional access sites.

A total of 23.5 miles were surveyed during the period October 12-19, 1983. This total includes 3 miles of Mineral Creek and 0.2 miles of Deep Creek.

#### B. Watershed Characteristics and Geomorphology

White River originates in the White River Glacier on the south side of Mt. Hood. It flows through old mudflow and glacial outwash deposits for much of its length on the National Forest. The stream appears most turbid in summerflows, while highest flows are apparently associated with snowmelt in late winter and spring. It has high sediment loading and a flashy flow regime. The aspect changes from southeast to east to northeast before flowing into the Deschutes River.

The valley configuration in the lower survey section (RM 25.0-32.6) is a narrow, flat-bottom V-shaped canyon with steep side slopes. Talus slopes and rock outcrops are common. Channel substrate composition is predominantly boulder. Two major tributaries are located in this reach. Boulder Creek (confluence RM 29.0) provides about 5 percent of low flows (5 cfs) and Clear Creek (entering at RM 29.8) provides approximately one-third of low flows (20 cfs) to White River at their confluences.

Above RM 32.6, the valley configuration changes significantly. The floodplain widens into a broad, glaciated U-shaped valley. The White River channel is actively working across the valley bottom as evidenced by abundant remnant and high flow channels. White River has recently captured the lower 2.7 miles of Iron Creek and abandoned the former channel it shared with Mineral Creek. Iron Creek provides about one-third the flow (15 cfs) at its confluence with White River (RM 43.11, and Mineral Creek provides about 15 percent (5 cfs) at its confluence (RM 40.4). Barlow Creek (RM 36.7) is another major stream flowing into White River in this upper section. It provides approximately 15 percent (7 cfs) of the flow to White River.

c. Reach Descriptions

Five reaches were delineated on White River, distinguished primarily by valley configuration, gradient and channel stability. Reach I (RM 25.0-32.6) lies in the White River gorge, a deep (1000 ft.), steep-sided (70-100 percent) canyon with very low flood-plain development. The channel maintains a consistent 2-3 percent gradient, is sharply entrenched between the talus sideslopes, and is very stable.

The reaches lying above are located in the very wide (1,000-2,000 ft.) flat valley bottom of glacial outwash and mudflows. The channels of reaches II-V are very transitory; the sandy/rubble banks and channel combined with the lack of large channel or bank structural components

contribute to highly active meander and very low pool development (10 percent of the stream area). Relatively high gradient (4-6 percent) in the upper reaches (IV and V, RM 43.1-45.3) contributes to extremely unstable channels. Although low flows are carried in a single channel for virtually the entire length of the stream, a network of active high flow channels is present throughout the floodplain above RM 32.5.

Reach characteristics above Reach I are diverse: Reach XI (RM 32.6-40.4) has a very wide (60 ft.), shallow channel and low gradient (2 percent); Reach III (RM 40.4-43.1) is the "captured" section of Iron Creek, well entrenched on the eastern margin of the floodplain with a gradient of 3 percent; Reach IV (RM 43.1-44.6) is a high gradient (6 percent) newly-created and highly unstable channel with no entrenchment; Reach V (RM 43.1-45.3) is more representative of the channel up to its confluence with the glacier, with a narrow, shallow channel, slightly entrenched in the wide, open sandy flats of the glacier's outwash plain.

#### D. Fisheries

Fish habitat on the mainstem is rated poor overall (4.5 HCR). Habitat quality is substantially lowered by the extremely high sand and fine sediment loading present during low summer and fall flows. This material is continuously moving downstream both in suspension or as bedload. Heavy temporary deposition occurs in all slack water areas, and pool volume is decreased by 50 to 75 percent. Pools average 8 square yards and 1.5 feet

deep. Spawning gravels are virtually non-existent in the mainstem (300 square yards in 20 miles ), likely covered by thick deposits of sand. It appears that these conditions are present from July to December. Discharge usually triples during the period of January to June, and this increase in stream power likely increases scour and benefits pool habitat quality and gravel cleaning. Mainstem habitat conditions, therefore, appear to favor winter and early spring spawning fish stocks.

Accessible major tributary systems are likely very important in providing high quality spawning and rearing habitat during the turbid period of summer and fall. Over 80 miles of potential anadromous habitat are present on these streams. In the upper basin, Boulder, Clear, and Barlow Creeks contain over 35 miles of high quality habitat, although minor passage barriers currently restrict passage from the mainstem of White River to over half of these miles. Iron and Mineral Creek systems are the uppermost major fish-bearing tributaries in the basin, containing about 3 accessible miles of fair quality habitat each. Other upper basin tributaries with salmonid habitat accessible from mainstem include Bonney (1 mile) and Buck (1 mile) Creeks. Please refer to survey reports for details on all tributary systems in the drainage.

Juvenile resident trout were observed along mainstem stream margins in low to moderate numbers throughout the survey area up to RM 45.3 (3 miles below the glacier). Very poor visibility due to high turbidity precluded observation of adult trout. (Two adult rainbow trout were caught at

RM 29.0 in July.) Potential anadromous utilization of the system is limited by the two 6-foot tall impassable chute/falls at RM 31.8. A total of 20 miles of potential anadromous habitat (including the mainstem up to RM 43.1 and Barlow, Iron, Mineral, Bonney and Buck Creeks) lie upstream of these chutes.

#### E. Riparian Area

The overall Riparian Condition Rating (RCR) for the mainstem of White River is high (RCR = 7.5). Positive factors include a high number of habitat units, a diverse coniferous overstory composition over most of the survey length, presence of deciduous overstory species, wide floodplain above RM 32.6 and high development of special habitat units (talus slopes, rock outcrops, meadows, wetlands, snag patches, ponds and spring lines). Negative factors are the narrow floodplain (60 ft.) in the steep-walled canyon below RM 32.6 and low vegetative species diversity in the upper 2 miles of the surveyed length.

Of special note are the numerous large (100 acre plus) wetland areas present in the valley bottom of White River in Reaches II to IV (RM 32.6-45.3). These usually occur along tributary streamcourses near their confluence with White River (i.e., Iron, Mineral, Bonney, Red and Barlow Creeks). These areas have exceptionally high habitat quality and are heavily utilized by wildlife. White River is also an important migration corridor for big game, and the remote character of Reach I

(RM 25.0-32.5) coupled with localized small wetland development there make it especially important to big game.

F. Rehabilitation and Enhancement

If passage is provided for anadromous fish at the White River Falls, several priority enhancement projects would be created. Improving passage at the two bedrock chutes at RM 31.8 would allow anadromous utilization of the 20 miles of mainstem and tributary habitat lying upstream. Mainstem low flow pool rearing habitat could be improved throughout the survey area, although Reach II (RM 32.6-40.4) appears to be the highest priority site.

Riparian habitat could be enhanced in Reach I (RM 25.0-32.6) by increasing overstory diversity through deciduous tree introduction (especially cottonwood), and by increasing browse and forage production for wildlife.

G. Special Interest

The White River on Mt. Hood National Forest is currently managed under interim maintenance guidelines while it is being evaluated for inclusion in the Wild and Scenic River system. The river has been broken into three sections which have been nominated for different status; the gorge section (roughly Reach I) qualifies for "Wild" status, Reaches II through V

qualify for "Recreational" status, and the area extending above the highway to the glacier is nominated for "Scenic" status.

Several special interest and historic sites are adjacent to White River. The old pioneer Barlow Road traverses the White River valley from RM 33.5 to 39.0. The remains of a log-carrying flume and diversion structure at the mouth of Clear Creek are present at Keeps Mill and along the south valley sideslope of White River from RM 28.3-29.8. An old stream gage station is present at RM 29.0, and an active gaging station is present at RM 33.4.

## WHITE RIVER

### Reach Summary

#### Reach I; RM 25.0-32.6:

1. The valley configuration is a flat-bottom, V-shaped canyon with an average floodplain width of 60 feet.
2. The gradient is low (2.5 percent).
3. The substrate is boulder dominated (55 percent), with a high percentage of sand (25 percent).
4. The stream surface area is dominated by riffles (P:R = 2:8).
5. Stream shading is moderate (70 percent).
6. Channel structure is provided by boulders.

#### Reach II; RM 32.6-40.4:

1. The width of the White River floodplain begins to increase significantly at RM 32.6, where it opens up into a very wide (200 to 1000 ft.), glacial U-shaped valley.

2. Stream gradient is low (1.5 percent).
3. Channel substrate material is comprised of glacial outwash and mudflow material of welded andesite tuff. Sand (35 percent) and rubble (20 percent) dominate the bottom composition. Channel structural components (boulders and LWD) are scarce.
4. Riffles dominate the stream surface area (P:R = 1:9). Small pools are usually found within run areas.
5. Stream shading is low (less than 10 percent), due to the very wide channel (60 ft.) development.

Reach III; RM 40.4-43.1:\*

1. The floodplain remains very wide (greater than 200 ft.). In this reach the White River has captured the lower 2.7 miles of the Iron Creek channel.
2. Stream gradient increases slightly to 3 percent.
3. Channel substrate is predominantly boulders and rubble (55 percent).
4. Riffles dominate the stream surface area (P:R = 2:8).
5. Stream shading remains low (20 percent).

6. Channel and bank stability is very low. The stream has numerous, low flow braids and high flow side channels.

\* From Iron Creek survey, July 7-8 and 11-12, 1983.

Reach IV; RM 43.1-44.6:

1. Floodplain is very wide in the glacial, U-shaped valley. This reach is a relatively new channel of the White River. Through most of the reach length, the stream is entrenched in a narrow channel with high banks. In other sections, especially near the confluence with Iron Creek, flow is overland with little channel development.
2. Stream gradient increases to moderate (6 percent).
3. Substrate is predominantly rubble (40 percent).

Reach V; RM 44.6-45.3:

1. The floodplain remains very wide in the glacial, U-shaped valley. The stream is actively meandering in this area, and the channel has changed its course often over time.
2. Stream gradient is low (4 percent).

3. Rubble continues to dominate (45 percent) the substrate materials.
4. **Riffles** dominate the stream surface area (P:R = 1:9).
5. Stream shading is very low (less than 5 percent).

### Tributary

#### Mineral Creek: RM 0.0-3.0:

1. Mineral Creek flows along the west side of the White River floodplain. USGS topographic maps from 1964 and aerial photographs (1978) show that White River and the lower 2 miles of Mineral Creek previously shared a common channel. Mineral Creek still flows-in that channel; however, the mainstem White River has shifted to the east side of the valley. Three small streams from the White River floodplain flow into Mineral Creek between RM 1.75-2.0. The flow in each is approximately 1/4 cfs. Their substrate material is stained red apparently from iron-oxide leaching into them.
2. Gradient is low (3.5 percent).
3. Channel substrate is predominantly rubble (35 percent).
4. Pools dominate the stream surface area (P:R = 6:4).

5. Stream side shading is low (avg. 30 percent). Shading is low from RM 0.0-1.75. Above RM 1.75 shading increases to moderate (60 percent) as the stream becomes entrenched along the steep western slope.

## WHITE RIVER

### Fish Habitat Summary

#### Reach I; RM 25.0-32.6:

1. The fish habitat is rated fair (HCR = 5.1). Low numbers of juvenile rainbow trout were observed in off-channel pools. No fish were observed in the mainstem, due to poor visibility from high turbidity and sediment loading.
2. Pool rearing habitat is fair. The stream is riffle dominated (P:R = 2:8). Pool size is moderate (avg. 8 sq. yd.) with shallow to moderate depths. Effective cover provided primarily by instream boulders is low.
3. Spawning habitat is poor. Only 136 square yards of spawning gravels were observed. Seventy-five percent of these are marginal due to channel placement and filling of the interstices with fine sediment. Most of the gravels are in small pockets (less than 1 sq. yd.) and above the mean high water line.
4. Two bedrock chutes near RM 31.8 are fish migration barriers. They are located immediately below the mouth of Deep Creek. The first chute is a partial barrier measuring 15 feet long with a 35 percent gradient. The

second chute consists of two slots. The right channel is smaller and choked with woody debris. The left channel is narrow (4 ft.) with very high stream velocity (25 percent gradient).

Reach II; RM 32.6-40.4:

1. The fish habitat is rated poor (HCR = 3.8). Low numbers of juvenile trout were observed in pools associated with an old log jam at RM 33.2 and in an off-channel pool at Rm 34.4.
2. Spawning habitat is poor. Spawning gravels total 138 square yards with approximately 75 percent of those rated marginal quality. Yost of the gravels are in small deposits (less than 1 square yard) above the mean high water line. Eighty percent of the total gravels are suitable for anadromous salmonids. All spawning gravels observed are between RM 32.6-34.0, largely in the sediment plain formed by a relic jam at RM 32.6.
3. Rearing habitat is poor. Pool size is moderate (avg. 12 sq. yd.) with depths of about one foot. Effective cover is low and is provided by rubble and boulder substrate. The pools are found within larger runs where water velocity is approximately 3 ft./sec. The influence of LWD in pool development is very low (5 percent). Most of the large woody debris is carried out of the system during high flows. Sediment loading in the pools is heavy.

Reach III; RM 40.4-43.1:\*

1. The fish habitat is rated fair (HCR = 5.1). Local residents report rainbow trout in this reach, although none were observed during the survey due to high turbidity.
2. Rearing habitat is fair. The stream is predominantly fast-flowing riffles (P:R = 2:8). Pools are small (1 sq. yd.) with moderate depths and are found behind boulders and along the stream margins. Effective cover provided by surface turbulence and instream boulders is moderate to high. The overall influence of LWD is low (10 percent). The number of high quality pools in this reach are low; however, 85 percent of them are dependent on LWD for their development.
3. Spawning habitat is poor. Only 24 square yards of marginal quality gravels were counted. These are in small pockets, with sediment filling the interstices.

\* From Iron Creek survey.

Reach IV; RM 43.1-44.6:

1. The fish habitat is rated poor (HCR = 3.7). No fish were observed over this section of the survey, likely due to poor visibility.

3. Rearing habitat is poor. Pools are small (2 sq. yds.) with shallow depths and low effective cover. Stream velocity is 3-5 ft./sec. causing high turbulence in the pools. The influence of LWD in pool development is low (20 percent). So high quality pools are present in this reach.
  
3. No spawning gravels were observed.

Reach V; RM 44.6-45.3:

1. The fish habitat is rated poor (HCR = 3.6). Rainbow trout were observed in low numbers in July 1983.
  
2. Rearing habitat is poor. Pools are small (1 sq. yd.) with shallow depths and low effective cover. Large woody debris is absent in this reach.
  
3. No spawning gravels were observed.

Tributary

Mineral Creek; RM 0.0-3.0:

1. The fish habitat is fair (HCR = 5.3). Low numbers of rainbow trout were observed at the mouths of tributary springs and streams. No fish were observed in the mainstem. Fish production may be limited by high iron (and other chemical) concentrations that appear to be present.

2. Rearing habitat is fair to good. Pool sizes are moderate (4 sq. yd.) with low to moderate depths and moderate effective cover. The cover is provided by instream boulders and rubble and an algal growth at the base of the pools. The influence of LWD on overall pool development is low (10 percent). LWD is, however, important in the formation of high quality pools. Seventy-five percent of these pools are associated with large woody debris. Most of the high quality pools are found above RM 1.75 where Mineral Creek is above the influence of remnant White River channels.
  
3. Spawning habitat is poor. Only 13 square yards of marginal spawning gravels were observed. These are located near the mouth of a small tributary of Mineral Creek (RM 2.7), flowing off the east side of Barlow Ridge.

WRITE RIVER

Riparian Summary

Reach I; RM 25.0-32.6:

1. The riparian habitat is rated high (RCR = 6.7).
2. The valley configuration is a narrow, flat-bottom V averaging 60 feet wide with steep sideslopes (greater than 70 percent). The stream is in a steep walled canyon through most of this reach.
3. All habitat units are well represented: grass-f orb, shrub-sapling, poles, small saw timber and large saw timber.
4. The coniferous overstory composition is dominated by Douglas-fir and ponderosa pine. Larch, true firs and cedar are also well represented. Deciduous species include red alder, cottonwood and oak. Red alder is found in low amounts throughout the reach and oak and cottonwood are rare. Tag alder is common along the stream margin.
5. Special habitats are talus slopes along 40 percent of the stream, rock outcrops (RM 25.0-29.0), snag patches and small wetlands along 10 percent of the streams. Large wetlands occur at RM 28.3 and RM 28.8.

Reach II; RM 32.6-40.4:

1. The riparian habitat is rated very high (RCR = 8.8).
2. The valley configuration is a very wide (200 to 1000 ft. ) floodplain in the glacial, U-shaped White River valley.
3. Four habitat units are present: shrub-seedling-sapling, poles, and small and large saw timber.
4. The coniferous overstory composition common to most of the reach is lodgepole pine, spruce, larch, Douglas-fir and true firs. Cedar is common below RM 34.5. Hemlock is rare. Cottonwood is found along the entire riparian corridor. Tag alder thickets are common along the river margins.
5. Special habitat units include a spring line along the north slope from RM 32.6-32.8, small snag patches, a talus slope, small wetlands, large wetlands along the west side floodplain from RM 35.4-36.3 and two small ponds.

Reach III; RM 40.4-43.1:\*

1. The riparian habitat is rated high (RCR = 7.5).

2. The floodplain is very wide (200 plus ft.), forming a flat-bottom, U-shaped valley. Wetlands are present along 10 percent of the reach length.
3. Four habitat units are present: grass-forb, shrub-seedling-sapling, poles and small saw timber.
4. The coniferous overstory is dominated by lodgepole pine between RM 40.4 and 41.9, and RM 42.7-43.1. The overstory is more diverse between these areas (RM 41.9-42.7) and is comprised of western hemlock, Engleman spruce, lodgepole pine, white pine, grand and noble fir, and Douglas-fir. Cottonwood and red alder are the two deciduous species in the riparian area.
5. Special habitat units include a one acre pond in the east side floodplain at RM 40.6 and a large sedge meadow (RN 41.9-42.4).

\* Data from Iron Creek survey.

Reach IV; RM 43.1-44.6:

1. The riparian habitat is rated moderate (RCR = 5.7).
2. The valley configuration continues to be very wide.

3. The number of habitat units in this reach decreases to three.  
Shrubs-seedlings-saplings and poles are common and found throughout; areas with small saw timber and/or grass-forbs are scattered.
4. Two coniferous species dominate this section, lodgepole pine and spruce.  
Low numbers of cottonwood are present.
5. A large snag patch (greater than 5 acres) is present at RM 43.0.

Reach V; RM 44.6-45.3:

1. The riparian habitat is rated moderate (RCR = 4.2).
2. The valley configuration continues to be very wide.
3. There are only two habitat units in this section: shrubs-seedlings-saplings, and poles.
4. Two coniferous species are found in this area, lodgepole pine and white pine.
5. No special habitats units are present.

## Tributary

### Mineral Creek; RM 0.0-3.0:

1. The riparian habitat is rated high (RCR = 6.9).
2. Three habitat units are present: shrub-seedling-sapling, poles and small saw timber.
3. Lodgepole pine dominates the coniferous overstory to RM 2.0 where spruce and silver fir become the dominant species. Spruce and larch are also in the lower section. Cottonwood is present in the riparian area from RM 0.0-1.0. Tag alder is common along the channel margins.
4. Special habitats include a 1-2 acre wetland and snag patch at RM 2.3, snags along the south slope from RM 1.8-3.0, and large wetlands and springs on the western slope from RM 3.0 to 6.5. Large meadows are present from RM 6.0-6.5 (above Oregon Highway 35); a small pond is located in one of the meadows. Mineral Creek apparently heads in these meadows.

## WHITE RIVER

### Rehabilitation and Enhancement Summary

#### Passage Enhancement; RM 31.8:

If anadromous fish are introduced to the White River system, the highest priority enhancement project would appear to be improving passage at the two 6-foot high bedrock chutes at RM 31.8 (see special case form for characteristics.) Passage could be relatively easily enhanced with jump pool improvement or a short fishway through a broad rock "apron" on the east side of the falls. Any improvement would likely require some blasting in the bedrock. Access is remote (1 mile away), and supplies would likely have to be hand carried into this area of the steep-sided gorge.

#### Rearing Habitat Enhancement; RM 25.1-43.1:

Pool habitat quality throughout the survey area is relatively poor during low flow periods. High quality pool development is usually associated with large channel structure such as bedrock outcrops. It appears that pool habitat could be improved using very large boulder (greater than 4 ft. diameter) placements either singly, clustered or in V-shaped berms. Heavy scour created by water moving over or around the structure is essential to keep the stilling area "cleaned" of sediment build-up. Habitat quality is lowest and heavy equipment access is best in Reach II (RM 32.6-40.4) and pool improvement

there would likely be highest priority. The road access at Keeps Mill (RM 29.8) would also allow heavy equipment work in that area of Reach I. An interpretive display could also be developed at Keeps Mill and other campground areas adjacent to White River on fish and wildlife habitat management in the basin.

Riparian Habitat Enhancement; RM 25.0-32.6:

Deciduous overstory components are scarce in Reach I along White River. Introducing or promoting deciduous tree regeneration, especially cottonwood, in this area would benefit many wildlife species. Small patch burns (1-2 acres) on the north bank, especially near seeps and springs, would likely encourage cottonwood regeneration.

Big game browse and non-game forage shrubs are relatively scarce in Reach I. Due to the high use this reach area receives as a migration corridor for big game, browse enhancement may be warranted. Wildlife plantings around the Keeps Mill area may yield some additional benefits by providing wildlife viewing opportunities in the campground area.

The campground and low water ford at Keeps Mill (RM 29.8) have several denuded areas that are slowly eroding and contributing sediment to White River.

Closing or redesigning the ford and reestablishment of ground cover in the camp and on the banks could alleviate this problem. Seeding and planting could be coupled with Wildlife forage enhancement (see above) for maximum benefits. This is a low priority project, due to the high sediment loading of White River already present.

WHITE RIVER

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM				POOLS				RIFFLES (%)					
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	1-6"	.1-1"	SD	D
I(25.0-32.6)	5.1	70	2:8	2.5	L-M	8	L	*	55	10	5	5	25	11
11(32.6-40.4)	3.8	10	1:9	2	L-M	12	L	0	20	20	10	15	35	8
<u>III</u> <u>1</u> / (40.4-43.1)	5.1	20	2:8	3	M	1	M-H	0	25	30	20	10	15	10
IV(43.1-44.6)	3.7	35	1:9	6	L	2	L	0	20	40	15	10	15	8
V(44.6-45.3)	3.6	5	1:9	4	L	1	L	0	30	45	15	5	5	3
Mineral Creek (RM 0.0-3.0)	5.3	30	6:4	3.5	L-M	4	M	0	20	35	20	10	15	4

1/ Data from Iron Creek survey, July 7-8 and 11-12, 1983.

LEGEND: HCR: Habitat Condition Rating  
s: Percent of stream shaded  
P:R: Ratio of pool length:riffle length  
G: Average gradient (%)  
d: Average maximum depth (L 12", M = 12 - 29", H \_ 30")  
A: Average pool area (sq. yards)  
EC: Effective cover (L \_ 40%, M = 40-60%, H \_ 60%)  
BR: Bedrock  
SD: Sand  
D: Average depth (inches)  
\*: Present, but less than 5%

WHITE RIVER

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT. 1/

<u>Species</u>	<u>REACH</u>					<u>TRIBUTARIES</u>	
	<u>I</u>	<u>II</u>	<u>III</u>	<u>IV</u>	<u>v</u>	<u>Deep Cr.</u>	<u>Mineral Creek</u>
Rb	L	L	*	*	L	( )	L

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)  
a = adult, j = juvenile

\* = habitat suitable; presence reported but not observed.  
( ) = habitat suitable; may not be present

1/: Very high turbidity levels in White River (0-0.5 ft. visibility) are likely responsible for the low numbers of fish observed. Population sampling should be conducted to determine the actual fish species and numbers present.

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

<u>Reach (R.M.)</u>	<u>Spawning Gravel (Sq. Yds.)</u>		
	<u>Total</u>	<u>Good</u>	<u>Marginal</u>
I (25.0-32.6)	136	32	104
II (32.6-40.4)	138	38	100
III (40.4-43.1)*	24	0	24
IV (43.1-44.6)	0	0	0
V (44.6-45.3)	0	0	0
Mineral Creek	<u>13</u>	<u>0</u>	<u>13</u>
TOTAL	311	70	241

\* Data from Iron Creek survey, July 7-8 and 11-12, 1983.

WHITE RIVER

TABLE IV - FISH MIGRATION OBSTRUCTIONS

<u>STREAM (R.M.)</u>	<u>TYPE</u>	<u>ID #</u>	<u>PASSABLE</u>	<u>RECOMMENDATIONS*</u>
RM 31.8	Bedrock chute	B1	P	Modify for passage.
RM 31.3	Bedrock chute	B2	N	Modify for passage.

LEGEND: F = full passage  
P = partial passage  
N = no passage

\*Refer to special case form for barrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

<u>REACH (RM)</u>	<u>Miles</u>		<u>P:R</u>	<u>Rearing</u>		<u>Spawning</u>		<u>Comments</u>
	<u>Avail.</u>	<u>Pot.</u>		<u>Area</u>	<u>Depth</u>	<u>1"-3"</u>	<u>3"-6"</u>	
1(25.0-32.6)	6.7	0.9	2:8	8	1	88	20	
X(32.6-40.4)	0.0	7.8	1:9	12	1	74	35	
111(40.4-43.1)	0.0	2.7	2:8	1	2	14	5	
IV(43.1-44.6)	0.0	0.0	1:9	2	1	0	0	
V(44.6-43.5)	0.0	0.0	1:9	1	1	0	60	
Mineral Creek	0.0	3.0	6:4	4	1	13	0	
<b>TOTAL</b>	<u>6.7</u>	<u>11.4</u>				<u>189</u>	<u>60</u>	

\* Data from Iron Creek survey, July 7-8 and 11-12, 1983.

LEGEND: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.  
Pot.: Additional miles of habitat potentially available with complete passage enhancement.  
P:R: Ratio of pool length : riffle length.  
Area: Average pool area (sq. yds.).  
Depth: Average pool depth (feet).  
Spawning: Number of Sq. Yards of gravels observed in the 1"-3" and 3"-6" size classes.

WHITE RIVER

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach R.M.)	<u>SP. GRAVELS</u>		<u>POOL</u>		<u>LWD CHARACTERISTICS</u>				
	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
1(25.0-32.6)	10	15	1	10	Var.	S-M	1	1-2	M
11(32.6-40.4)	10	10	5	5	Var.	M	1	1-2	T
111(40.4-43.1)*	10	0	10	85	Var.	M	1-2	1-2	M
IV(43.1-44.6)	0	0	20	0	Perp.	S+M	-1	1-2	L
V(44.6-43.5)	0	0	0	0	--	--	--	--	--
Mineral Creek	0	0	10	75	Perp.	S	1	1-2	M

\* Data from Iron Creek survey.

LEGEND: Total: Percent of total habitat area dependant on LWD  
 HQ: Percent of high quality habitat area dependent on LWD  
 OR: Angle of orientation to flow; Perp = perpendicular, Var = variable  
 #: Number of logs/structure; S = single log, M = multi-log  
 L: Average length of logs, expressed in channel widths  
 Dia: Diameter of average logs in feet  
 Source: L = local  
 T = transported  
 M = mixture of local and transported

TABLE VII - HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach (R.M.)	<u>SUMMER</u>				<u>BANKFULL</u>		<u>Floodplain Width (Ft.)</u>
	W	d	v	Q	W	D	
1(25.0-32.6)	25	1.5	2	75	35	2.5	60
11(32.6-40.4)	20	1	2.5	50	55	2.5	200 +
111(40.4-43.1)*	15	1	3	45	25	3	200 +
IV(43.1-44.6)	6	0.8	5	24	20	2	200 +
V(44.6-45.3)	5	1	4	20	20	3	200 +
Mineral Creek	6	0.8	1	5	15	2	200 +

\* Data from Iron Creek survey.

LEGEND: W,w: Stream width (ft)  
 D,d: Stream depth (ft)  
 v: Velocity (feet/second)  
 Q: Average reach flow in cubic feet/second

WHITE RIVER

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

<u>REACH (R.M.)</u>	<u>DATE</u>	<u>FLOW (cfs)</u>	<u>% SHADE</u>	<u>ASPECT</u>	<u>AIR/WATER</u>		<u>TIME</u>
					<u>TEMP. ° F</u>	<u>A/W</u>	
1(25.0-32.6)	10/12-19/83	70	70	E	57/47-47/41		1330-1630
II(32.6-40.4)	10/12-19/83	35-65	10	SE	63/50-46/43		1130-1715
111(40.4-43.1)	7/7, 11/83	45	20	S	54/46-40/46		1145-1645
IV(43.1-44.6)	10/19/83	24	35	SE	57/48		1400-1500
V(44.6-45.3)	10/19/83	20	0	SE	49/46		1310
Mineral Creek	10/13-19/83	5	30	SE	49/44-41/41		1335-1705

TABLE IX - RIPARIAN HABITAT SUMMARY

<u>REACH (RM)</u>	<u>RCR</u>	<u>VALLEY</u>		<u>VEGETATION</u>		<u>AQUATIC</u>			
		<u>F.P. (ft.)</u>	<u>H.U.</u>	<u>Overstory</u>	<u>Con. Dec.</u>	<u>Streamclass</u>	<u>Wetland%</u>	<u>Size</u>	<u>Special Habitat</u>
1(25.0-32.6)	6.7	60	5	5	1	I	L	S	4
11(32.6-40.4)	8.8	200 +	4	4	1	I	L	L, S	4
X11(40.4-43.1)	7.5	200 +	5	4	2	II	L	S	2
IV(43.1-44.6)	5.7	200 +	3	2	1	II			1
V(44.6-45.3)	4.2	200 +	2	2	0	II			0
Mineral Creek	6.9	200 +	4	3	1	II	L	L, S	2

LEGEND: RCR: Riparian Condition Rating  
 F.P.: Floodplain width in feet  
 H.U.: # Habitat units (H = 4; M = 2-3; L = 1)  
 Con: # Conifer species  
 Dec: # Deciduous species  
 Wetland: Percent of stream length with adjacent wetlands;  
 (H = 50%; M = 25-50%; L = 25%)  
 Size: Size of wetlands  
 S = small (less than 1 acre)  
 L = large (greater than 1 acre)

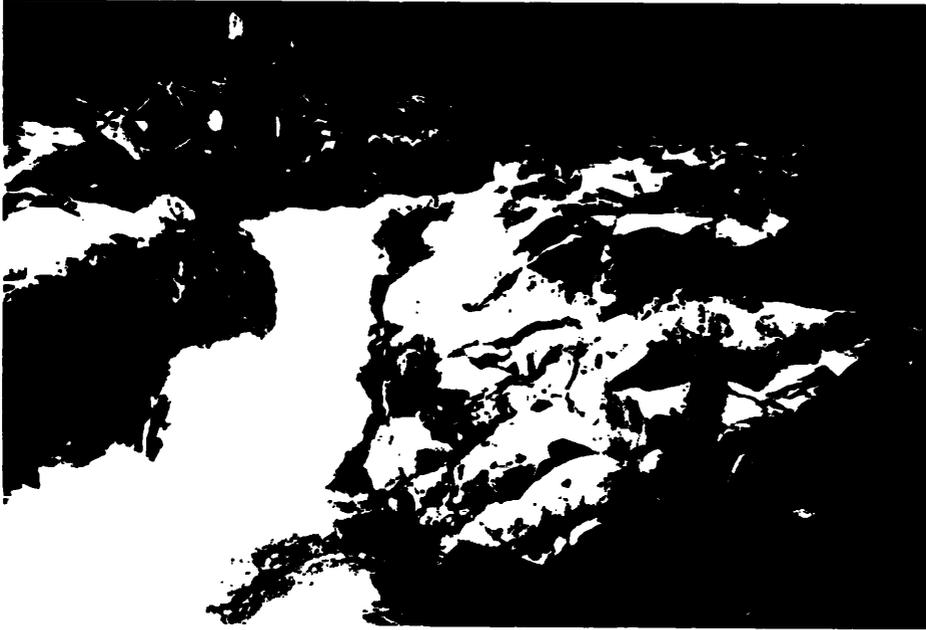
KAnderson:paw (WP-PJS-5276N)



Reach I (RM 25-32.60) lies in the deep, steep-sided White River gorge. Floodplain development is very limited in this reach, but localized 1-10 acre benches alternate frequently along the riverbanks and provide excellent wildlife habitat. Snag patches, bedrock outcrops, talus slopes, and small wetland/sprigs are special habitats commonly found in the reach. This large springline area at RM-28.2 has been heavily utilized by beaver and big game.



High quality pool development on White River is dependent on very large structural elements in the channel, such as bedrock outcrops or large boulders (more than 4 feet in diameter). These elements are relatively common in Reach I (RM 25-32.61), but very rare in the upstream reaches. Much of the stream's **pool** volume in summer low flows is filled with temporary deposits of sand and **silt**. Photo at RM 25.8.



Two 6 foot high chutes block resident and potential anadranous passage at RM 31.8 (upper barrier shown). Twenty miles of fair to good quality tributary and maInstem habitat lie above this point. No other migration obstructions were observed on the mainstem-survey area (RM 25-49. Passage enhacement options Include jump pool or fishway develoment.



White River in Reach II flows In a very wide, glaciated, U-shaped valley. Gradient is low over a substrate comprised primarily of sand and rubble. The stream surface area is dominated by fast flowing riffles and runs. The riparian zone contains lodepole pine, spruce, larch, Douglas-fir, cottonwood and tag alder. (Photo at RM 36.4.1



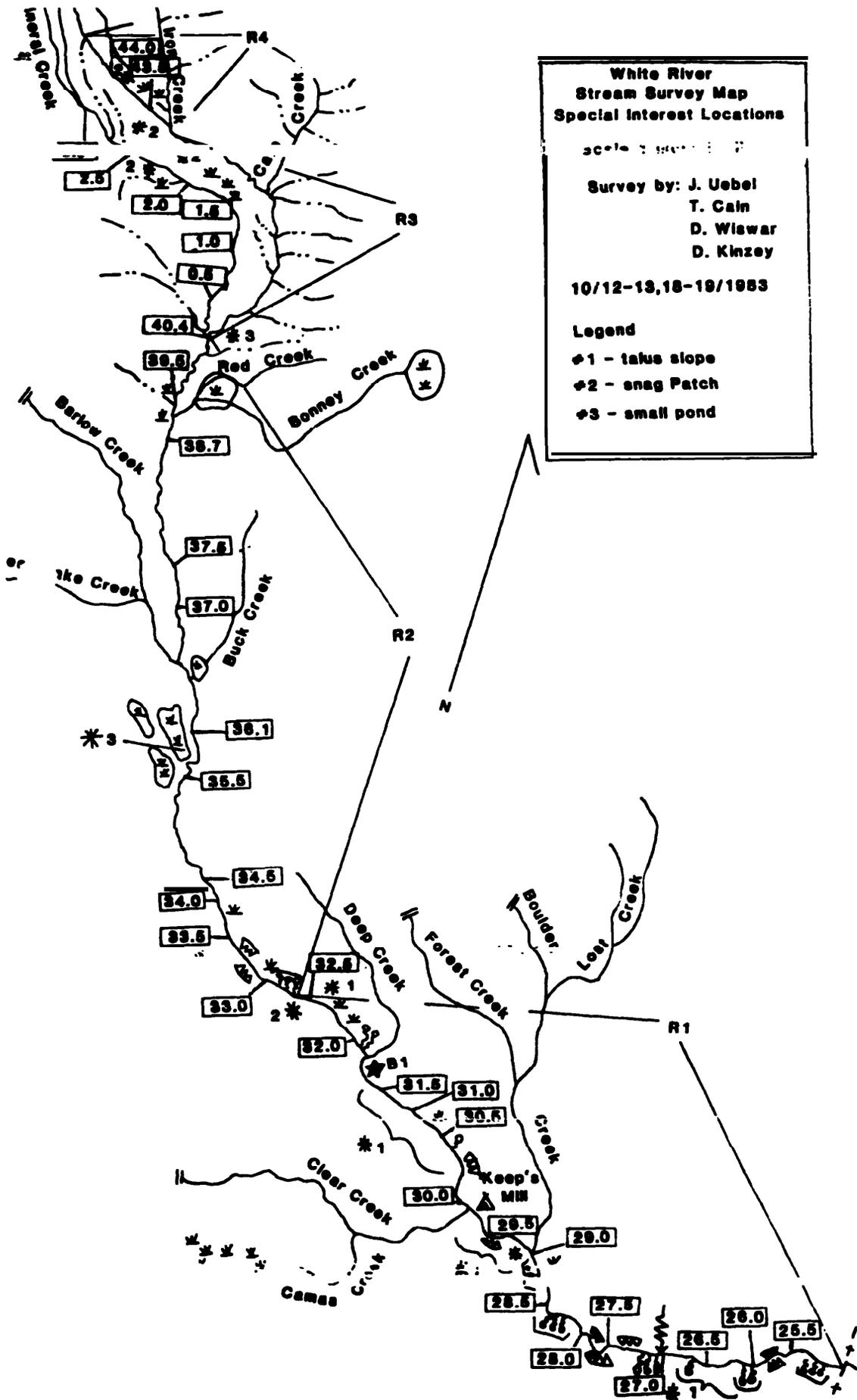
Large wetland development is high along the west side flood plain from RM 35.4 - 36.3. This wetland at RM 36.0 has a small pond associated with it. Deer and elk sign was abundant. Wetlands and springs are common along stream margins throughout the survey area (RM 25.0 - 45.3).



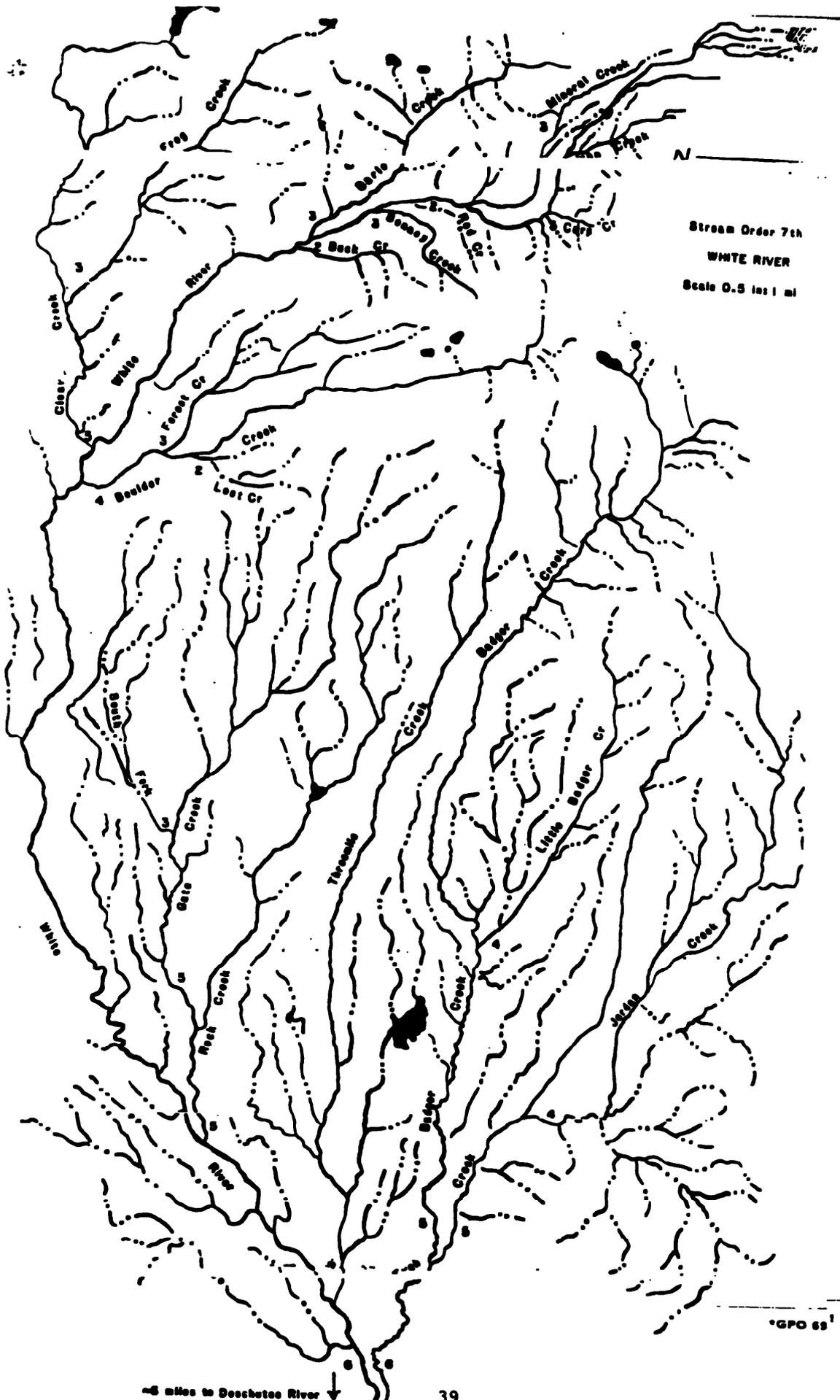
White River has recently captured the lower 2.7 miles of Iron Creek. Above the confluence (Reach IV), the channel and banks of White River are very unstable and the stream flows overland, with no channel development (shown at RM 42.3). Further upstream (Reach V), the channel characteristics change significantly, and the stream is entrenched in a narrow channel with high banks.



Rearing habitat in Mineral Creek is fair to good. Pools dominate the stream surface area (P:R=6:4). Pool size is moderate (4 sq. yds.) with shallow to moderate depth and moderate effective cover. Cover is provided by instream boulders and rubble, and a dense algal growth on the pool substrate. This view is at RM 0.2.







Stream Order 7th  
 WHITE RIVER  
 Scale 0.5 in = 1 mi

GPO 69-1-462 (1988)