NATURAL PROPAGATION AND HABITAT IMPROVEMENT

VOLUME I - OREGON

SUPPLEMENT C: WHITE RIVER HABITAT INVENTORY

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WHITE RIVER HABITAT INVENTORY

Mt. Hood National Forest

1983

Prepared by: Dave Heller (Project Leader)
Jeff Uebel
David Wiswar
Tom Cain
Doug Kinzev

1983 WHITE RIVER DRAINAGE FISH HABITAT INVENTORY

ABSTRACT

More than 130 miles of stream fish habitat was inventoried and evaluated on the Mt. Hood National Forest during the first year of this multi-year project. The number of stream miles somewhat exceeded the original target. Inventory, data evaluation and reporting work were accomplished within the original budget established in BPA/USFS Agreement No. DE-A179-83BP 13992, White River Habitat Inventory, Project No. 83-440.

First year 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.

A total of 136 miles on 17 stream systems in the White River drainage on the Forest have been inventoried and are assessed in this report. The surveyed area appears to contain most 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 IT-IV, in Section II, Drainage Summary Section). One hundred and twenty-four miles of potential anadromous fish habitat were identified in the survey. Currently, 32 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 20 miles of habitat, however, will require major investment to provide fish passage. (See Table I, Drainage Summary Section). Three large lakes (Boulder, 14 acres; Badger, 45 acres; Clear, 550 acres) appear to he well-suited for rearing anadromous fish, although passage enhancement would be needed before self-sustaining runs could be estahlished in any of the lakes.

All objectives of FY '83-84 project were met or exceeded within time and budget limits agreed upon with BPA. Summary tables, included in Section II of this report, and individual stream reports, Sections III, IV, and V, present findings of this year's inventory. Basic findings are as follows:

WHITE RIVER DRAINAGE
Potential Anadromous Fish Habitat Summary
Mt. Hood National Forest

STREAM	MILES 1/	REARING AREA (Yd^2)	POOL VOLUME (Yd^3)	SPAWNING 2/ AREA (Yd^2)	Spp. POTENTIAL
Tygh Cr.	3.4	9,011	2,973	318	St, Co
Badger Cr.	13.9	31,258	15,629	1,186	Ch, St, Co
Little Badger	5.5	8,125	2,681	237	St
Threemile Cr.	7.3	15,418	5,088	687	St, Co
Gate Cr.	6.0	9,387	4,694	348	St, Co
Boulder Cr.	10.7	31,539	21,131	2,310	Ch, St, Co, So
Forest Cr.	1.3	2,746	906	89	St, Co
White River	21.2	46,981	31,477	249	Ch, St, Co
Clear Cr.	12.3	48,953	32,798	1,347	Ch, St, Co
Frog Cr.	8.8	21,683	7,155	273	St, Co
Barlow Cr.	6.8	23,936	7,899	738	Ch, St, Co
Buck Cr.	1.0	1,373	387	149	St, Co
Bonney Cr.	0.7	493	163	85	St, Co
Iron Cr.	5.0	12,320	8,254	45	Ch, St, Co
Total	103.9	263,022	141,235	8,061	

1/ Miles of habitat currently accessible or potentially accessible with minor passage improvement work (see Tables I-III, Section II, White River Habitat Inventor&

2/ Includes only spawning habitat suitable for anadromous salmonids (l-6 dia.). Taken from Table V of the individual stream reports.

Habitat inventory work, using FY' 83-84 procedures, will occur on 40-60 miles of additional White River tributaries. These streams are believed to offer relatively less potential for anadromous fish production than those examined during the first year. Additionally intensive transect sampling of selected habitat parameters will also likely occur on various sample stream reaches. Habitat parameters and sample reaches for streams on National Forest System lands will be selected through consultation with appropriate BPA and ODFW personnel involved in the White River project.

WHITE RIVER HABITAT INVENTORY

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1983 WHITE RIVER DRAINAGE FISH HABITAT INVENTORY

INTRODUCTION

More than 130 miles of stream fish habitat was inventoried and evaluated on the Mt. Hood National Forest during the first year of this multi-year project. The number of stream miles somewhat exceeded the original target. Inventory, data evaluation and reporting work were accomplished within the original budget established in BPA/USFS Agreement No. DE-A179-83BP 11992, White River Habitat Inventory, Project No. 83-440.

First year 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 O.D.F.W. personnel involved in the White River Project.

All objectives of FY '83-84 project were met or exceeded within time and budget limits agreed upon with B.P.A. Summary tables, included in Section II of this report, and individual stream reports, Sections III, IV, and V, present findings of this year's inventory.

METHODS

The assessment was conducted by two, two-men teams. The teams 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 1/2 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.

Semi-quantitative 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 hahitat 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 streams 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 he used in place of, site specific reconnaissance and interpretation for the planning of individual projects.

RESULTS

A total of 136 miles on 17 stream systems in the White River drainage on the Forest have been inventoried and are assessed in this report. The surveyed area appears to contain most 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 and twenty-four miles of potential anadromous fish habitat were identified in the survey. Currently, 32 miles of this habitat would be readily accessible to anadromous fish. An additional 73 miles of habitat could be accessed with only minor passage improvement work. About 20 miles of habitat, however, will require major investment to provide fish passage. (See Table I, Drainage Summary Section). Three large lakes (Boulder, 14 acres; Badger, 45 acres; Clear, 550 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.

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 this year. 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 (blue pages). 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 (yellow pages), 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 (white pages), 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.

FUTURE WORK

Habitat inventory work, using FY '83-84 procedures, will occur on 40-60 miles of additional White River tributaries. These streams are believed to offer relatively less potential for anadromous fish production than those examined during the first year. Additionally, intensive transect sampling of selected habitat parameters will also likely occur on various sample stream reaches. Habitat parameters and sample reaches for streams on National Forest System lands will be selected through consultation with appropriate B.P.A. and O.D.F.W. personnel involved in the White River project.

White River Habitat Assessment

Budget FY 83

A.	Personnel	$32,079.93
B.	Travel/Per Diem	3,485.79
c.	Equipment/Supplies	
	Expendable	1,688.52
D.	Administrative Overhead	2,835.76
TOTAL SPENT TO DATE		$40,090.00

PHYSICAL AND BIOLOGICAL STREAM SURVEY FORM

*Required Data for TRI

PART A* (Office Routine Prior to Field)

USDA - Forest Service

Stream or Lake Name _____ Stream Index Nos. _____ Compartment Names and No. _____

Forest _____

Watershed No. _____

Trib. to _____ Basin _____ County _____

Surveyor(s) _____ Date _____ Agency _____

Stream Mouth in: Twp. _____ R. _____ Sec. _____

Transect _____ River Mile _____

Field Routine

PART B*

RIFFLE BOTTOM COMPOSITION (BY %)

	Riffles		Riffles
Bedrock	_____	1-6"	_____
More than 3'	_____	0.1" - 1"	_____
1' - 3'	_____	≤ sand	_____
6" - 12"	_____		

PART C*

POOL CHARACTERISTICS

Pool to Riffle Ratio _____

Avg. Length _____ x Avg. Width _____ = _____ sq. yds.

(% Maximum Depth)

<12"	12" - 29"	≥30"
_____	_____	_____

PART D

Effective Cover

V. Low 0-20%	Low 20-40%	Mod. 40-60%	High 60% +
_____	_____	_____	_____

% Pools Dep. L.W.D. _____%

PART E SPAWNING GRAVEL

			% Present
_____	Sq yd. good	1/2 - 1"	_____
_____	d. marginal	1-1/2 - 3"	_____
_____	ea Dep. L.W.D.	3 - 6"	_____

PART F LWD: HABITAT QUALITY INFLUENCE

LWD SOURCE

		Local	Trans	Mix	%	
Pool Quality	L					12-29", Low EC;<12", Mod EC
	M					>30",Low EC; 12-29",Mod EC;<12,High EC
	H					>30", Mod EC; 12-29", High EC

		Local	Trans	Mix	%
Gravel Quality	Good				
	Marg				

Perp. flow/⊥ flow
Single/Multi log
LWD Characteristics

LWD Size Class: >24" dia 12-24" <12"

>2x ch. width 1-2 ch. width <ch. width

Part G FISH SPECIES, SIZE, AND ABUNDANCE

Species	No. per 100' 0-5 (L)	6-50 (M)	50+ (H)	Method of Collection

Fish Species
Co - Coho
ChF - Fall Chinook
Chs - Spring Chinook
StS - Summer Steelhead
StW - Winter Steelhead
Rb - Rainbow Trout
Ct - Cutthroat
BT - Brook Trout
DV - Dolly Varden
WF - White Fish
Cot - Cottid

a-adult J-Juvenile

PART H - BARRIERS (Check Appropriate Column)

Item	Present	Special Form Used	Mapped Location	See Narrative for Elaboration
Log Jams				
Landslides				
Culverts				
Falls/Chutes				

Part I GENERAL NARRATIVE

Part J HABITAT AND HYDROLOGIC FEATURES

Today's Condition		Bankful Condition	
Water Width	ft	M.H.W Width	ft
x Water Depth	ft	x M.H.W. Depth	ft
x Velocity	fs	Gradient	%
Flow (Q)	cfs	Shade	%
x Riffle Depth	in	Temp. Air/Water	

_____/_____@_____hrs.

Part K FLOW REGIME

Flashy_____ (2:1) Moderately Flashy_____ (1.5:1) Well Regulated_____ (1:1)

MHW/LFW

Debris Orientation 11%_____ Random %_____

Other Lat Cut% on Jams_____ Sm Dbr on Jams Y___ N___

Part L BANK STABILITY

% Eroded

Stable_____ 10% ERSN Moderately Stable_____ 11-29% ERSN Unstable_____ 30% ERSN _____

Vegetation G.C %____ Root Matrix; Deep, Dense, Shallow, Sparse

Bankrock content 1"-3"%____ 3"-6"____ 6"-1'____ 1'-3'%____ 3'___ BDR%____

Other

Part M CHANNEL SUBSTRATE STABILITY

% Detached

Stable_____ 20% Detached Moderately Stable_____ 20-50% Detached Unstable_____ 50% Detached _____

Detachment_____ #size classes_____ Mix H__ M__ L___

Tone Dull____ MDull____ MBright____ Bright____

Embrication Lo____ Mod____ Hi____

Vegetation Y or N Riffles/Pools

Part N CHANNEL STRUCTURE

High_____ 50% Medium_____ 30-49% Low_____ 30% % Lg Pools During LFW____

Composition % Depn LWD_____

% Depn Bedrock_____

% Depn Boulders_____

% Lg Pools During MHW____

Other _____

Part O RIPARIAN VEGETATION

Vegetative Structural Diversity

Habitat Units_____ 30 Ft._____ Balance H 70

Description_____ _____ M 40-70

_____ _____ L 40

Overstory Comp. #Con spp____ # Dec Spp____ H 70

M 40-70

L 40

Description_____ _____

True Riparian Width_____ Valley Configuration_____

PART P AQUATIC HABITAT

Large Wetlands_____ #/M

Sm. Wetlands_____ % Length

Stream Class_____ Fld Pln Width_____

RIP_____

Part Q TRIBUTARIES

Special Form Used _____ I.D _____

Part R TICKLER FOR OTHER TRT INPUT

1. Dams, Beaver activity
2. Point source pollution
3. Stream channel diversions
4. Hydroseres (Ponds, wetlands)
5. Impoundment sites
6. Fish planting sites
7. Water turbidity
8. Springs/Seeps
9. Snag pockets
10. Sensitive Species
11. Rec. Use

Part S GENERAL NARRATIVE

WHITE RIVER DRAINAGE
Mt. Hood National Forest

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

	Accessible	Passage Enh. Level 1	Passage Enh. Level 2	Total Hab.
Tygh Cr.	1.2	2.2	3.5	6.9
Badger Cr.	10.3	3.6	3.2	17.1
Little Badger	1.9	3.6	2.0	7.5
Jordan Cr.*	0.0	0.0	4.5	4.5
Threemile Cr.	7.3	0	0	7.3
Gate Cr.	2.0	4.0	3.8	9.8
Boulder Cr.	1.0	9.7	0	10.7
Forest Cr.	0	1.3	1.1	3.4
White River	6.8	14.4	0	21.5
Clear Cr.	1.4	10.9	1.0	13.3
Frog Cr.	0	8.8	0	8.8
Barlow Cr.	0	6.8	0	6.8
Buck Cr.	0	1.0	0	1.0
Bonney Cr.	0	0.7	0	0.7
Iron Cr.	0	5.0	0.5	5.5
TOTAL	31.9	72.0	19.6	123.5

*Two 20-25 ft. 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 Enh.: 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 ft.) 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	REARING LENGTH (Mi.)	REARING WIDTH (Ft.)	REARING P:R	REARING AREA (Yd^2)	REARING VOLUME (Yd^3)	SPAWNING (Yd^2) 1-3"	SPAWNING (Yd^2) 3-6"	Spp. POT.
Tygh Cr.	1.2	8	5:5	2,816	929	77	36	St, Co
Badger Cr.	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 Cr.	7.3	9	4:6	15,418	5,088	443	244	St, Co
Gate Cr.	2.0	5	6:4	3,520	1,760	112	20	St, Co
Boulder Cr.	1.0	18	4:6	4,224	2,830	148	104	Ch, St, Co
White River	6.8	25	2:8	19,947	13,364	77	17	Ch, St, Co
Clear Cr.	1.4	17	3:7	4,189	2,807	18	26	Ch, St, Co
TOTAL	31.9			75,769	38,942	1506	757	

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 sq. yards.
- Volume : Total low flow pool volume in cu. yards.
- Spawning : Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes. Taken from Table V, individual stream reports.
- 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 III - HABITAT SUMMARY OF STREAM MILES ACCESSED BY MINOR PASSAGE ENHANCEMENT (LEVEL I*)

STREAM	REARING LENGTH (Mi.)	WIDTH (Ft.)	P:R	AREA (Yd^2)	VOLUME (Yd^3)	SPAWNING (Yd^2) 1-3"	3-6"	Spp. POT.
Tygh Cr.	2.2	8	6:4	6,195	2,044	142	63	St, Co
Badger Cr.	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	4.0	5	5:5	5,867	2,934	198	18	St, Co
Boulder Cr.	9.7	16	3:7	27,315	18,301	1455	603	Ch, St, Co, So
Forest Cr.	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 Cr.	10.9	14	5:5	44,763	29,991	1024	279	Ch, St, Co
Frog Cr.	8.8	6	7:3	21,683	7,155	247	26	St, Co
Barlow Cr.	6.8	10	6:4	23,936	7,899	421	317	Ch, St, Co
Buck Cr.	1.0	4	5:5	1,173	387	105	44	St, Co
Bonney Cr.	0.7	3	4:6	493	163	60	25	St, Co
Iron Cr.	5.0	14	3:7	12,320	8,254	34	11	Ch, St, Co
TOTAL	72.0			187,253	102,293	4200	1598	

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 sq. yards.
- Volume : Total average low flow pool volume in cu. yards.
- Spawning : Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes. Taken from Table, V, individual stream reports.
- 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	REARING LENGTH (Mi.)	REARING WIDTH (Ft.)	REARING P:R	REARING AREA (Yd^2)	REARING VOLUME (Yd^3)	SPAWNING (Yd^2) 1-3"	SPAWNING (Yd^2) 3-6"	Spp. POT.
Tygh Cr.	3.5	6	5:5	6,160	2,033	237	98	St, Co
Badger Cr.	3.2	13	3:7	7,322	3,661	135	49	St, Co, So
Little Badger	2.0	3	3:7	1,056	348	46	16	St
Jordan Cr.	4.5	8	3:7	6,336	3,168	526	183	St, Co
Gate Cr.	3.8	6	4:6	5,350	2,675	192	21	St
Forest Cr.	1.1	15	2:8	1,936	639	48	13	St, Co
Clear Cr.	1.0	3	5:5	880	590	86	2	St, Co, So
Iron Cr.	0.5	5	3:7	440	295	2	2	St
TOTAL	19.6			29,480	13,409	1272	384	

LEGEND:
- Miles : Miles of anadromous fish hahitat
- 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 sq. yards.
- Volume : Total low flow pool volume in cu. yards.
- Spawning : Number of sq. yards of gravels observed in the 1"-3" and 3"-6" size classes. Taken from Table V, individual stream reports.
- Spp. POT.: Potential anadromous fish species apparently suited to habitat conditions present on each stream system. St = steelhead, Co = coho, Ch = chinook, So = so&eye.
- * : Stream miles from Table I.

TABLE V - IRRIGATION DIVERSION STRUCTURES (MHNF)

STREAM	LOCATION	TYPE	PASSAGE Up	(Mi.)	Down	PASS. ENH. Up	Down	Comments
Tygh	15.2	LH	N	(5.7)	N	H	H	Log structure with board spillway 6 ft. high, 6 ft. long.
Badger	15.3	LH	N	(7.0)	N	H	H	Concrete structure with board slat inserts.
Gate	8.6	LH	N	(6.2)	N	M	M	Concrete structure with board slat inserts.
Boulder	3.1	LH	P	(7.6)	N	H	H	Log structure with board slat inserts.
Forest	1.6	LH	N	(0.8)	N	L	L	Log and concrete with board slat inserts.
Clear	7.8	LH	N	(4.0)	N	H	H1/	Concrete structure with board slat inserts (5 ft. high).
Frog	4.6	LH	N	(4.0)	N	H	H	Earth fill structure with concrete and board slat spillway.
Rock2/	8.3	D	N	(1.7)	N	L	L	50 ft. tall earth fill structure.

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

2/ Rock Cr. has not yet been surveyed for the White River Habitat Inventory.

LEGEND:

LOCATION : Location on stream, in miles moving upstream from the mouth (RM).

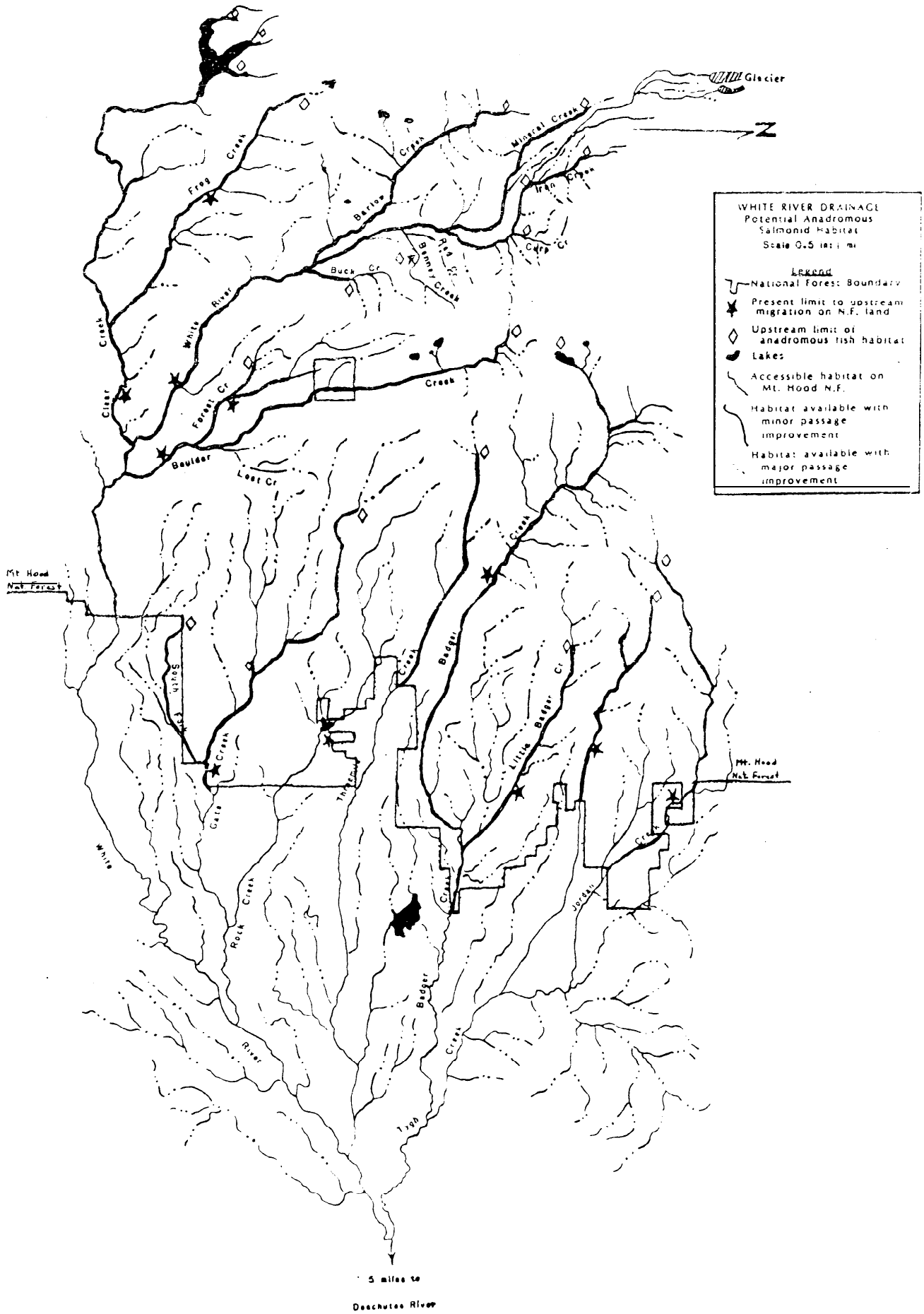
TYPE : LH = Low head structure, less than 8 ft. tall. D - dam, greater than 8 ft. tall.

PASSAGE : Does structure present an obstruction to fish migration?

Up: 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 ( ).

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.


WHITE RIVER DRAINAGE
Potential Anadromous
Salmonid Habitat
Scale 0.5 in = 1 mi
Legend
National Forest Boundary
Present limit to upstream migration on N.F. land
Upstream limit of anadromous fish habitat
Lakes
Accessible habitat on Mt. Hood N.F.
Habitat available with minor passage improvement
Habitat available with major passage improvement
Glacier
N
Frog Creek
Barlow Creek
Mineral Creek
Iron Canyon
Red Cr
Bennett Creek
Buck Cr
Clear Creek
White River
Forest Cr
Boulder Creek
Lost Cr
Mt Hood Nat Forest
South Fork
Gate Creek
Thirtyone
Badger Creek
Little Badger Cr
Jordan Creek
Rock Creek
White River
Tygh Creek
5 miles to
Deschutes River

TYGH CREEK
BARLOW RANGER DISTRICT

Surveyors: David WIswar
Doug Kinzey

County: Wasco

Dates Surveyed: September 12, 14-15, and 20, 1983

Mouth Location: T.4S., R.l3E., Sec. 11

Tributary to: White River

Watershed Area: 77,200 acres
730.6 sq. miles

Drainage: Deschutes

Stream Order: VI

TRI Compartments:
Flag 1402, Jordan 1405
Ball 1404, Tygh 1406

Stream Length: 20 miles

Game Fish: Rainbow trout

Low Flow Width (Avg.): 6 feet

Potential Anadromous Species:
Steelhead trout
Coho salmon

Distance Surveyed:
Mainstem: 6.1 mi. (RM 14.0 - 20.1)
Tributary B: 0.75 ml.

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 numbers from RM 14.0-18.0.

B. Watershed Characteristics and Geomorphology

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 flows in a narrow, V-notched valley. Floodplain width is generally between 50-60 feet until RM 18.2, where the floodplain width decreases to less than 30 feet. Sideslopes are moderately steep to steep (50-70%) throughout the stream's length up to about RM 19.3 where they are moderate (30%). Stream channel gradient is low (4%) between RM 14.0 and 16.4. From RM 16.4 to RM 18.2, the gradient is high (8%) with short, steeper sections (14-23%). 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%. 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 contributes approximately 50% of the flow (2 cfs) at its confluence with Tygh Creek (RM 17.4). Small wetlands 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% 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% of the surveyed length, boulders 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%) 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 gravels are numerous, totalling 3038 square yards. Approximately 60% 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, l-2 square yards, with 80% of the gravels suitable for anadromous fish. Above RM 18.2, bed size increases to 3-4 square yards with 50% suitable for anadromous species. The overall influence of LWD on gravel retention in the lower two reaches is relatively low (<30%). In the upper reaches (RM 17.4 - 20.1); its importance increases (70%). In all reaches, high quality gravel bed formation and retention is highly dependent on LWD.

Pool size throughout the surveyed length averages 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 8. The importance of LWD in pool formation is low (<40%) between RM 14.0 - 18.2. In the upper reach, LWD has an influence on 70% of the pool development. Several migration barriers are present, including the diversion structure and four high gradient areas (17-23%) 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 were also identified between RM 15.2 and 16.8. Shallow pool development below these structures may present passage problems during low flows. The habitat appears suitable for winter steelhead trout and marginal for coho salmon. Rainbow trout were observed in low numbers 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 over-story 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 barriers and increasing pool quality. Presently, 4.9 miles of stream are blocked due to the diversion structure at RM 15.2. Additional barriers which block almost 400 square yards of potential spawning habitat in Reach IV include three high gradient (>20%) 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.

TYGH CREEK
Reach Summary

Reach I; RM 14.0 - 16.4:

1. Va1ley configuration narrows at RM 15.1 from a very wide WOO feet), flat bottom V-shaped val1ey 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%).

3. Rubble and gravel dominate the substrate composition (55%).

4. Pool to riffle ratio is equal (P:R = 5:5).

5. Stream shading is high (85%).

Reach II; 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%), with maximums of 17% and 20% at RM 16.8 and 17.25, respectively.

3. Substrate sizes increase with boulder and rubble dominating (70%).

4. Pooh are slightly more common than riffles (P:R = 6:4).

5. Stream shading is high (90%).

Reach 711; 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%).

3. Substrate size classes decrease slightly from the previous reach, remaining boulder and rubble dominated (60%).

4. Pool and riffle ratio is even (P:R = 5:5).

5. Stream shading remains high (80%).

Reach IV; RM 18.2 - 20.1:

1. Valley configuration narrows to a 25 foot wide, V-shaped floodplain with gentle (30%) sideslopes.

2. Gradient remains moderate (6%) and has a stair-step profile controlled by LWD.

3. Substrate size decreases substantially with the gravel size class dominating (70%).

4. Pool to riffle ratio remains even (P:R = 5:5).

5. Stream shading decreases to moderate (75%).

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%, increasing from 8% at the confluence with Tygh Creek to a high of' 22% at RM 0.4 and then decreasing to 5% above that point.

3. Substrate is predominantly rubble (45%).

4. Pool-to-riffle ratio averages 45

5. Stream shading is high (90%).

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 yards along the stream banks above the low flow channel. The higher quality gravels are also in small accumulations. Boulder structure is dominant and accounts for most of the ravel rentention. The influence of LWD on gravel rentention is low (35%); however, 75% of the high quality beds are LWD dependent. Fifty percent (184 square yards) are in the 1.5-3 inch size class, and 35% (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%). As with gravel retention, boulder structure is far more significant. High quality pools are rare. Of those observed, only 30% 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 yards 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% 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%; 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% and at RM 17.25, it increases to 20%. 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% 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% of the total) are in the 1.5-3 inch size class; 15 square yards in the 3-6 inch size class; and 50% (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%). 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% 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% are boulder formed.

4. The stream shows two consistent and distinct variations with respect to gradient. The boulder-rubble sections generally exhibit an 8% gradient. The gradient above LWD accumulations is 3-5% 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%, and at RM 18.2 where the gradient is 22% 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.

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% of the total gravel retention and is important in the formation of 90% of the high quality beds. Gravel in the 0.5-1.5 size class accounts for slightly more than 50% 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% of the total pool development. High quality pools are very rare. Of those present, 80% 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% to 22% at RM 0.4. Above RM 0.4, the gradient decreases to 3%. 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% 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% 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-shape4 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).

   The floodplain width remains narrow (55 feet), forming a flat bottom, V-shaped valley.

2. Habitat units decrease to four. Grass-forbs are generally lacking.

3. 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% 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 19.2, 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/Enhancement Summary

Passage Enhancement; RM 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 RM 0.4) are boulder and bedrock chutes approximately 100 feet long with greater than 20% 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

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(14.0-16.4)	6.3	85	5:5	4	L	3	M	0	25	25	30	10	10	3
II(16.4-17.4)	6.5	95	6:4	10	L-M	2	H	0	45	25	15	10	5	3
III(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 (%)
- 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%, 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	REACH				TRIBUTARIES
	I	II	III	IV	TRIB. B
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)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
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
TOTAL	1038	426	612

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (RM)	TYPE	ID#	PASSABLE	RECOMMENDATIONS*
15.15	Logjam	J_1	P	Low priority
15.2	Diversion structure		N	Modify for passage
15.7	Logjam	J_2	P	Low priority
15.75	Logjam	J_3	P	Low priority
16.1	Falls	F_1	P	Low priority
16.45	Logjam	J_4	P	Low priority
16.7	Logjam	J_5	P	Low priority
16.8	17% gradient	B_1	P	Low priority
16.81	Logjam	J_6	P	Low priority
17.25	20% gradient	B_2	N	Modify for passage
17.6	Chute (23% gradient)	B_3	N	Modify for passage
18.2	22% gradient	B_4	N	Modify for passage
Tributary B (RM 0.4)	22% gradient	B_5	N	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 Avail.	MILES Pot.	REARING P:R	REARING Area	REARING Depth	SPAWNING 1-3"	SPAWNING 3-6"	COMMENTS
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	5.65				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

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	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

TYGH CREEK

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

Reach (R.M.)	SUMMER w	SUMMER d	SUMMER v	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
I (14.0-16.4)	8	.5	1	4	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

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP. ^{o} F A/W	A/W	TIME
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	80	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	90	E	57/47		1315

TYGH CREEK

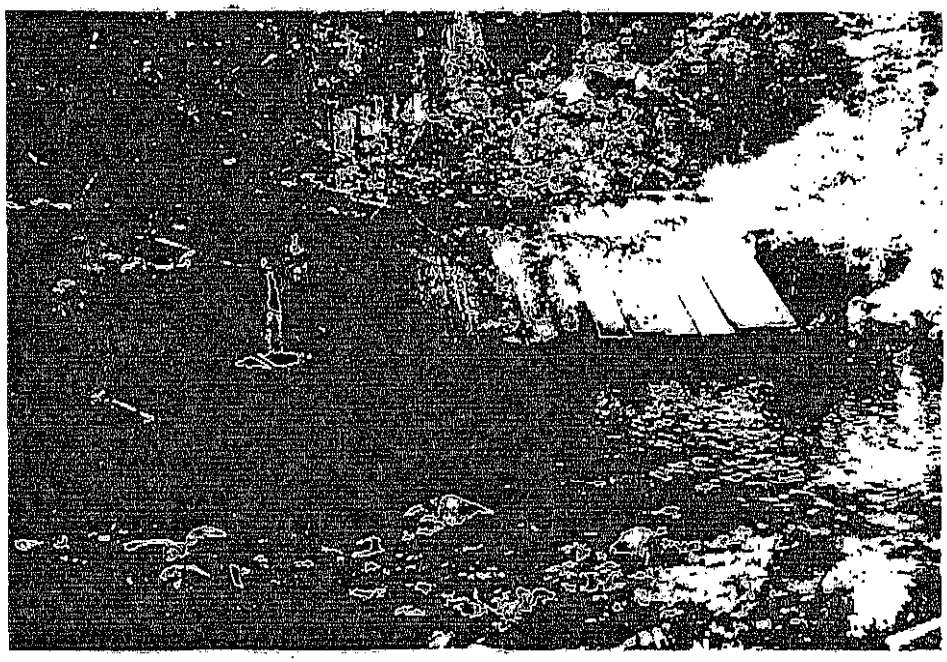
TABLE IX - RIPARIAN HABITAT SUMMARY

REACH (RM)	RCR	VALLEY	VEGETATION			AQUATIC			
		FP (ft)	H.U.	Overstory Con.	Overstory Dec.	Streamclass	Wetland%	Size	Special Habitat
I(14.0-16.4)	7.0	135	5	2	1	I	-	-	2
II (16.4-17.4)	5.3	45	5	4	1	I	-	-	2
III(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 H $\geq$ 4; M = 2-3; L $\leq$ 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)

The stream gradient in Reach I 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.)

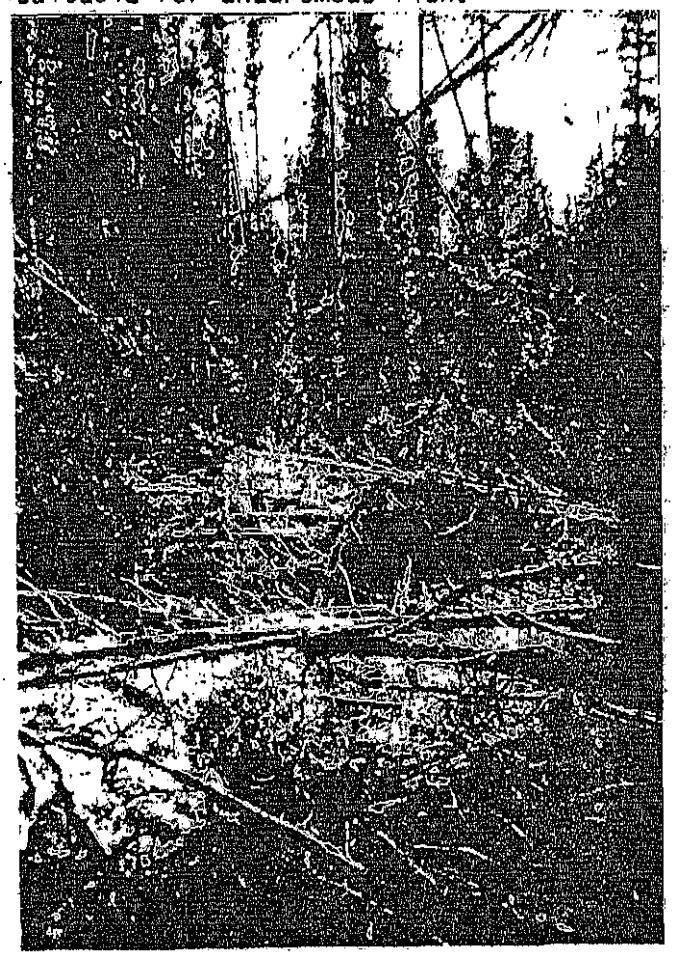


The diversion structure at RM 15.2 is a complete barrier to fish migration which blocks an additional 6.85 miles of potential fish habitat. The structure is about 5 feet high and has a good size pool below it (20 sq. yds.). At the time of the survey, no flows were diverted; however, it has been reported 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.) then Reach I; however pool depths and effective cover are greater.

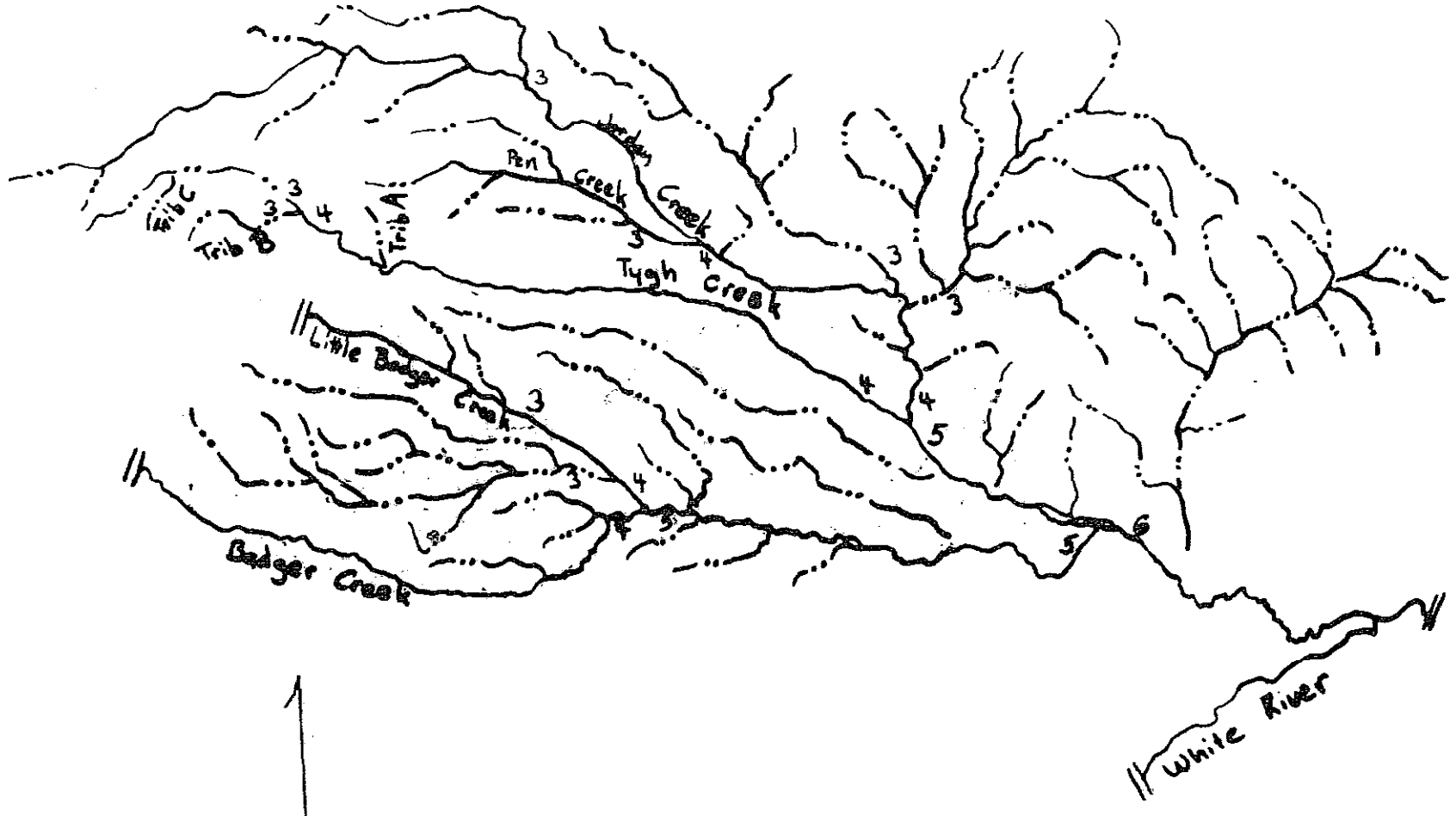
Pool sizes and gradient are variable in Reach III (RM 16.4 shown). Boulder-rubble sections are 8% gradient, with low quality pool development. Other interspersed sections are influenced by large woody debris (LWD) with associated large sediment plain development. Pools behind the LWD are larger (6-10 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.

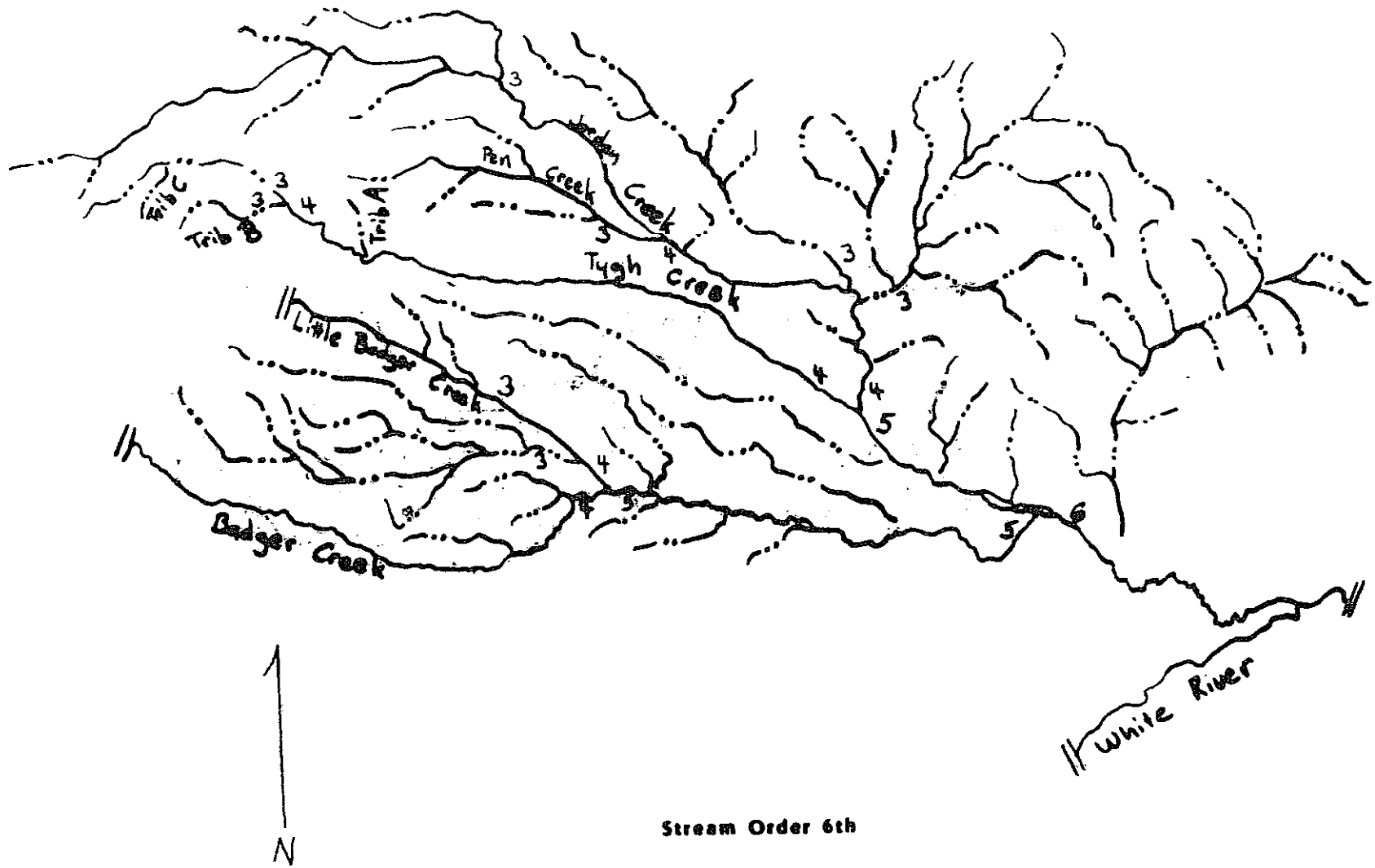


N

Stream Order 6th

TYGH CREEK

Scale 0.5 in: 1 mi



Stream Order 6th

TYGH CREEK

Scale 0.5 in: 1 mi

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
^{R}I,II,III	REACH # and SECTION
T_1 1.0	TRANSECT # and RIVERMILE
OBSTRUCTION	BARRIER
J1,2,3,	JAM and #
F( )1,2,3	FALLS, HEIGHT, and #
C1,2,3	CULVERT and I
B1,2,3	CHUTE and I
	DIVERSION STRUCTURE (I = water Is used for irrigation purposes1
	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
S-47	ROAD AND ID NUMBER
	EARTHFLOW

BADGER CREEK
BARLOW RANGER DISTRICT

Surveyros: Jeff Uebel
Tom Cain

Countv: Wasco. Hood River

Dates Surveved: August 30-31. 1983
September l-15. 1983

mouth Location: T4S, Rl3E, Sec. 5

Tributary To: Tygh Creek

Watershed Area: 32,000 acres
50 sq. miles

Drainage: Deschutes

Stream Length: 22.1 miles

Distance Surveved:
17.1 miles mainstem
0.2 miles Gumjunwas Creek

TRI Compartments: Morrow 1420
Sling 1419
Grasshopper 1418
Pine 1407
Drop 1406
Badger 1405

Average Low Flow Width: 12 feet

Game Fish: Rainbow Trout

Stream Order: V

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% (29,000 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% 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 (HR 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 (ODFW) 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% (5 cfs) of the combined low flow with Badger Creek, and Pine Creek, contributing 10% (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%), and low shading (30%). 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% 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 sitings 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) anadromous fish juveniles from the system. Increasing spawning habitat through installation of gravel catchment structures would improve the mainstem habitat conditions for anadromous 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 Resevoir. Also, the area from RM 10.3 to 11.5 is located on the margin of the 1974 Rocky Burn. 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%).

3. The riffle substrate composition is predominantly boulder/rubble (65%).

4. The pool to riffle ratio is balanced (P:R=5:5). Bedrock outcrops are common, which have created long, large pool areas.

5. Shading is low (30%) 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%.

3. The riffle substrate size increases with boulders composing 70%.

4. Riffles increase to 70% of the stream area.

5. Shading doubles from Reach I levels (60%) 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%). 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%.

3. The substrate remains boulder dominated (60%).

4. The pool to riffle ratio is similar to Reach II.

5. Shading increases to 80%.

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%), 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% 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 anadromous species (especially summer steelhead).

3. Moderate amounts of spawning gravel were observed (381 sq. yds.), of which 60% were rated marginal due to poor channel placement. Seventy percent of the gravels are of a size class suitable for anadromous 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%) 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% of the 878 sq. yds. of gravel are rated marginal due to poor channel placement. Seventy percent are in the anadromous size class.

4. A logjam (J6, RM 8.25) creates a partial passage barrier to potential anadromous 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% of the 634 sq. yds. of gravel observed are marginal due to channel placement and 70% 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 (J1-J2) 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%) the stream area. Stream gradient is steep, 12%. 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% were rated marginal and 80% of a size class suitable for anadromous 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 anadromous 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 vallev floor tvpifies the area from RM 5.0 to approximatelv 13.0. The sideslopes in this stretch are generally talus and felsemeer with rock cliffs along the vallev rim; 2) A transitional area (RM 13.0-17.0) shows a gradual change in decidious 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 occassional oak and grass clearings in the moderately wide valley bottoms; 3) A predominantly dense cedar/hemlock overstorv is present from RM 17.0 to 22.1. The sideslopes are heavilv forested with intermittent talus slopes. The vallev is 'r-notch shaped, with little floodplain or valley bottom development.

The riparian understory. ground cover and hank stability has been heavilv impacted by cattlegrazing from RM 5.7 to 7.0. A range fence at RM 7.0 limits grazing above this point. The Forest boundarv occurs at RM 6.3.

Wildlife sign and sitings in the survev area included heaver. mink, deer, elk, wood ducks, golden eagle, ruffed arouse, and wild turkev. The vallev is heavilv utilized as a travel corridor by hig game. Ladybugs, apparentlv preparing to overwinter, 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 ha: that gives this area a disproportionatley nigh 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 oenerallv scarce.

4. The sparse overstorv 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

I. The gioarian 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/forh is greatlv reduced while the occurence of large saw timber is incresased.

4. The overstorv 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 hahitats are present between transect ooints including rock cliffs. drv meadows. talus slopes, and snag patches (which are predominantlv located between RM 11.0-11.5 and are remnants of the Rocky Burn of 1974).

Reach III; RM 16.3-22.1

1. The Riparian Condition Rating decreases to 5.6 (moderate).

2. The floodplain width decreases to 40 feet.

3. Four hahitat units are present (shrub/sheedling/sapling, poles, small and large saw timber).

4. An average-.of four conifer species make up the overstorv. No deciduous species are included in the overstory, although cottonwood was occasionally observed hetween RM 15.3-18.0. Its presence and role in the riparian overstorv is vet-v limited.

5. Small wetlands (RM 21.9-72.1) and bedrock cliffs are the oredominant 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 cshrub/seedling/sapling, pole, small and large saw timber).

4. Four conifer species are well represented (cedar, hemlock true and Douglas-fir).

5. No soecial habitat units were observed.

BADGER CREEK
Rehabilitation and Enhancement Summary

Passaqe Enhancement, RM 8.3-19.3

Several logjams (RM 8.3. 19.0, 19.3) chutes amd falls (RM 18.2-19.1) and a diversion structure (RM 15.3) present partial to full migration barriers for salmonids. Alteration of loq jam J6 (RM 8.31 and the diversion structure (RM 15.3) to provide passage would appear to he a ver.v high prloritv if anadromous fish are Introduced to the Badger Creek system. This would access ten additional miles of high qualitv holdina, spawning. and rearing habitat for chinook and steelhead. Altering the harriers RM 18.2 to 19.3 for passage would he comparatively easy and would access 3 additional miles of fair-good quality habitat for steelhead. The value of this added anadromous hahitat mav be outweighed, however, by its value as an area for wild trout management.

If anadromous 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 mav limit present resident trout and potential anadromous fish habitat capability. Pools in this area generallv lack volume and effective cover durinq low flow conditions. This is largelv due to the diversion of 90% of the streamflow to the Highland Ditch (RM 15.31. Holding habitat qualitv (particularly depth\ for anadromous fish is greatly lessened bv 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 hahitat is particularlv imoortant considering the very flashv flows and high bedload movement in the mid and lower reaches of Badqer Creek.

Increasing pool depth fprincipallvl, area and effective cover appears to he a high prioritv for improving hahitat capahilitv for salmonids, particularlv in Reach II (RM 8.0-15.31. This could be accomplished throuqh pool excavation, installation of large channel structure and/or increasing low flow discharge past the diversion structure. In-channel work will likely be verv limited due to the remote character of the drainage and the relatively larae 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 larqe logs favailahle on-site) in the channel using hand tools and labor mav be an option in remote sections.

An excellent opportunitv 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 fusing on-site material1 could be implemented at this site. Enhancement activity in this area would have additional recreational henefits ffishing, swimming etc.) due to the adjacent campground area.

Spawing Habitat Enhancement, RM 5.0-15.3

Spawning habitat is relativelv scarce and patchy in distribution throughout the potential anadromous habitat on Badger Creek. Gravel area averages 90 sq. yds. per mile, with 65% rated marginal due to poor channel placement. The sections from RM 7-8 and 11-16 are oarticularlv low in gravels. This condition appears to he 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 capahilitv for anadromous fish. Project desiqn and implementation will be complicated by the lack of access and flashy nature of the stream. Proiect desiqn could be integrated with rearing habitat enhancement (see above1 for added benefit. The Bonnev Crossing area would appear to he a high orioritv site for initial treatment.

Side-Channel Rearlnq and Riparlan Habitat Improvement, RM 5.0-17.0

Broad vallev 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 5.0-8.41. These areas provide an opportunity to increase rearlng areas through the creation of small side channels. In some cases. old stream channels or intermittent tributary channels are present. and could easilv he 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.

Construcing these channels would provide refuge habitat for fish during high flows (and heavy hedload movement1 as well as provide excellent juvenile rearing habitat. They would also create additional benefits throuqh riparian habitat enhancement. Greatly added henefits to fish and wildlife could he expected if side channel development was coupled with the creation of ponded areas in the terraces. An excellent opportunitv 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 he limited to this area, adjacent to the Bonnev Creek campground. The terrace is in the Rocky Burn area, with ahundant snags and relativelv hiqh wildlife habitat diversity. Pond and/or side channel development would improve the habitat for fish, biq game, furhearers and waterfowl. Pond development in these areas mav also help supplement summer low flow conditions downstream in the main channel. Proiect 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 Rehahilitation, RM 5.7-7.0. 11.7, 21.8-77.0

Riparian vegetation has been heavilv impacted bv grazing RM 5.7-7.0. Reduced vegetative cover, compacted sails, and bank erosion due to livestock activity has decreased the riparian qualitv and hank stabilitv 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 reveaetation of the banks in this area would greatly improve fish habitat. Heavy recreational use at the Bonnev Crossing (RM 11.71 and Badger Lake campgournds (22.0) has denuded larqe areas of the valley bottom and stream banks. with much ground compaction evident. Management to decrease human impact, possihlv coupled with educational exhibits, could assist in the recovery of the area. Both grazing and recreation damaged areas could benefit from seedinq and planing to reduce surface erosion.

Forest Service Road S-2710 has inadequate cross drainage and draiinage now is occurinq down the road surface. This could he 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	BR	1'+	6-12"	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
III(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:
- HCR: Habitat Condition Rating
- 5: Percent of stream shaded
- P:R: Ratio of pool length:riffle length
- G: Average gradient (%)
- d: Average maximum depth (L $\leq$ 12", M q 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, hut less than 5%

Badger Creek

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

	Reach			Tributaries				
Species	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)	(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)

	Spawning Gravel (Sq. Yds.)		
Reach (R.M.)	Total	Good	Marginal
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
TOTAL	1,951	739	1,212

Badger Creek

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIOONS*
8.25	Logjam	J6	P	Partial removal.
15.3	Diversion dam	D1	N	Develop jump pool
18.2	Chute	B4	N	Modify for passaqe
18.3	Chute	B3	F	Possible velocftv harrier
18.3	Log sill	None	N	Modifv for passage
18.9	Falls	F2	N	Modify for passage
14.0	Logjams	J2	N	Modify for passage
19.1	Chutes	B1 and B2	N	Remove logs from B1
19.1	Falls	F1	N	Modifv for passaqe
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 harrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning I"-3"	Spawning 3"-6"	Comments
I (5.0-8.0)	3.0	0	5:5	20	1-2	172	101	
II f8.D - 15.3)	7-2	6.8	3:7	8	1	432	209	
III (15.3-22.1)	10.3	6.8	3:7	14	1-2	334	132	
Total						938	442	

Legend: Avail.: Miles of habitat presently accessible to anadromous fish if introduced.
Pot.: Additional miles of habitat potentiallv available with complete passage enhancement.
P:R: Ratio of pool lenqth : riffle length.
Area: Average pool area (S q. ft)
Depth: Average pool depth (feet).
Spawning: Number of Sq.,Yards of qravels observed in the I"-3" and 3"-6" size classes.

Badger Creek

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach	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 dependant 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 = sinaie loq, m = multi-loq
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

	SUMMER				BANKFULL		
Reach (R.M.)	w	d	v	Q	W	D	Floodplain Width (Ft.)
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: Velocltv 'feet/second'
q: Average reach flow in cubic feet/second

Badger Creek

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP. °F A/W	A/W	TIME
I (5.0-8.0)	9/15/83	5	30	E	65/57	- 72/65	1300-1630
II (8.0-15.3)	9/1,9,12,14/83	4	60	E	57/49	- 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

REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstory Con.	Dec.	AQUATIC Streamclass	Wetland%	Size	Special Habitat
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

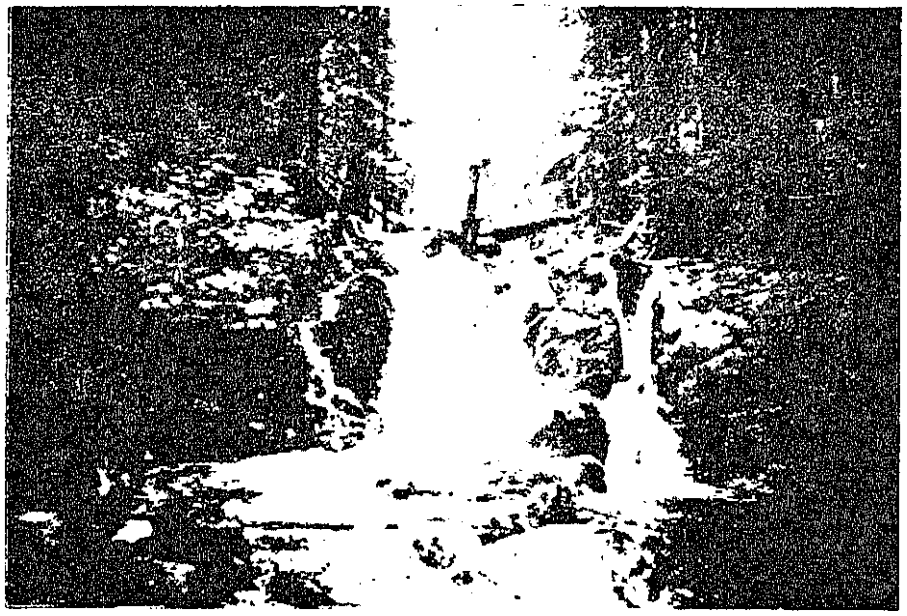
LEGEND: RCR: Riparian Condition Rating
- F.P.: Floodplain width
  - H.U.: Habitat Units H ≥ 4; M 2-3; L ≤ 1
  - Con: # Conifer Species
  - Dec: # Deciduous Species
  - Wetland: % stream length with adjacent wetlands; H > 50%; M 25-50%; L < 25%
  - Size: Size of Wetlands
    - S = Small (less than 1 acre)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

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 habftat and some are suitable as holding areas for large fish. Pool quality could be improved In these areas. however. by increasing effective cover and/or low flow discharge.

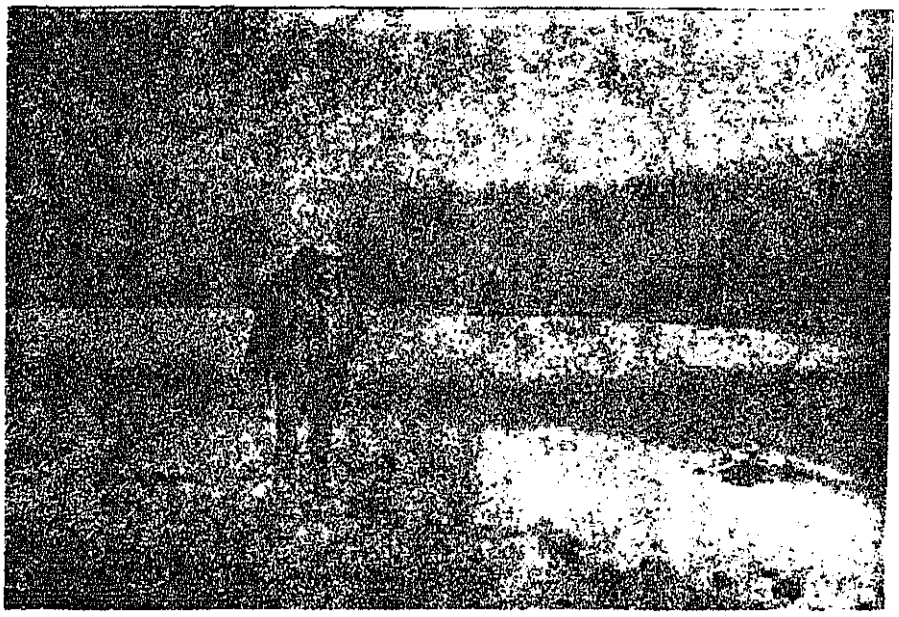
Low flow pool quality in Reaches I and II is greatlv reduced by the water withdrawal at RM 15.3. Long sections (0.1-0.2 mi.) in these reaches also lack large channel structural components for pool development. Pool enhancement, possibly using large boulder clusters, or berms, could greatly improve rearing 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



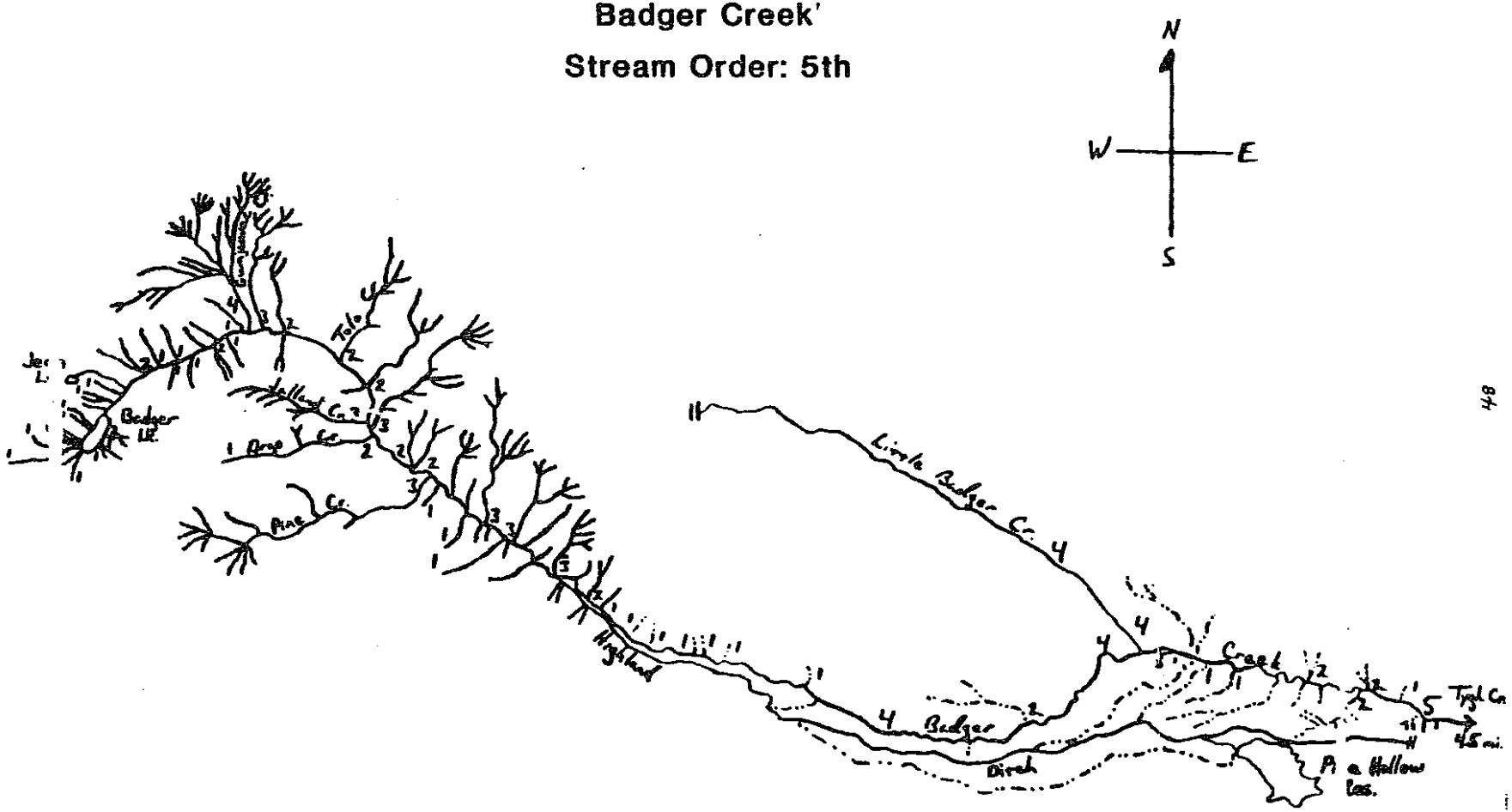
Badger Creek heads in Badger Lake (35 acres), 22.1 miles above the stream's confluence with Tygh Creek. A samll dam has been installed at the lake outlet which has increased storage capacity and allows regulation of the stream for supply to the irrigation diversion downstream. As a result, the stream 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).

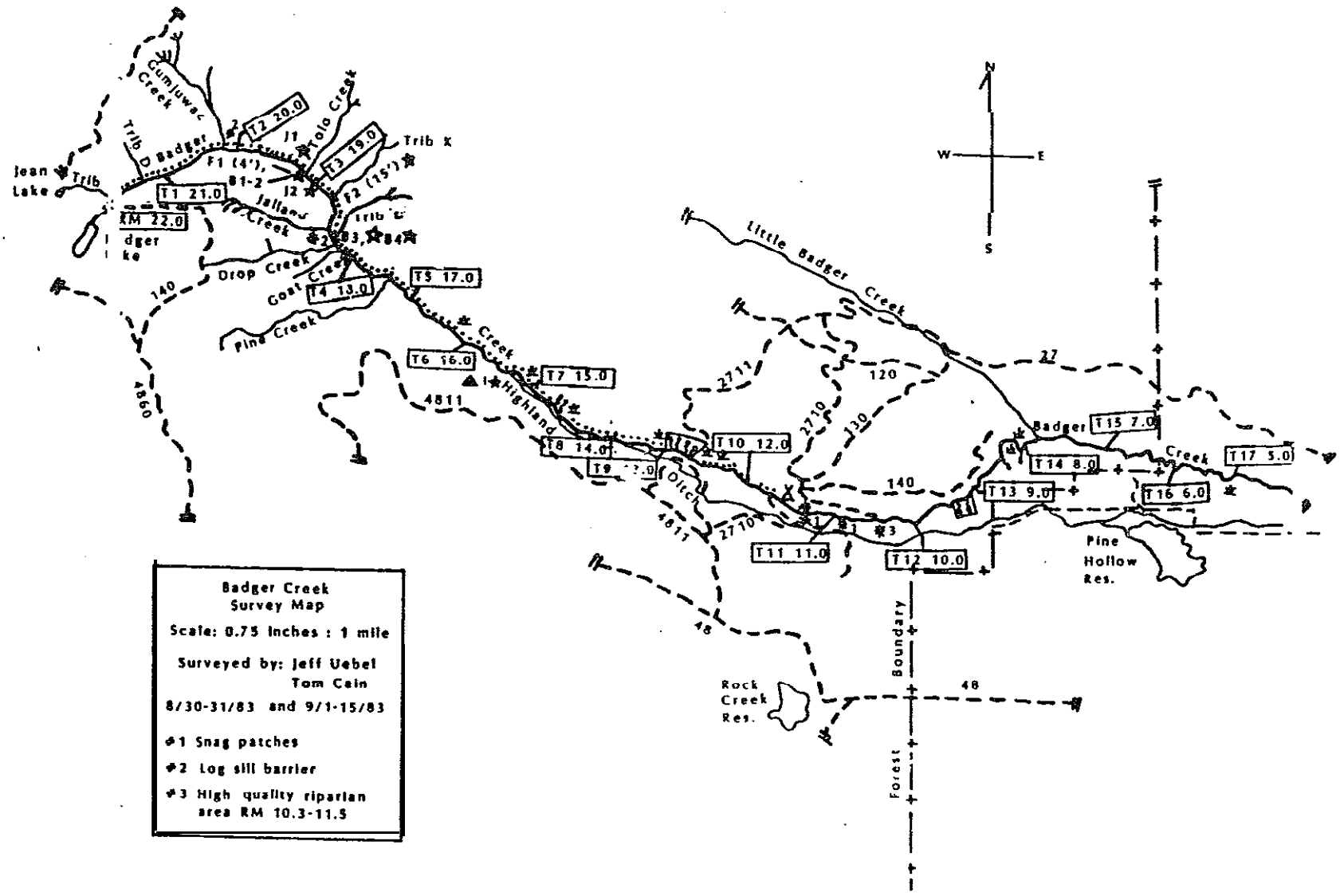
This pond/wetland area (RM 8.2) provides excellent wildlife habitat and could be utilized as an off-channel rearing area by anadromous species (especially coho). Opportunities exist for creating further off-channel rearing areas and increasing wetland wildlife habitat on the wide valley bottom terraces 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, Gumjuwac C-eek (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 Gumjuwac 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




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
N
S
W
E
Jean Lake
Trib D
Badger
Cumluwac Creek
T1 21.0
RM 22.0
T2 20.0
T3 19.0
T4 13.0
T5 17.0
T6 16.0
T7 15.0
T8 14.0
T9
T10 12.0
T11 11.0
T12 10.0
T13 9.0
T14 8.0
T15 7.0
T16 6.0
T17 5.0
Trib K
Jallaus Creek
Drop Creek
Goat Creek
Pine Creek
Highland Ditch
Little Badger Creek
Badger Creek
Pine Hollow Res.
Rock Creek Res.
Forest Boundary
140
4860
4811
2711
2710
120
130
27
48

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 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 purposes1
	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
S-47	ROAD AND IO NUMBER
	EARTHFLOW

LITTLE BADGER CREEK
BARLOW RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

County: Wasco

Dates Surveyed: August 24-25, 1963

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% of the survey length (l/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 irosses the stream at RM 2.4 and is the site of Upper Little Badger Campground. Lower Little Badger Campground is located at RN 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% gradient) to very steep (90+%) 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%) and flows over a boulder and rubble substrate. Little Badger Creek provides about 30% of the flow (3 cfs) to Badger Creek at their confluence (RM 7.81. 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, qradient. and substrate as described above are consistent.

D. Fisheries

The fisheries habitat rating is fair (HCR=5.81. Rainbow trout were observed throughout the survey. Spawning habitat is very limited. Spawning gravels totalling 35 square yards occur in small pockets of l-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% 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 l/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

Rehahilitation and enhancement opportunlties 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 hahitat above RM 2.4 is fair to good (see 1982 survey report). 21 Increasing gravel retention in Reach I (RM 0.0 - 2.4). 3) Improving pool quality fn 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, wlth steep (70-90% gradient) to very steep (90+%) sideslopes. The floodplain is narrow (40-60 feet wide). The flow regime is flashy.

2. Stream gradient is moderate (5%).

3. Substrate is primarily boulders and rubble.

4. The pool-to--iffle ratio is even (P:R=5:5). Riffles are short cascades over rubble. Pools average two square yards.

5. Stream shading is high, averaging 85%.

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 IO-foot lonq bedrock chute (RM 1.9) and a 20-foot long, 12% 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 loq 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.B).

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 hluffs 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/Enhancement Summary

Passaqe 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 presentlv 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 cauabilities.

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 (%)						
	HCR	S	P:R	G	d	A	EC	BR	1'±	6-12"	1-6"	l-l"	SD	D
1983														
I (0.0-2.4)	5.5	80	5:5	5	L	3	M	*	25	35	20	10	10	3
1982														
I (2.4-4.2)	4.6	RO	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 lenqth
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 finches)
*: Present, but less than 5%

TAbLE Ii - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT

SPECIES	REACH I
Rainbow trout	

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High 50-)
a = adult, j = juvenile
* = habitat suitable; presence reported but no! observed.
( )= habitat suitable; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

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

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASS	RECOMMENDATIONS*
1983				
0.3	Logjam	11	P	Low priority.
0.6	Logjam	J[illegible]	P	Lou priority.
1.9	Falls	F1 (5')	N	Modify for passage. Alaskan steep-sass and/ or increase pool depth.
2.0	Bedrock chute	B:	N	On priveate land.
2.4	Culvert	iI	F	Low priority.
1982				
2.5-4.2	Logjams	[illegible]	P-N	Modify for passage.
4.9	Falls (3')		P	Modify for passage.
5.8-7.0	Falls (4'-20')	F[illegible]-6	N	Low priority.

LEGEND: T full Passage
P = partial passage
N = no par-sage

*Refer to special case form fnr barrier characteristics.

TABLE V- ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
1983								
I (0.0-2.4)	1.9	0.5	5:5	3	1	35	0	
1982								
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	l-2	60	34	
III (5.5-7.5)	0	2.0	3:7	4	l-2	48	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.).
Deoth: Average pool depth (feet).
Spawning: Number of sq. yards of gravels obsr ved in the 1"-3" and 3"-6" size classes.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HO (%)	Total (%)	HO (%)	OR	#	L	Dia	Source
1983									
I (0.0-2.4)	10	10	10	20	Pero	s	l-2	l-2	L
1982									
I (2.4-4.2)	40	60	5	25	Perp	S-M	I-2	2+	M
II (4.2-5.5)	55	55	1	5	Perp	S-M	l-2	1-2	M
III (5.5-7.5)	75	75	15	5	Perp	M	l-2	l-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: i = local
T = transported
M = mixture of local and transported

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

	SUMMER				BANKFULL		
Reach (R.M.)	W	d	V	Q	W	D	Floodplain Width (Ft.)
1983							
I (0.0-2.4)	i	0.3	I	2	13	1.0	40-60
1982							
I (2.4-4.2)	[illegible]	0.3	[illegible]		11	7.5	120-200
II (4.2-5.5)	4	0.3	[illegible]	[illegible]	10	2.0	120
III (5.5-7.5)	[illegible]	0.2			9	1.[illegible]	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

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	OREINTATION	AIR/WATER TEMP.° F A/W	A/W	TIME
1983							
I (0.0-2.4)	8/24-25/83	2.5	80	SE	64/55-69/59		1030-1700
1982							
I (0.0-4.2)	8/13/82	2.0	80	E	64/56		1000-1400
II (4.2-5.5)	8/31 /a2	1.0	70	E	65/54		1400-1800
III (5.5-7.5)	9/1/82	1.0	75	E	65/49		1230

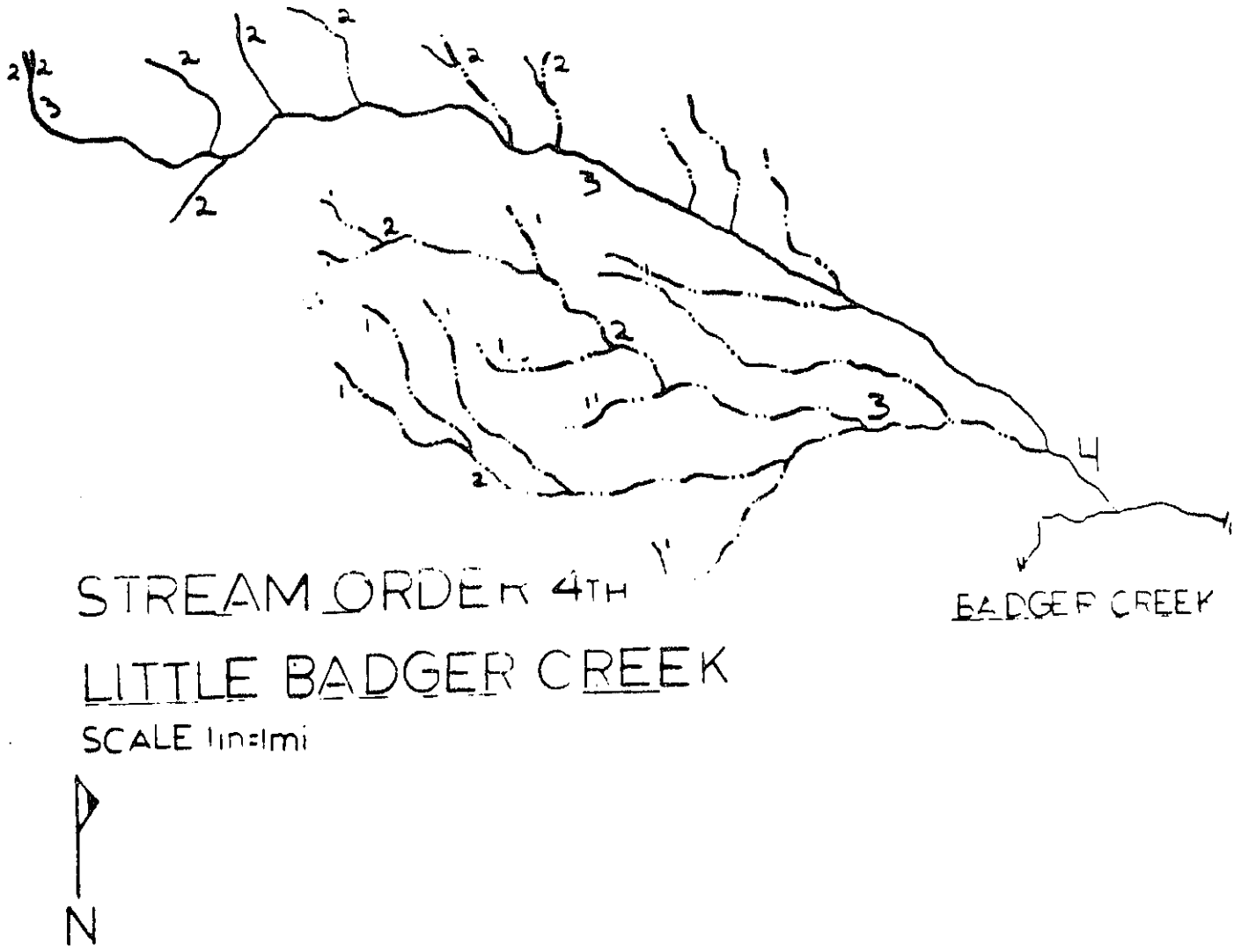
TABLE IX - RIPARIAN HABITAT SUMMARY

Reach RM	RCR	VALLEY F.P. (ft.)	H.U.	VEGETATION Overstory Con.	Dec.	Streamslass	AQUATIC Wetland%	Size	Special Habitat
1983									
I (0.0-2.4)	5.8	50		3	1	T			3
1982									
I (2.0-4.2)	6.1	120-200	i	3	1	I	L	S	-
II (4.2-5.5)	6.0	120	2	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 unit H > 4; M 2-3; L ≤ 1
- Con : I Conifer species
- Dec: # Deciduous species
- Wetland: % stream length with adjacent. wetlands; H>50% M 25-50% L<25%
- Aize: Size of wetlands
  - S - Small less than 1 acre
  - L = Large greater than 1 acre

The pool-to-riffle ratio In Reach I is even (P:R=5.5). The stream qradient is moderate (5%) over a small houlder and rubble substrate. Pools averaqe 3 square yards and have shallow depths. Enhancement wportunlties 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 mlqration. 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 - 5.51 with good spawning hahitat (250 sq. yds.).


STREAM ORDER 4TH
LITTLE BADGER CREEK
SCALE 1in=1mi
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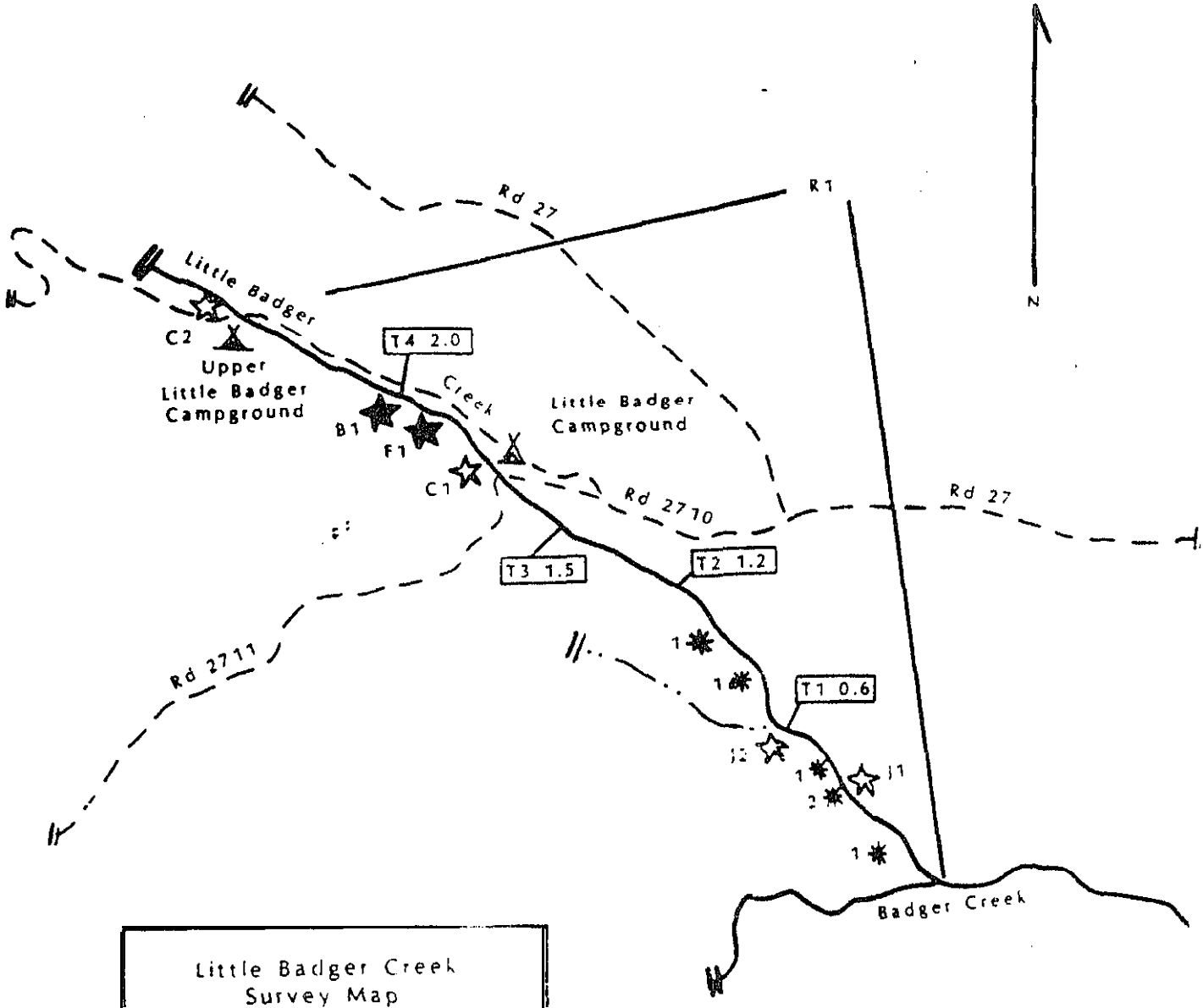
BADGER CREEK



Little Badger Creek
Survey Map

Scale: 2.6" : 1 mile

Surveyed
8/24, 25/83

by: David Wiswa
Doug Kinzer

Legend
#1 Rock Outcrop/Talus
#2 Snag Patch

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 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 [illegible] PRESENT ([illegible] of potential anadromous fish habitat)
	BANK EROSION (EXTENSIVE/SEVERE)
	1,2,3, :MISCELLANEOUS
	WETLAND HABITAT
S-[illegible]	ROAD AND ID NUMBER
	EARTHFLOW

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

Location: T. ____ R. ____ S. ____ Stream 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 log or boulder berm.

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

Location: T. ____ R. ____ S. ____ Stream 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 # ____ 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: ____

RM 1e7

Culvert # 1 Stream Little Badger Date 8/25/83

Gradient greater than 1½%: 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 1½%: 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 30', 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 1½%: 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 1½%: 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: _____

LITTLE BADGER CREEK - BARLOW RANGER DISTRICT

SURVEYORS:	Kevin Godbout Jeff Uebel	COUNTY:	Wasco
DATES SURVEYED:	8/31/82-9/1/82	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 1404 1407	AVERAGE WIDTH:	10 ft.
		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 creak originates from Sunrise Spring near the summit of Flag Point and flows approximately nine miles to Its confluen e with Badger Creek at RM 7.7, (T35 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 Bational Forest System land. The lower 2.0 miles (about 20%) of the drainage consist of discontinuous private-land holdings. Access In the loner 2.5 miles is fair with road crossings (S-20B) at RM 2.0 and 2.4. In the upper drainage access Is poor, limited to a hiklng 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 (70-200 ft.). Sideslopes are steep and often consist of vertical bedrock walls.

The drainsge pattern-is pinnate in the survey area and palmate In the lower mile. Host surveyed tributaries were intermittent, short, steep, first or second order and originated 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 II 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, (120-200 ft.); low stream radient (5%); rubble dominated substrate; riffle dominated stream area (70%3; good stream shading (80%); and high numbers of rainbow trout. Reach II exhlbtts: decreased floodplain (70-120 ft.); increased gradient (7%); small boulder-rubble substrate; and decreased shading (70%). Within Reach III the valley becomes steepsided (70% slope) resulting in minimal floodplain development (less than 70 ft.); stream gradients are steep (9-12X); 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 wall. Low water temperatures and falls passage barriers appear to limit Perennial fish populations above that point (in addition to poor habitat characteristics.)

Flsh 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 ard bedrock outcrops) are generally scarce and gravel catchment and pool scour are minimal. me 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 four rq. yards). Pool area composes 30-40% of the stream area In low flows, but appears to diminsh to 10-20% in higher flows. Pool depth IS low to moderate (6-29 inches) and effective cover Is moderate. Reach II shows the best pool development.

Spawning habitat development Is very poor overall. Of the 350 cq. yrcdps observed, 55% were considered marginal due to placement in channel. Only about 15% of the total were of a size class suitable for the resident trout population present. Potential spawning habitat for anadraaous fish (if introduced) is better idstributed, although one quarter of the total gravels lie above total passage barriers starting at RM 5.6. Gravel trapement is highly dependant on LWD: over 50% 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 obstruction may be limiting present and potential fish production in this drainage. Several log jams 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 (F_1-F_7) 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 Badgere 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 anadraaous fish are introduced to the Badger Creek system, thelr management will be complicated by the private ownership on the lower reaches of the drainage and the system of irrigation diversions present. me remote character of Little Badger on Forest lands could provide a spawning and rearing refuge for anadrcmous 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% bank erosion resulting in unstable stream banks in Reach I; unstable channel bottom in Reach I (30% 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 cannon and act up further reduce the stability rating.

The true zone of rlparlan vegetation is limited In development (20 ft.). The rlparlan area quality Is rated moderate (RQR q 6.0). Factors which have a positive influence on the score include: moderate to wide floodplain development (70-200 ft. in Reach I end II); a perennial water supply providing habitat for resident (and potentially anedrcmous) fish as well es wildlife: and moderate vegetative structural dlverslty consisting of a mixed deciduous end coniferous overstory. shawlng little variance in agesize calsses and low ground cover. Factors which generally ect to reduce the overall score include: the lack of streamside wetlands throughcut the survey and the decreased floodplain width ln Reach III.

Snag Rockets end areas of dead end dylng conifers were noted at RR 4.3 and 5.3-5.5. The rlparlan area receives heavy use by elk end deer. Silver-gray squirrels were also observed. Riparian hebltat could become hlgh to very high uallty through modification of the dense overstory to promote a greater 8lstrlbutlon of age/site classes.

Rehebtlltetlon and enhancement efforts offer great potential for aquatic end terrestrlal habitat-development and center on: increased spawning end rearing habitat In Reach I and II; enhancing fish passage in Reach II; channellzlng stream flows in Reach I and II; construction of headwater storage Impoundments in Reach III to increase base flows ln low flow periods; and selective openlngs ln the dense rlparlan canopy to encourage the development of a diversity of species and structural elements.

LITTLE BADGER CREEK
REACH SUMMARY

Reach I (RM 2.0-4.2)

1. The valley configuration is flat bottomed "V" containing e wide floodplain (120-200 ft.).
2. The substrate is composed of rubble and cobble.
3. The stream is dominated by riffles (70%).
4. gradient averages 5%.
5: Stream shading is good, (80%).

Reach II (RM 4.2-5.5)

1. The floodplain decreases to a moderate width (70-120 ft.),
2. The substrate is composed of small boulders and rubble up to 3 ft. in dismeter.
3. Gradient Increases to 7%.
4. Stream shading is moderate (70%).

Reach.111 (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 being common.
3. Steep stream gradients dominate (9-12X).

LITTLE BADGER CREEK
FISH HABITAT SUMMARY

Reach I (RF4 2.0-4.2)

1. Habitat is rated poor, (4.6 HCR). mOderate to high numbers Of resident rainbow trout are presen.t
2. Rearing habitat Is poor. Pools average 30% of the stream area In low flows; pool area decreases in high flow due to low channel structure. Pools average 4 sq. yards In area, 4-12 inches deep and have moderate effective cover.
3. Spawning habitat is very limited in quantity and queltty. Only 113 sq. yards of gravels were observed, and 60% of these were rated marginal. Only 10% of the total ware of a sire class suitable for resident trout utilization. Forty percent of the total spawning habitat was associated with LWD deposits.
4. Jams Jl 'RM 2.6). J_2 (RM 2.9). end J_3 (RR 3.1) are barriers to trout mogration, and may be potential barriers to anadromous fish. A log sill (3' high) et RM 2.8 Is also e trout barrier.

Reach II (RM 4.2-5.5)

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

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 obserserved.
2. Rearing habitat is poor. Pools again compose only 30% of the stream area. Pool size end depth are similar to Reach II, but effective cover Is reduced (low).
3. Spanning habitat Is very poor. Sixty-five percent of the 95 sq. yards observed wore of marginal quality. Only 20% were usable by resident trout. Over 70% of the total gravels were associated with LWD.
4. Several falls (F_1 - F7) are barriers to resident trout end potentially to anadromws fish. Debris jam are numerous and form numerous obstacles to fish migration In low flows. Low water temperature end passage may be llmiting fish production In this reach (combined with poor habitat characteristics).

LITTLE BADGER CREEK
RIPARIAN QUALITY SUMMARY

The rlperian area quality Is moderate. (RQR. 6.0). Factors which have a positive influence on the score include: the flat bottomed "V" shaped valley configuration resulting In moderate-wide floodplain development (70-200 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 a similar age/size class (pole and small sawtimber). Additionally, ground cover is low-moderate (50%), composed of a shrub (Oregon grape, wildrose) habitat unit.

The decreased valley width in Reach III and the lack of streamside wetland areas generally act to reduce the overall score. Management of this area could increase the rtparian quality through: increasing the aquatic diversity bv creating headwater impoundment areas to increase the base flow: and l&easing-the vegetative struvtural diversity by creating canopy obenings to encourage the development of more habltat 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 structura' diversity is low due to the presence of two habitat units (pole, small sawtimber) and 40% ground cover factor. The overstory composition of three conifers and a deciduous species Increases the diversity.
3. The valley bottom Is wide 120-200 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 (RR 4.2-5.5)

1. The RQR is 6.0, moderate-nigh 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%) present.
3. The valley width decreases 70-120 ft.
4. The aquatic habitat remains similar moderate
5. Snag pockets and many dead and dying conifers are present RM 4.3 and 5.3-5.5.

Reach III (RM 5.5-7.5)

1. The RQR is 5.6, moderate:
2. The vegetative structureal diversity increases with an additional habitat unit (shrub).
3. The valley width continues to decrease (70 ft. wide). and slopes are greater thin 70%.
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 seventy to eighty percent of the stream area is caposed 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 spawing habitat. Highest priority is Reach 1. Wumerous sites are present in the first mile And materials are readily Available throughout the strea. 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 deflectors could be designed to channelize and focus stream flows And increase channel stability. Due to moderately steep stream gradients in Reach II (5-9%), use of large boulders and single gabion wing deflectors may be Advisable. Lateral cutting Around instream large' woody debris is high in Reach II and indicates that log sills could fail in areas where gradients exceed 5%.

Stream Bank Stabilization; RN 2.0-4.5

StreAm banks show moderate amounts of bank erosion (25%). These banks are dependent upon streamside vegetation And rootwads for Stability. Currently, vegetative cover is low (40%). Stream banks are generally composed of sandy soils and have A low bank rock content (40%). 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 IO ft. waterfall at RR 5.7, and A series of falls and chutes At RM 5.9, 6.3, 6.8, and 7.0 preclude anadromous and resident trout 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; RW 5.5-7.5

Throughout Reach III pool development is low (20-30% of the area). Blasting of pools in this bedrock area could Increase the potenrial rearing area available. Likewise, construction of sills or berms In the tailouts of these pools could act As gravel catchments.

Headwater Storage impoundments

very low summer flows are limiting the rearing Area Available to resident trout. Channel scour is resuitin from the occasionally violent fluctuation in flows following periods of rapid runoff or snowmile Construction of storage impoundments in the upper reaches could help provide A better regulated streamflow. improving both fisheries habitat and strem stability. Access is limited to the trail. and all work would likely 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.109 jams J_1-J_3 and several other debris jams In this section should be A priority. Partial removal of these jams would provide passage into the higher quality spawning And rearing Areas of Reach II. Care should be taken to preserve the hjgh 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 ii relatively low. The dense conifer-dominated canopy limits development of understory and deciduous canopy elements. Selective opening, though 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 condition is moderately unstable. The stream stability rating is 4.4. Factors Which influence the scope include: A flashy flow regime indicated by A wide variation between seasonal flow; sandy soi ls (low rock Content) and low vegetative cover (40%) resulting in unstable Stream banks in Reach I (30% bank erosion); A moderate amount of Channel substrate scour due to the relatively high substrate detachment factor (30%) 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 gtnerally 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%); increased Channel substrate stability Reach II and III due to decreased detachment (20%) of the bottcm 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 tc 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 flows 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%) and lateral cutting around jams is common (90%).
3. The bank stability is moderate with 25% erosion observed. Bank rocks content is moderate (40%) and vegetative cover is low (40%).
4. Channel substrate stability is moderate with 35% of the substrate being detached.
5. Channel structure is low As only 5% of the area consisted of long pools.

Reach II (RN 4.2-5.5)

1. The SSR is 3.8. unstable.
2. The flow regime remains flashy.
3. Bank stability increases with 10% less bank erosion due to an increase in bank rock content (60%) and vegetative cover (60%).
4. The channel substrate stability increased slightly.
5. Channel structure remains low.
6. Cultural resources are present At RR 5.7-5.8: the Kinzel Mine and homestead are located on the north bank in this Area.

Reach III (RM 5.5-7.5)

1. The SSR increases 5.7. moderately stable.
2. The flow regime is moderately flashy with Instream LWD maintaining a 65% parallel orientation.
3. Stream banks are stable wlth l0% observable bank erosion. The vegetative cover *(70%)* And rock content (70%) is high.
4. The channel substrate is stable with 20% of the substrate being detached.
5. Channel structure remains low.

LITTLE BADGER 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 (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:

RCR: Habitat Condition Rating
S: Percent of stream shaded
P:R: Ratio of pool length:riffle length
6: Average gradient (%)
d: Average maximum depth (L < 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 (feet)
*: Present, but less than 5%

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

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

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

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

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

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

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS
(RM 2.4)	Culvert	C1	P	Velocity barrier at high flow. Low priority.
(2.5-4.2)	Log jams	J_1-J_3 Many unnamed	P-N	Modify to enhance
(4.9)	Falls (3')	F	P*	Modify to enhance passage.
5.8-7.0	Falls (4'-20')	F_1-F_6	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.

TABLE V - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		pooL		LWD CHARACTERISTICS				
Reach (R.M.)	Total	HQ	Total	HQ	OR	#	L	Dia	Source
I (2.0-4.2)	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
I % of hi h quality habitat area dependent on LWD
2 . angle o8 orientation to flow:. perp = perpendicular. var = variable
# = number of logs/structure; s = single log, m = multi-log
L = averaoe lenath 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 WI — HABITAT AND HYDROLOGICAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

Reach	(R.M.)	SUMMER W	SUMMER d	SUMMER v	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
I	2.0-4.2	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

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

REACH	(R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP.° F	TIME
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

REACH RM		RCR	VALLEY F.P. (ft.)	H.U.	VEGETATION Understory G.C.X	Overstory Con.	Dec.	AQUATIC Streamclass	Wetland%	Size
I	2.0-4.2	6.1	120-200	L	40	3	1	I	8	S
II	4.2-5.5	6.0	120	M	60	3	2	II	10	S
III	5.5-7.5	5.6	70	M	70	3	2	II	0	-

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: I Conifer Species
Dec: # Deciduous Species
Wetland: % stream length with adjacent wetlands;
H $\geq$ 50%; M 25-50%; L $\leq$ 25%
Site: Size of Wetlands
S = Small less than 1 acre)
L = Large greater than 1 acre)

TABLE IX - STREAM STABILITY SUMMARY

REACH		SSR	FLOW REGIME			STREAM BANKS			CHANNEL SUBSTRATE			
			Ratio MF:LF	LWD Omt	LAT CUT	ER	RC	VEG	DTCH	TONE	IMBRO	VEG
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 DRNT:	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%)
TONE:	B-(Brlght), RB-(Moderately brlght), 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)

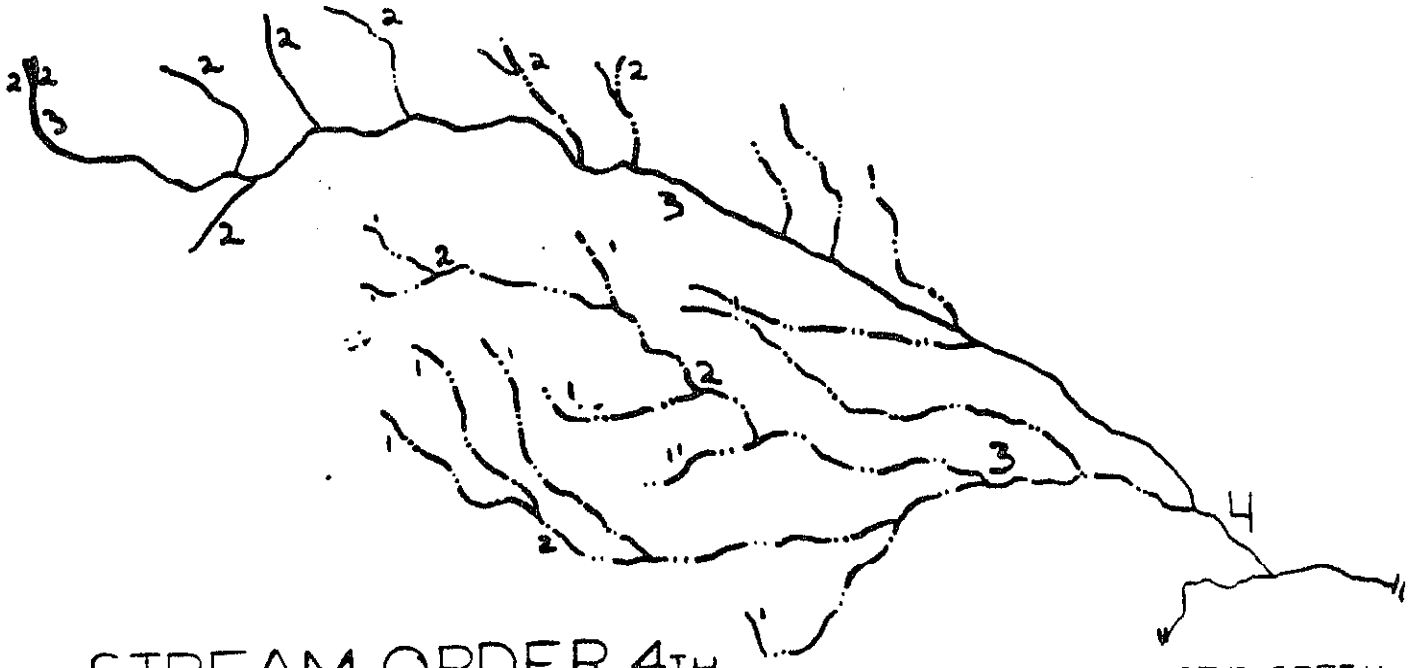
*Data on channel structure not included due to modification of data collection & evaluation procedures

'In Reach I (RM 2.0-4.2)strcam 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 4.6) Stream flows Of a violent nature appear to be frequent and consequently "blow cut" or lateral cut most log sills The use of large boulders, gablon wing deflectors, or keyed in log sills appears to be desireable 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.

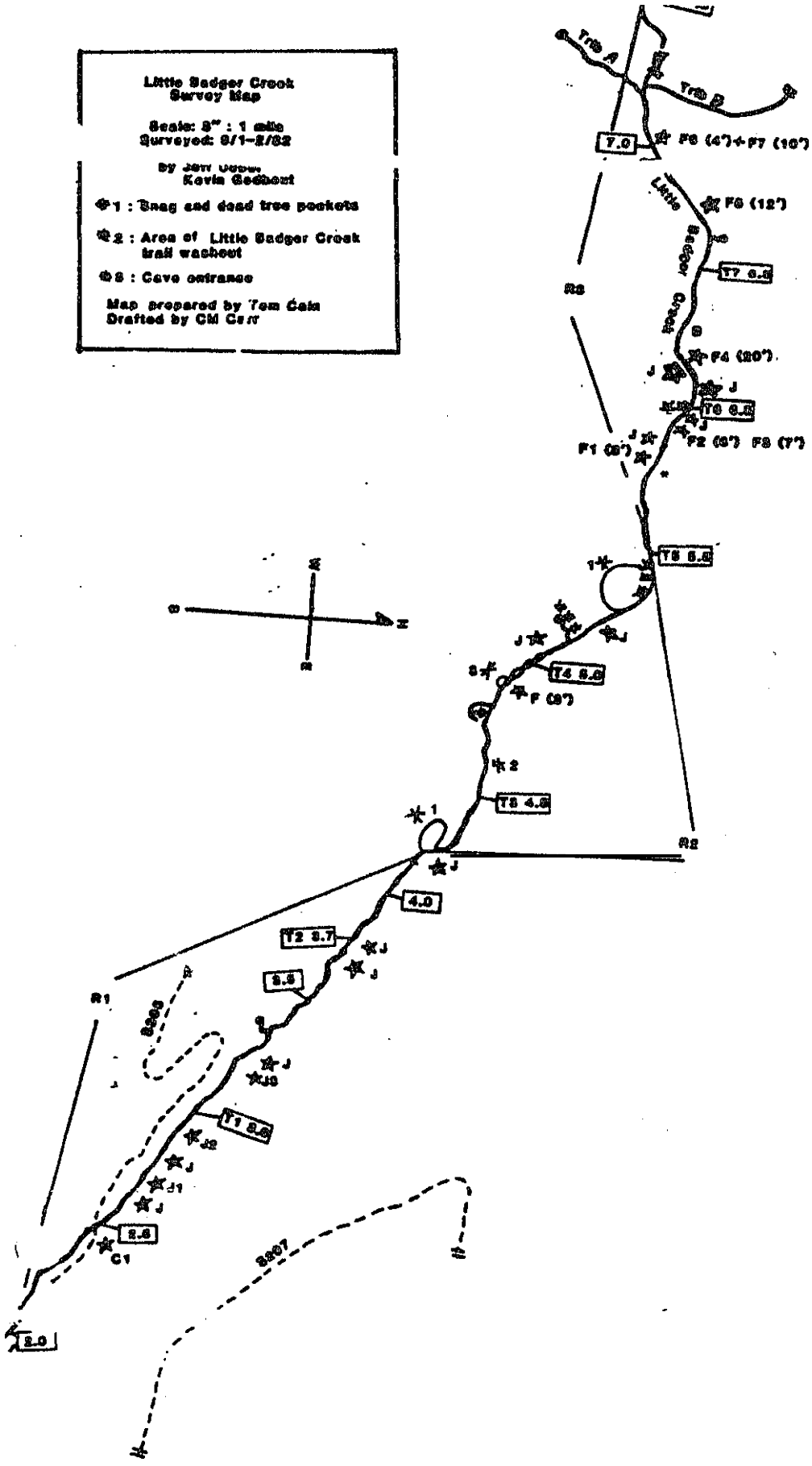


STREAM ORDER 4TH

LITTLE BADGER CREEK

SCALE 1in=1mi

N


Little Badger Creek
Survey Map
Scale: 8" : 1 mile
Surveyed: 9/1-2/82
by Jerr Dobes
Kevin Godbout
1 : Snag and dead tree pockets
2 : Area of Little Badger Creek trail washout
3 : Cave entrance
Map prepared by Tom Cain
Drafted by CM Carr
Trib A
Trib B
7.0
F6 (4")+F7 (10")
F5 (12")
Little Badger Creek
T7 6.5
R3
F4 (20")
T6 6.0
F1 (8")
F2 (9")
F3 (7")
T5 5.5
T4 5.0
F (8")
T3 4.5
R2
4.0
T2 3.7
3.5
R1
T1 3.0
2.5
C1
2.0

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

$R_{I,II,III}$ REACH I and SECTION

T_1 1.0 TRANSECT # and RIVERMILE

OBSTRUCTION BARRIER

J1,2,3, JAM and #
F( )1,2,3 FALLS, HEIGHT. and I
C1,2,3 C'JLVERT and #
B1,2,3 CHUTE and I

DIVERSION STRUCTURE (I = water Is used for irrigation purposes1

MINE or ROCK PIT SITE

BRIDGE

LANDSLIDE, SLUMP

DEBRIS TORRENT TRACK

SPRING

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

BANK EROSION (EXTENSIVE/SEVERE)

1.2.3, :MISCELLANDOUS

WETLAND HABITAT

S-47 ROAD AND ID NUMBER

EARTHFLOW

JORDAN CREEK - BARLOW

SURVEYORS:	**Kevin Godbout** **Jeff Uebel**	**COUNTY:**	Wasco
		MOUTH LOCATION:	**T3S, R12E, Sec. 26**
DATES SURVEYED:	8/23-24/82	WATERSHED AREA:	**23 sq. mi.,** **15,000 acres**
TRIBUTARY TO:	**Tygh Creek**	**STREAM LENGTH:**	**15.3 miles**
DRAINAGE:	**Deschutes**	**DISTANCE SURVEYED:**	**7.0-11.5 main stem. .05 tribs**
TRI COMPARTMENT:	Friend, Jordan, Sunset (1430). (1431). (1402)	AVERAGE WIDTH:	13 ft.
FISH:	Rainbow/Cutthroat hybrids winter steelhead) coho salmon)	**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 I major (fourth order) tributary to Tygh Creek containing 40% of the Tygh Creek drainage area. This east-west oriented creek originates from a spring line near Flag Pofnt and flows east 15 rfles to its confluence with Tygh Creek at River Mile (R.M.) 9.0 (T3S, R12E, Sec. 26). A total of 5.5 miles, from R.M. 7.0-11.5. wen surveyed on August 23 and 24. 1982. On August 23, the flow et R.M. 7.0 was estimated et 3 cfs.

The lower eight miles, or 40% of the Jordan Creek drainage is located on private lend. National Forest System Lands extend upstream from R.M. 6.2 to its headwaters. In the upper drafnage, access Is fair. wfth Forest roads S-205 end S-209 paralleling the creek on the north end south slope respectively. Road crossings are found et R.W. 7.6. 3.0, end 2.0.

The surveyed reach lies fn a sharply incised, narrow "V" shaped canyon. This has resulted In minimal floodplain development (70 ft.). Sideslopes are steep, often with veitlcsl bedrock walls and terreces interspersed wfth 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 tributarfes appear to respond rapidly to Inputs of percipitation (i.e. snow, rafn) and apparently contribute to a flashy flow regime in the mainstem.

One reach was identified in the survey area. Characteristically, thfs stream flows at a 6% gradient over a small-boulder rubble substrate. Rfffles dominate the stream area (70%) and steam shading is moderate from both vegetative and topographic sources. Resident rafnbow and rainbow/cutthroat trout hybrids are found in moderate to high *numbers* throughout the reach.

The ffsh habitat Is rated moderate (6.3 HCR) fn the survey area. The boulder/rubble dominated substrate (70%). low pool development, low stream stability and low base flows all tend to reduce the rating. Hfgh amounts of spawning habitat in sane areas and moderate fish numbers rafse the ratlng.

Pool rearing habitat fs limited fn quality and quantlty. Pools average only 30% of the stream area and are generally small to moderate in size, es well as shallow (10 sq. yards, 6-29 Inches deep) . Effective cover Is moderate. The overall lack of high quality pool habitat Is likely limiting production of salmonids partfcularly native cutthroat stocks.

Spawning habitat Is abundant overall, but distribution Is very patchy. Of the total 1000 sq. yards observed In the survey area, over 60% were fn three small 0.1-0.2 ofle long sections, representing only 10% of the total survey area. Sfxty percent of all the gravels observed were marginal due to poor placement in the channel. Seventy percent are of a size class suitable only for anadromous ffsh utilization.

Passage is obsturction by a culvert (C_1) at R.M. 7.7, a 4 foot falls at R.M. 7.6 and numerous small to large log jams throughout the reach. Passage does not appear to be limiting resident trout production in this area.

Physical structural componants in the channel, such as bedrock and large boulders, create excellent habitat development (spawning end rearlng) 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% of the high quality spawning end rearfng habitat observed was associated with LWD. Significant channel scour and habitat degradation was observed in areas where incorporated LWD was removed. Maintainance 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 ratlng (SSR) Is 4.1. This low score is due tO the combination of: a fleshy flow regime: moderately unstable Stream banks (25% 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%) 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 riparlan 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 end 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 diversfty.

Wildlife diversity and densities are apparently quite high along Jordan Creek. Abundant sign of deer and elk ware observed. gear, 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 (R.W. 7.0-9.0) appeared to increase habitat dlversfty.

Rehabilitation end enhancement opportunities are diverse end could be implemented in such areas as: improving fish habitat through increasing quality rearing and spawning area; modification of log jams, 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 recieving heavy grazlng pressure; and selective removal of canopy cover in heavily timbered areas to increase riparian vegetational species end structural diversity.

Note: The Oregon Dept. of Flsh and Wildlife has established provision of andromous fish passage into the White River system as II 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 Rfver basin, management for anadromous production from Jordan Creek on National Forest System Lands will be complicated by the presence of Irrigation dtverslons and three impassable falls (6-25 feet high) located on private land below the survey area.

JORDAN CREM
REACH SUMMARY

Reach I - R.N. 7.0-11.5

1. Stream shading Is moderate (70%) and is provided by the coniferous overstory and local topography.

2. Valley configuration is steep and V notched, with II narrow valley bottom, resuting in minimal floodplain development.

3. 'Substrate is composed of small boulders **(60%)** and rubble.

4. The stream is dominated by riffles (76%).

5. Resident trout era found in high numbers.

6. Stream pragient averages 6%.

ROTE:' This strea 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 - R.M. 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%) favors riffle adapted species (i.e., rainbow trout). Pools are small (10 sq. yards) and shallow (6-29 inches deep) with moderate effective cover from LWD and the boulder/rubble substrate.

3. Spawning habitat is plentiful, but very patchy in distribution. Over 1000 sq. yards total were observed, but 50% of these gravels were limited to three small depositions1 plain areas at R.M. 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 dependant on LWD Input. Over 50% of the hlgh quality spawning and rearing habitat observed was associated with LWD. LWD generally accumulated as both single log (sills) or small mulitple log deposits. The logs were most often 5-20 feet long and of the 12-24 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 aopear to be significantly affecting resident trout production. Culvert C1 (R.M. 7.7). a four foot falls (R.M. 7.6) and many small jams block fish migration,

JORDAN CREEK
RIPARIAN AREA SUMMARY

The rlparian 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 (l-2 acre) sediment depositional areas at R.M. 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%) and composed of grass/forb (sedge, fern) shrub (Oregon grape. vine maple) habltat units.

Through management, the true zone of rlparian 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 ENHANCEMENT SUMMARY

Passage Enhancement; R.M. 7.6, 7.7, 8.3, 10.2.

Currently, a four foot falls (R.M. 7.6) (with an associated debris jam), two large log jams (R.H. 8.2 and 10.2) and numerous (13) small debris jams throughtout the survey area are barriers to trout and would present potential anadromous fish obsturction. A culvert (C_1) at R.M. 7.7 is a trout barrier and would present a potential velocity barrier to anadromous fish at high flows. Partial removal of log jams, 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 six or more miles of potential anadromous habitat.

Pool and Spawning Habitat Enhancement; R.M. 9.0-11.6.

Pool development throughout the surveyed reach is low (70% 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 R.M. 9.0-11.5. Boulder berms and/or log sills appear well-suited to this area. Several good sites are found from R.M. 9.0-10.0. Access to the creek is very good in the Frailey Timber Sale area from a logging spur at R.M. 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; R.M. 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; R.H. 9.0-10.5.

Streambanks show moderate amounts of bank eroslon (25%). 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 R.M. 9.65, 200 sq. yd. of raw exposed stream bank is present. Bank armoring, possibly utilizing juniper or cedar tree riprap, could deflect flow: from this bank and enable vegetatlve 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. Reference FSH 2509.12 watershed structural measures handbook for suitable potential project design.

Riparian Vegetation Manipulation; R.M. 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 varlation 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 for (50% ground cover) stability, resulting in moderately unstable banks (25% erosion); low channel structure due to discontinuous occurance of the primary structural element (LWD) resultlog in riffle dominated stream area; heavy grazing pressure resuling 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%) factor, resulting in moderate channel substrate stability; and point related bedrock outcrops providing channel structure.

This drainage appears to produce flows 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. Rehab 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

REACH (R.M.)	STREAM				POOLS				RIFFLES (%)						
	HCR	s	P:R	B	d	A	EC	BR	l'+	6-12"	l-6"	1-l"	SD	D
1 (7.0-11.5)	6.3	65	3:7	6	L-H	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 FT.

Species	REACH I	TRIBUTARIES
Rb/ct hybrid - a		None observed
Rb/ct hybrid - j	ii *	
i i	*	

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

ι = habitat suitable; major passage work needed for utilization

Rb = rainbow trout
Ct = cutthroat trout
Stw = wfnter steelhead
Co = coho salmon

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

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

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATINS
(RM 7.6)	Falls (4')	Fl	P-N*	Modify for passage; low priority at present
(7.7)	Culvert'	C_1	"	Modify for passage. low prior ty at present
(8.3)	Log Jam	J_1	"	Modify for passage; low priority at present
(10.2)	Log jam	J_2	"	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 = parital passage
N = no passage

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

TABLE V - LWD HABITAT QUALITY INFLUENCE

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

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 - transoorted
M = mixture of local and transported

JORDAN CREEK

TABLE A - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles Avall.	Pot;	P:R	Rearing Area	Depth	Spawning l"-3"	3"-6"	Comments
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 jams, chutes) lie above the 4' falls barrier at RM 7.6.
TOTAL	0.6	3.9				526	183	

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 fsq. 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

Reach (R.M)	SUMMER W	SUMMER d	SUMMER v	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
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

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP.° F	
I (7.0-11.5)	8/23&24/82	3	65	SE	61/57	1100-1600

TABLE VIII RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY	VEGETATION			AQUATIC		
		. . . . .	Understory G.C.%	Dverstory 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 >5; M=3-5; L $\leq$ 3
G.C.: Ground Cover %
Con: # Conifer Species
Dec: # Deciduous Species
Wetland: % stream length wlth 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 DUMMARY

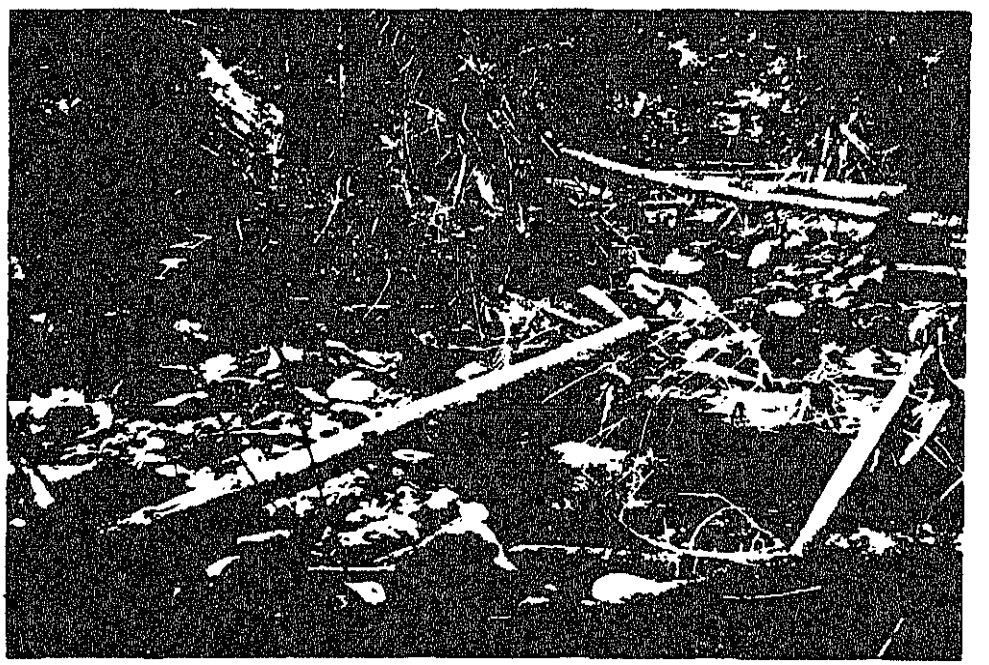
REACH (R.M.)		SSR	FLOW REGIME			STREAM BANKS			CHANNEL SUBSTRATE				
			Ratio MF:LF	LWD Dmt	LAT CUT	ER	RC	VE6	DTCH	TONE	EMBRC	VEG	
I	(7.0-11.5)	4.1	2:l	11	H	M	ML		M	MB	L-H	Y	P

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 (11=parallel:R=Random)
LAT CUT:	Lateral cutting (H BOX, # * 20-80%, L 20%)
ER:	Bank erosion H 50%, M = 20-50%, L 20%)
RC:	Rock content IDiameter 1 ft.) (H > 65%, M = 30-65X. L < 30%)
VEG:	Vegetatlve cover (Ground cover & root matrix) (H 80%, M = 50-80%, L 50%)
DTCH:	Percent detached (H 50%, N 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)
VE6:	Vegetation: Y (Yes), N (No), R (Riffles), P (Pools)

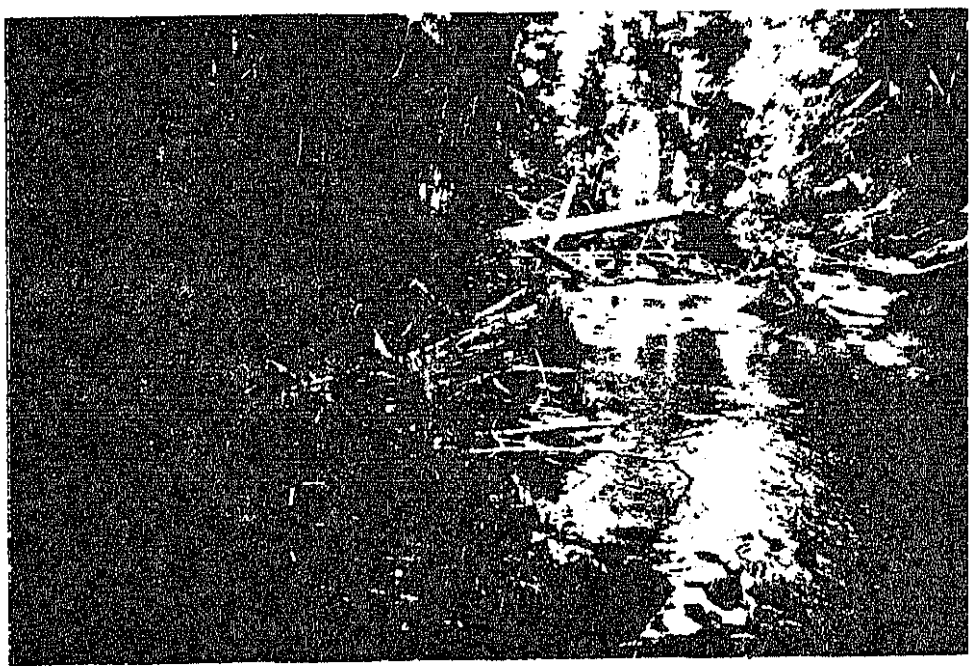
*Data on channel structure not Included due to modification of data collection & evaluation procedures

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



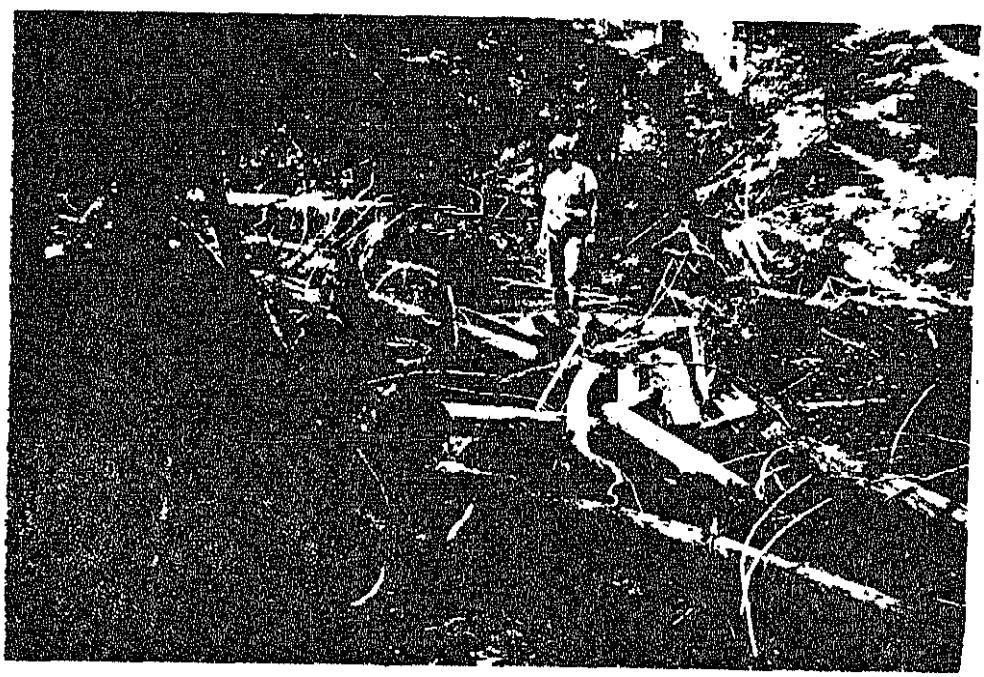
Stream flows of a violent nature appear to be common. The presence of streamside vegetation is important in maintaining long-term bank stability through mechanical binding with root matrices and deflection of seasonal high flows. The stream is rated moderately unstable (SSR 4.1).

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.N. 9.0-10.0. Access is good with a logging spur crossing at R.M. 9.4.



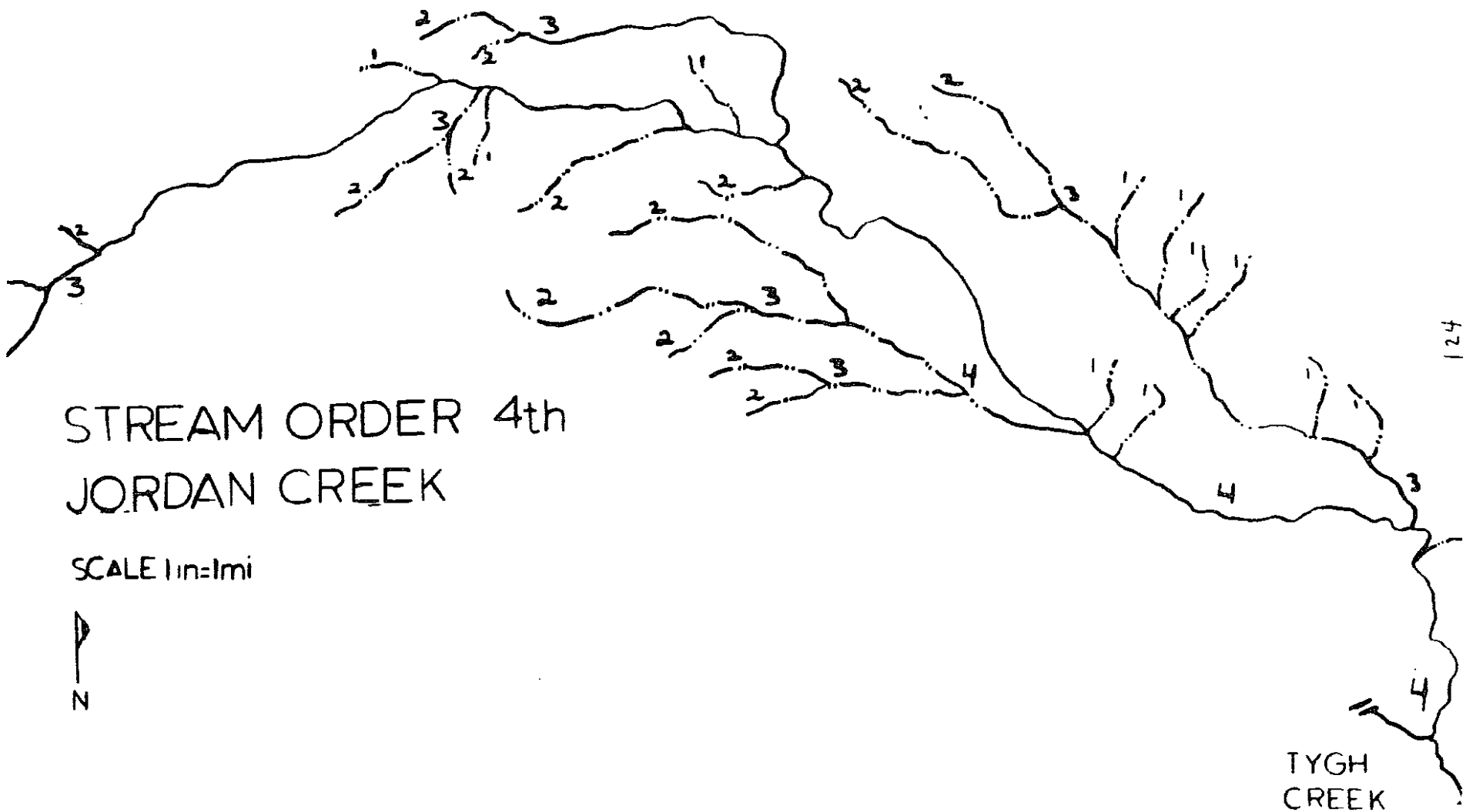
Log jam two (R.M. 10.2) has created a large sediment plain. Partial removal would enhance fish passage and provide a source material to seed enhancement structures downstream.

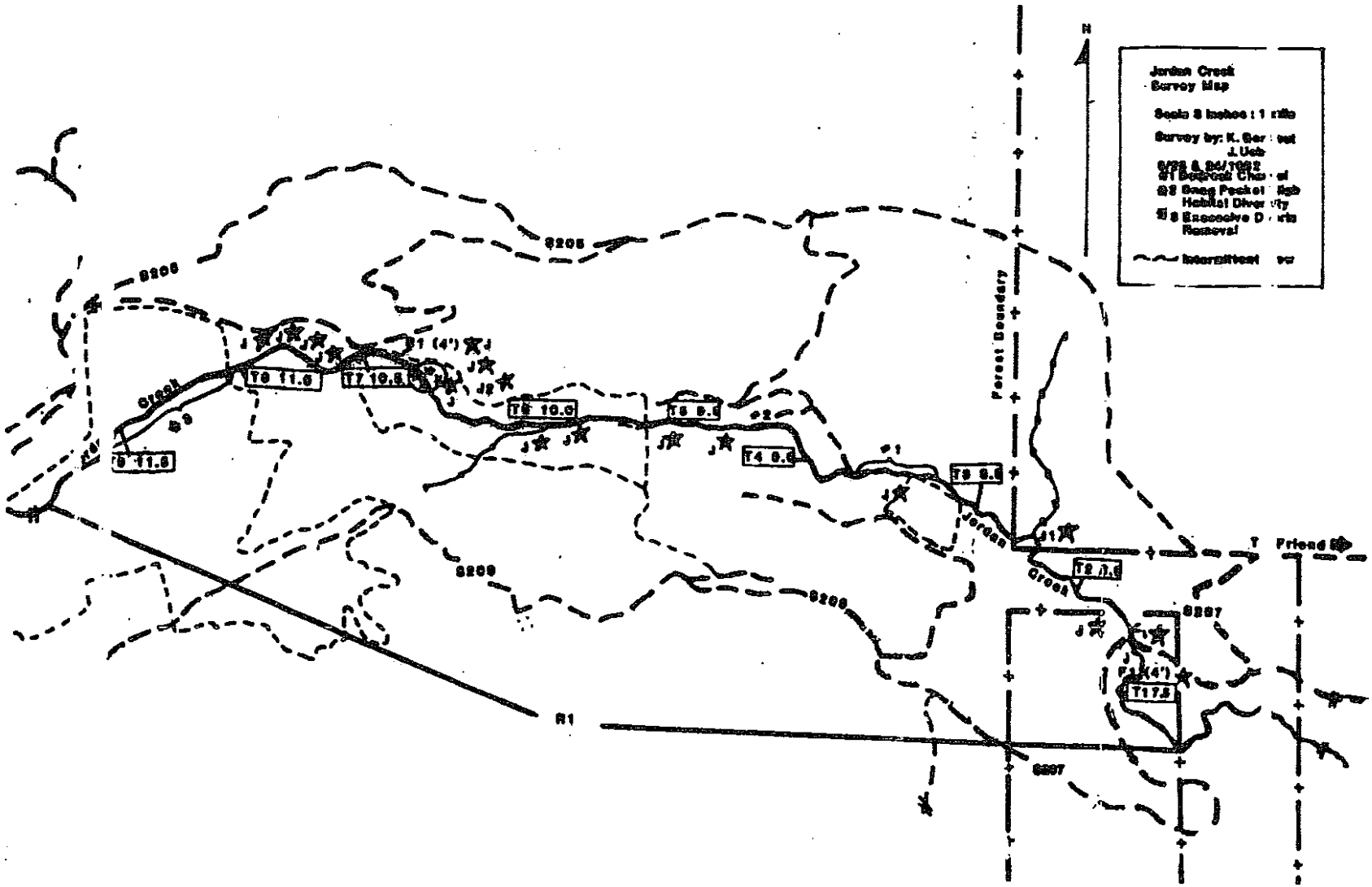
Over 50% of the high quality spawning and rearing habitat is associated with LWD. Maintenance of large trees will provide a future source material for continued habitat formation and stream stability.



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
N
TYGH
CREEK


Jordan Creek
Survey Map
Scale 8 Inches : 1 mile
Survey by: K. Ber : wat
J. Ueb
Intermittent
N
Forest Boundary
Friend
Jordan
Creek
T9 11.6
T7 10.5
T6 10.0
T5 9.5
T4 9.6
T3 9.6
T2 7.6
T1 7.5
S205
S206
S207
S208
S209
R1

THREEMILE CREEK
BARLOW RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

Dates Surveyed: August 29-31, 1983

Tributary To: White River

TRI Compartments:
Stockton 1501
Rocky 1502
Bell 1503

Gamefish: Rainbow trout

Potential Anadromous Species:
Steelhead trout
Coho salmon

County: Hood River, Wasco

Mouth Location: T4S, R13E, Sec. 16

Watershed Area: 24,900 acres
39.7 square miles

Stream Length: 20.5 miles

Low Flow Width (Avg.): 9 feet

Stream Order: III (on sec. surveyed)

Distance Surveyed:
Mainstem: 7.3 miles (RM l2.0-19.3)

Average Fish Habitat Condition Rating: 6.9 (good)

Average Riparian Condition Rating: 5.8 (moderate)

THREEMILE CREEK
Survey Summary

A. Stream Summary

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 survev began immediately below Forest Service Road 4811 (RM 12.01 and continued to RM 19.3. Forest Service Road 4811 Parallels the drainage on the north slde and crosses the stream again at RM 17.5. The 1974 "Rocky Burn" extends from RM 12.0-13.7. A diversion structure is located near RM 11.5 on private land. It was reported that most of the 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 vallev from RM 12.0-13.5. Vallev sideslopes are moderate (30-50%). The stream gradient is low (4%) in a very wide floodplain (200+ feetl. Above RM 13.5 the floodplain narrows to less than 100 feet wide. Stream gradient increases to 10% 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 Tributarv 8, which provides approximatelv 30% of the flow 12.5 cfsl at its confluence (RM 14.61, and Tributarv D, which provides about half of the flow (1 cfs) at its confluence (RM 18.31. Tributarv D drains through a wet meadow (10 acres). A smaller meadow (2 acres1 is located at RM 19.2 Threemlle Creek maintains a good base flow (4-7 vfs), with a moderately flashy flow regime. In the area of the "Rocky Burn" stream shading is low (10%), whereas upper reaches have moderate to hiqh 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 stabilltv and cover.

C. Reach Descriptions

Four reaches were identified along the surveyed section of Threemile Creek. All reaches are riffle dominated. The stream grasient is low *(4%)* in Reaches I and II (RM 12.0-14.9) and hiqh (,8%1 in Reaches III and IV. Large woody debris is important in retention of greater than half the total spawning gravels and over 70% of the pool formation.

D. Fisheries

The overall rating of the fisheries habitat is good (HCR = 6.91. Rainbow trout were observed up to RM 17.4. Pool size is 3-K square yards over 75% of the surveyed length. Depths are moderate and effective cover is moderate to high. High quality pools are common and are found on the outslde of meander turns and at the base of log sills. Large woody debris (LWD) is influential in 80% of all pool development and 90% of the high quality pools. Spawning ravels total 791 square yards with 85% suitable for anadromous salmonids. iiravel beds are 2-4 square yards in area over 75% of the surveyed length. The presence of LWD In the channel Influenced the retention of 75% 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 area 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 velocitv barrler. The habitat In Threemile Creek appears highly suitable for steelhead trout and marginal for coho salmon.

E. Rlparian

The overall riparian quality rated moderate (RCR = 5.81. Positive factors influencing the rating Include a wide floodplain in Reach 1. a high number of habitat unlts above RM 13.7, deciduous overstorv species scattered in the floodplain between 14.9 and 17.4, and the presence of special habitats (talus slopes and wet meadows). Overstorv 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 stabilitv and increasing Introduction of slash and sediment to the stream.

F. Rehabilitation and Enhancement

Rehabilitation efforts should center on re-establishing an overstorv canopy in the area of the "Pocky 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 conpounded 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.

6. Special Interest

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

THREEMILE CREEK
Reach Summary

Reach I: 12.0 - 13.7

1. Valley configuraion is a broad, flat-bottom V. Floddplain Is greater than 200 feet wide.

2. Stream gradlent is low (4%).

3. Substrate is primaril rubble and gravel (80%)

4. Riffles dominate the stream surface area (P:R = 3:7).

5. Stream shading is low (10%). The 1974 "Rockv 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).

3. Substrate is a rubble-gravel mlxture (70%) with an increase in boulders (10%).

4. Pool-to-riffle ratio remains the same (P:R = 3:7).

5. Stream shading increases substantially to 85%.

6. Channel braiding is common. Braids averae about 100 feet in lenght and have flows of 1-2 cfs.

Reach III; 14.9 - 17.4

1. Vallev conflguration continues as a flat-bottom V with a variable width. Floodplain width varies from 80 to 200 feet.

2. Gradient is hlgh (10%). The stream has a stairsreo proflle. LWD and large boulders are the structural components creating the rise In the profile.

3. Riffle area is reduced bv 10% (P:R = 4:6).

A. Shadlng is moderate (70%). Four clearcut/shelterwood units (Slide Timber Sale) are in this reach. Shadlng in these areas it low (15%). 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%). Floodplain width is 60 feet wide and narrows to 30 feet at the upper end.

2. Gradient is high (8%).

3. Substrate comoosltion is gravel and rubble (65%) fine gravel and sand comprise 30% of the bottom composition. The flow regime is well-regulated.

4. Pool-to-riffle ratio 4:6.

5. Stream shading is moderate (60%).

6. Instream LWD is abundant.

Tributaries

Six perennial streams are tributaries to the surveved section of Threemile Creek. Two of these, Tributaries B and D, are important because thev contribute more than 30% of the flow at their confluence with the mainstem. The flow In the others is less than 0.5 cfs and fish hahitat is verv marginal.

Tributary B contributes approximately 30% of the flow (2.5 cfs) at its cofluence with Threemile Creek (RM 14.6). The tributary was surveved to RM 0.2. Habitat appears suitable for resident trout, althouth none were observe?.

1. Vallev configuration is v-notched with moderately steep sideslopes (30-50% gradient).

7. Stream gradient is high (11%) with a stairstep orofile provided by LWD. Floodplain width is 20-40 feet.

3. Bottom composition is predominatntluy sand, gravel, and rubble.

a. Pools comprise approximatev 40% of the stream surface area. The quality of the rearing habitat is low. Pools are l-2 square yards. shallow (0.5 ft), and have low effective cover.

5. Shade is high (90%).

6. Channel braiding is common.

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

THREEMILE CREEK
Fish Habitat Summary

Reach I; RM 12.0 - 13.7

1. The fish habitat qualitv is rated fair to good (HCR = 6.31. Electroshocking in August 198% (Cain, T. and Smith, 0. 1982. Resldent Trout Population Assessment Program. Mt. Hood National Forest) gave a population estimate for rainbow trout that was relatiely high (2374 fish/acre). No other game species were ohserved.

2. Spawning gravels total 217 square vards with 60% (123 square yards) considered high quality. Appro,imately 40% (91 square yards) of the total are in the 1.5-3 inch size class and 50% (108 square yars) in the 3-6 inch size class. Spawning beds are typically 3-4 square yards in area. LWD influences-formation of about 50% of the beds.

3. Riffles domlnate 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 qualitv pools are associated with large, overhanging root wads. LWD influences 75% of the pool development and 95% of the high quality pools.

4. Double, d-foot diameter culvertsq (64 feet in length) at Forest Service Road 4811 (RM 12.05) are likeiy partial barriers to fish migration, particularly juveniles. Low flow velocities of 3 ft/sec and water depths of six inches were observed in the culvers. Two debris accumulations at RM 13.2 and 13.25 are also partial barriers. Both are four feet high and have accumulated more debris behind them. The stream channel in the area of Logjam #3 (RM 13.251 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 = 8.01. No fish were seen in this section; probablv due to low light conditions at the time of survey.

2. Spawning gravels total 134 square vards; 45% (62 square yards) are of high qualitv. 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% 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 vards, are typically associated with meanders, and natural loq sills. Depths are moderate to deep (30+ inches). Effective cover is high and created by overhanqing root wads, pool depth, and surface turbulence. LWD influenced 85% of the pool development and 100% of the high quality pools.

a. Logjam #3 at RM 14.35 is four feet high and mav 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 = 7.51. Rainbow trout are present and were observed in low numhers.

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% in the 3-6 Inch size class. Spawning bed size averages 3 square vards. About 80% 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 (l square yard) are found behind boulders alonq the stream margins. These are shallow and offer little effective cover.

4. No migration obstructions are in this reach. The overall high gradient (10%) 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 = 5.41. No fish were observed in this section.

2. Spawning gravels total 150 square yars, fiftv percent are high qualitv. The distribution by size categroy is as follows: 40% (60 square yards) are 0.5-1.5 inch; 40% are 1.5-3 inch; and 20% are 3-6 inch. The average gravel bed size is small (l-2 square yards) and almost totally dependent an lnstream LWD for its formation and retention.

3. Pools comprise 40% of the stream surface area (P:R = 4:6). Pool sizes are l-2 square yards, shallow and with low effective cover. LWD is influential in 30% 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% 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 probahle barrier at higher flows, with velocities over 7 ft/sec.

THREEMILE CREEK
Rlparian 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\. forminq a broad, flat bottom, V-shaped valley. Small wetlands are present along 10% of the reach length. Thev are more frequent at the upper end of the reach (RM 13.5-13.71. Negative factors include the lack of an overstorv as the result of fire and salvage logging.

3 Two habitat units fgrass-forb and shrub-seedling-sapling) are abundant, along with a sparse overstorv (western red cedar and Douglas fir) at either end of the reach. Small (30-40 feet1 snags are scattered throughout.

4. The small wetlands present (see above) are a special hahitat in this reach.

5 Livestock are presently excluded from approximately 50% of the reach length. In sections in which either access is permitted or occurs due to down fenceline (RM 13.21. 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 1100 feet). Numerous high-flow braids have resulted in small silt-bottomed skunk cabbage wetlands over 20% of the reach length.

3. All five habitat unlts fgrass-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 overstorv 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 rlparian habitat rates moderate 9RCR = 5.7).

2. The floodplain width is narrow (averaging 65 feet), formfng 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-dcnninated.

   Deciduous overstorv species present, although none are common, are quaking aspen (RM 16.11, 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%). 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 facinq 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 Toading exists at these locations.

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

Reach IV; RM 17.4 - lg.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%) 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. Mo deciduous species were noted.

5. Special habitats include two wet meadows at RM 19.3 and 19.2 The first Is a large (10 acres! sedge/alder meadow with a sparse overstorv of spruce, true fir, and numerous *nags. it is presentlv 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, qrasses, 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 "Rockv 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% of the reach length bv barbed-wire fencing. Exclusion areas have higher banks and greater shading fprovided predominantly by willow1 than sections accessible to cattle. Repair of downed fenceline at RM 13.2 would exclude an additional 20% 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 recentlv logged funburned at time of survey1 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%). Planting a buffer of fast-growing deciduous species such as willow, adler, 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 ma,v 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 surveved, a low ground pressure skidder salvage unit (Hiland #8) surrounds two smaller clearcuts (Hiland # 4 #5) whose flagged boundaries presently extend into the Threemile floodplain (l0-20 feet from stream edge). The salvage sale plan includes winching downed logs from the ten-acre special habitat wetland on Tributarv D (RM 18.31. Re-establishing sale boundarles to provide a streamside protection and exclude wetlands from logoing activity would help maintain fish and wildlife habitat in these areas.

Passaqe Enhancement

A diversion structure (RM 11.5) on private land, just below the area surveved, diverts all summer discharge so that the stream immediately below this point is usually dry from July through November finformation 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 17.51 appear to be partial passage barriers. Baffling or some other modification mav be reauired 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. 14.751 may also partiallv reduce passage during low flows but are low priority. Passage during higher flows would probably he unobstructed.

THREEMILE 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 (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	3 0	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
- 5: Percnet 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%

THREEMILE CREEK

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

SPECIES	REACH 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 - SPAWING GRAVEL 'SQUARE YARDS)

Reach (R.M)	Spawning Gravel (Sq. Yds.1 Total	Good	Marginal
I (12.0-13.7)	217	123	96
II (13.7-14.9)	134	62	72
III (14.9-17.41	290	130	160
IV (17.4-19.31	150	76	74
TOTAL	791	391	400

THREEMILE CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
12.05	Culvert	Cl	P	Modify for passage. 64 ft long, 3 ft/sec velocity.
13.2	Logjam	Jl	P	Low priority.
13.25	Logjam	J2	P	Low priority.
14.35	Logjam	J3	F	Low priority.
17.5	Culvert	C2	P	Modify for passage. Velocitv barrier. 5 ft/ sec. 40 ft long, 2.5 $ gradient. Low priortiy.

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

*Refer to special case form for barrier characteristics.

TABLE V - ANADROMDUS HABITAT SUMMARY

REACH (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
I (12.0-13.7)	1.7	0.0	317	5	1	91	106	
II (13.7-14.9)	1.2	0.0	3:7	5	I.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	244	

Legend: Avail.: Miles of habitat presentlv accessible to anadromous fish if introduced.
Pot.: Miles of habitat potentially available wlth passage enhancement.
P:R: Ratio of pool lenath : riffle lenqth.
Area: Average pool area s q yds.1.
Depth: Average pool depth (feet).
Spawning: Number of sq. yards of gravels observed in the l"-3" and 3"-6" size classes.

THREEMILE CREEK

TABLE VI - LWD HABITAT OUALITY INFLUENCE

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

LEGENO: Total: % of total hahitat area dependant on LWD
HQ: % of high qualitv habitat area dependent on LWD
OR: angle of orientation to flow; perp = perpendicular, var = variahle
#: 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*

	SUMMER				BANKFULL		
Reach (R.M.)	W	d	v	Q	W	D	Floodplain Width (Ft.)
I 112.0-13.7)	9	.4	1.5	5	14	1	200+
II 113.7-14.9)	14	.3	2	a	23	1.5	70
III (14.9-17.41	7	.5	1.5	5	16	1.5	100
IV (17.4-19.31	5	.2	1	1	9	.5	711

* Data compiled from transect measurements.

LEGEND: W,w: Stream width (ftl
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

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP.0 F A/W	A/W	TIME
I (12.0-13.71	8/25/03	6.5	10	SE	65/54-	75157	1430-1700
II 113.7-14.9)	8/29/83	9-7.5	90	SE	60/50		1735-1845
III 114.9-17.4)	8/30/83	7-4	80	E	57/50-	62/50	1l00-1630
IV (17.4-19.3)	8/31/83	1-2	80	E	56/46-	62/47	1100-1425

TABLE IX - RIPARIAN HABITAT SUMMARY

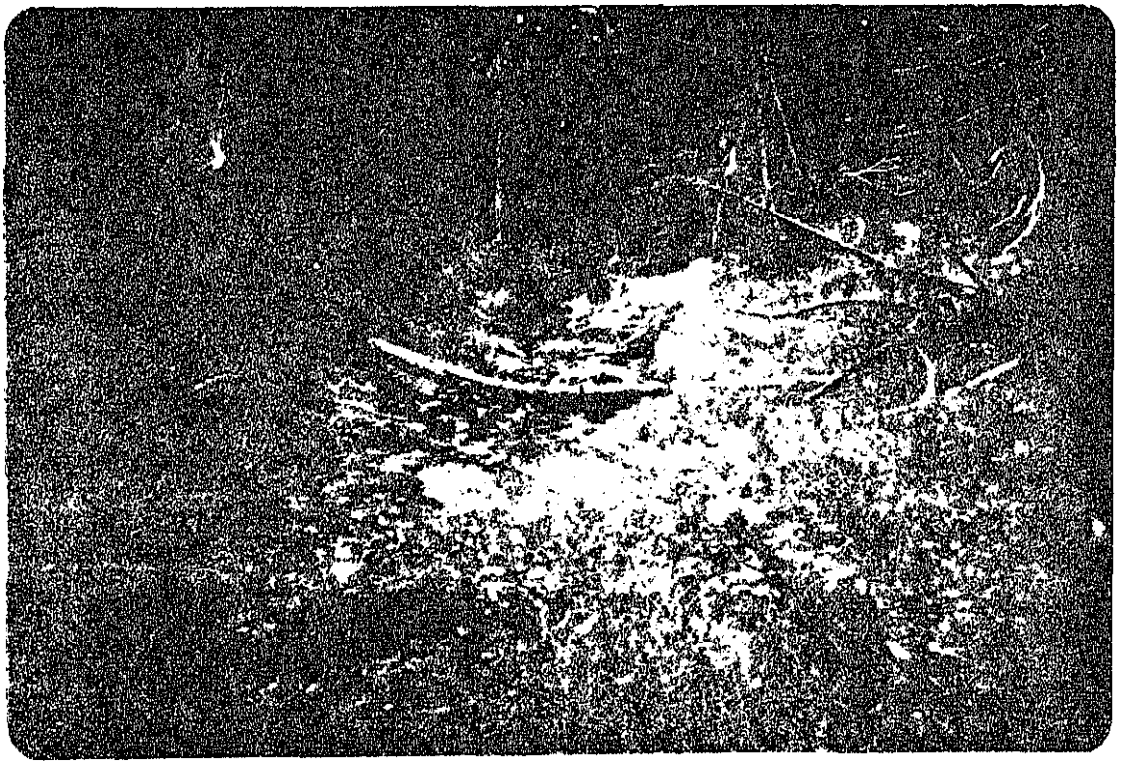
Reach RM	RCR	VALLEY FP(ft.)	VEGETATION H.U.	Overstory Con.	Dec.	AQUATIC Streamclass	Wetland%	Size	Special Hanitat
I 12.0-13.7	5.6	200+	2	0	0	I	10	SM	1
II 13.7-14.9	6.3	100	5	3	0	I	20	SM	1
III 14.9-17.4	5.7	65	5	5'	1	II			2
IV 17.4-19.3	5.5	45	5	3	0	II	20	LG,SM	2

LEGEND: RCR: Riparian Condition Rating
F.P.: Floodplain
H.U.: Habitat Units H >_ 4; M 2-3; L ≤ 1
Con : # Conifer Species
Dec: I Deciduous Species
Wetland: % stream length wlth 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!

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).

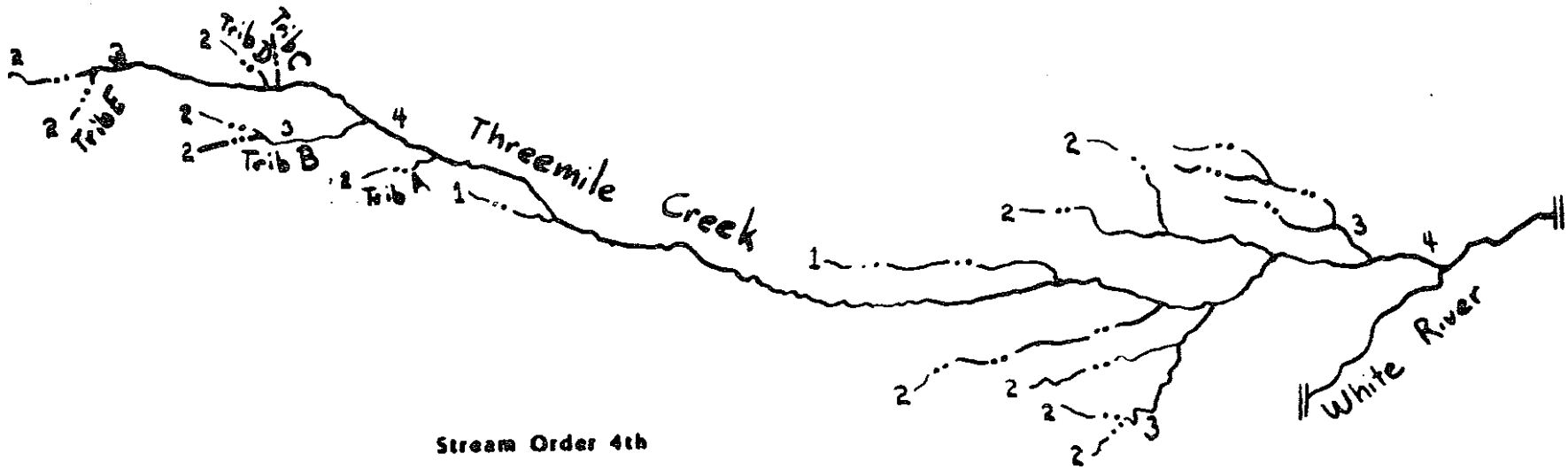
Pool development is highly dependent on large woody debris throuqhout the stream length, with 95% of the high quality pools present associated with Incorporated woody debris. Log sills and rootwads such as these pictured in Reach I are particulary common components In the stream channel, frequently creating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

The fish hahltat in Reach IV is onlv fair (HCR=5.4). The gradient is high (8%) over a gravel and rubble The flow regime is well-reaulated. Riffles dominate the stream surface area slightly (P:R=4:6). Pools are small, with shallow depths and low effective cover. Spawning hahitat Is fair) there are 150 square yards of spawning qravels present, with approximately 60% suitable for anadromous salmonids. (Photo at RM 17.6.)



The two-acre grass meadow borderinq Threemile Creek at RM 19.1 Is one of the special habitats noted In the surveyed area. Other speceal habitats include small wetlands, snag patches. and falus slopes. Rlparlan habitat conditions are rated moderate overall, largely limiteed by low species and structural diversity in the streamside plant communities. Exsiting special habitat units are therefore especially important In wildlife habitat quality on this stream.

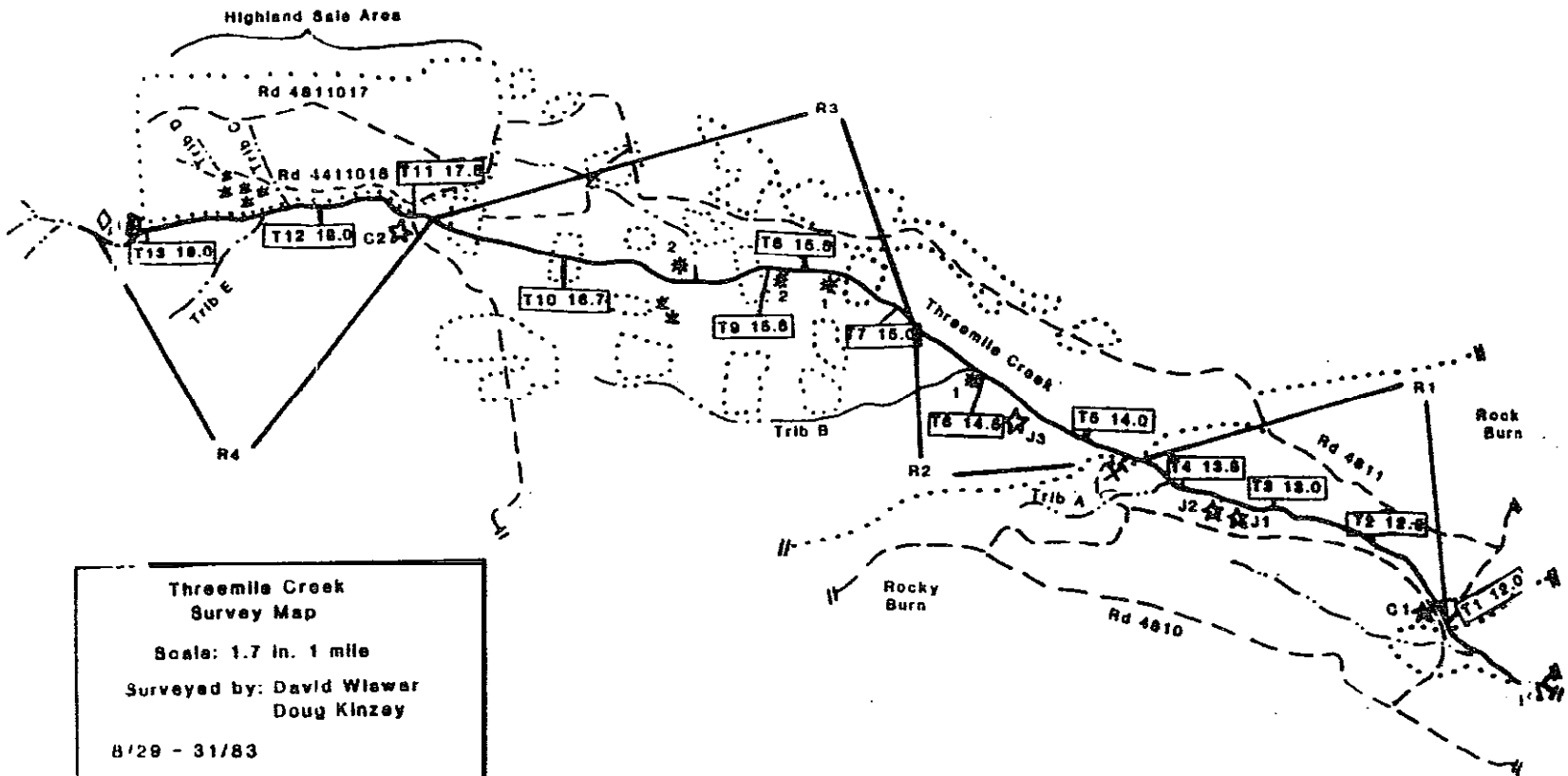
Tributary D braids into three channels through this high quality sege and tao alder meadow (10 acres). The overstorv species within it are spruce and true fir. Standinq and downed snaqs are abundant. The meadow Is within the boundary of the Hiland #8 slavage sale. (Shown at RM 0.1)



Stream Order 4th

THREEMILE CREEK

Scale 0.5 km; 1 mi


Highland Sale Area
Rd 4811017
Rd 4411018
Trib D
Trib C
Trib E
T13 19.0
T12 18.0
C2
T11 17.8
R4
R3
T10 16.7
T9 15.8
T8 15.8
T7 15.0
Trib B
Threemile Creek
T6 14.8
J3
R2
T5 14.0
Trib A
T4 13.8
T3 13.0
J2
J1
T2 12.8
Rd 4811
R1
Rock Burn
Rocky Burn
Rd 4810
C1
T1 12.0
Threemile Creek
Survey Map
Scale: 1.7 in. 1 mile
Surveyed by: David Wiewer
Doug Kinzey
8/29 - 31/83
Legend
1 dead new growth on conifers
2 talus slope

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 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
S-41	ROAD AND ID NUMBER
	EARTHFLW

GATE CREEK
BARLOW RANGER DISTRICT

Surveyors: Jeff Uebel, Tom Cain, David Wiswar. Doug Kinzey

Countv: Wasco

Dates Surveyed: October 5. 6. & 11, 1983

Mouth Location:
T4S, R12E, Sec. 27

Trfbutary to: Rock Creek

Watershed Area:
23,700 acres
37 sq. miles

Drianage: Deschutes

Stream Length: 13.5 miles

TRI Compartment:
Gate 1505

Distance Surveyed:
8.0 miles mainstem
1.8 miles South Fork Gate Cr.

Game Fish: Rainbow Trout

Low Flow Width (Avg.): 5.5 feet

Potential Anadromous Species:
Coho
Steelhead

Stream Order: IV

Average Fish Habitat Condition Rating: 5.2 (fair)

Average Riparian Quality Rating: 5.5 (moderate)

GATE CREEK

Survey Summary

S.tream 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% 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 sours 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.

8. 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% in the lower reaches to about 30% in Reach IV. The low topography of the drainage combined with relatively low mainstem gradient (maximum 8%) 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 trihutary system, South Fork Gate Creek (RM 7.1), 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%) with substrates dominated by fine gravels, sand, and silt in Reach I. and gravels in Reach II. Reach III has increased gradient (3%). and the highest boulder-rubble component of any reach (35%). Gradient increases throughout Reach IV (5-8%) 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.

0. Fisherfes

The overall rating of fish habitat is fair (HCR = 5.2). Approximately 9.6 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% in Reaches II, III. and IV are LWD-dependent. Gravel quantity (averaglng 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% in Reach I to 85% by Reach XV. 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 gradally 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 Burn 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 burn, logging corridors and streamside logging have removed the canopy In several localized areas.

F. Rehabilitation and Enhancement

Several oartial 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 throuqhout 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 loq sill or boulder berm construction could greatly improve the fish-rearing capabilities of this stream.

Llvestock impacts, such as bank and streambed trampling and overgrazing, are evident in the lower 4.0 miles surveved, 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 dlversity enhanced by revegetating streambanks in these areas with fast-growing deciduous species and protecting the riparian area from livestock overgrazing during the revegetation process.

6. 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 braidinq is comon.

2. The gradient is very low (1%).

3. The riffle substrate is predominatley fine gravel, sand, and silt (70%). 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=6:4).

5. Stream shading is 60%.

Reach II; RM 6.4-8.8

1. The floodplain width decreases (avg.= 55 ft) as the vallev 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% gravel.

4. The pool to riffle ratio is similar to Reach 1 (P:R=6:4).

5. Shading increases to 90%.

Reach III; RM 8.8-10.9

1. Valley configuration is a V-shaped valley with a floodplain width averaginq 95 feet.

2. Gradient increases to 3%.

3. Substrates remain gravel-dominated (60%). The boulder-rubble component (35%) is the highest of anv reach.

4. Riffles dominate the stream area (P:R=4:6).

5. Stream shading is moderate (50%). It is low (30%) throughout the Rocky Burn (RM 8.8-10.2) but increases to 90% in the upper end of the reach.

Reach IV; RM 10.9-13.0

1. Floodplain width remains moderate (100 feet side) and is contained in a flat bottom V-shaped valley.

2. Gradient increases from 5% at the lower end of the reach to 8% at the upper end.

3. Substrate remains gravel dominated (55%)

4. Pool to riffle ratio remains 4:6.

5. Stream shading remains high (80%).

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%).

3. Gravel remains the predominant substrate size class (50% 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%).

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 (R.M. 8.8 to 10.91, while the lowest rating, 4.5 (poor), is In Reach II (R.M. 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 limitinq 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 hut the quality is generally marginal. Pools average 12 square yards in size but depths are predominatelv less than 12". Effective cover Is moderate and is provided by overhanging vegetation and LWO. A few high quality pools associated with beaver dams are present at RN 5.0-6.0. Channel braids in this reach also provide excellent off-channel rearing habitat.

3. Spawning habitat is fair with 45% 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" 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 LWO.

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") and cover are moderate, with an average surface area of three 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 ratinq include the effects of recent logging activity throughout this reach. In the Rocky Burn (RM 8.8-10.2), salvage operations have reduced the potential for future LWD input into the channel. Above the burn area 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 prevuous reach. One hundred and thirty-one square yards (33 sq. yds./mile) were counted, aporoximately 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 qradient (33%) at this location qreatlv 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). Averaqe 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% of stream length) beaver-pond wetlands, and snag patches.

6. A reduction in riparian vegetation and bank stahility due to livestock activity lowers the riparian habitat quality in isolated areas (R.M. 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 generallv 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 overstorv.

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-E-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 a!! 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 hahitat 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 psecies per transect (cedar, grand fir. and Douglas-fir).

5. Three special habitats are a small (less than ½ 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 one acre) quaking aspen grove at RM 1.6.

6. Cattle grazing impacts include bank tramo'lng and vegetation grazing. Grass height at the time surveyed was less than six inches in areas accessible to grazing and three 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 ten debrls 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 (R.M. 8.6) would likely present both up and downstream passage problems to anadromous fish. The dam is two 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% of the area surveyed. Pool depths are predominantly shallow (12") 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, 9.3-10.2, and 10.3-12.4; 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 minimuj. 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	-	1	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 ≤ 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)
- l: Present, but less than 5%

GATE CREEK

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

Species	REACH				TRIBUTARIES
	I	II	III	IV	S. Fork
Rainbow Trout-a	LL		L	L	L
Rainbow Trout-j	ML		L	L	L

LEGEND: L = Low (O-51; M = Moderate (6-50); H = High (SO+)
a = adult, j = juvenile

* = habitat suitable; presence reported hut not observed.
( )= habitat suitahle; may not be present

TABLE III - SPAWNING GRAVEL (SOUARE YARDS)

Reach (R.M.)	Spawninq Gravel (Sq. Yds.) Total	Good	Marqinal
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
TOTAL	823	325	a-R--

GATE CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
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	D1	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 - ANADRDMOUS HABITAT SUMMARY

REACH (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comment s
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	
TOTAL	2.0	7.8				502	59	

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 fsq. yds.).
Depth: Average pool depth (feet).
Spawninq: Number of Sq. Yards of gravels observed in the 1"-3" and 3"-6" size classes.

GATE CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HQ (%)	Total (%)	HO (%)	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	l-2	1	T-M
III(8.8-10.9)	50	50	70	90	Perp	S-M	I	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 hahitat area dependent on LWD
OR: Angle of orientation to flow; Perp = perpendicular, Var = variable
A: Number of logs/structure; S = single log, M = multi-loq
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 BANKFUL CONDITIONS

	SUMMER				EANKFULL		
Reach (R.M.)	w	d	v	0	W	D	Floodplain Width (Ft.)
I(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

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

GATE CREEK

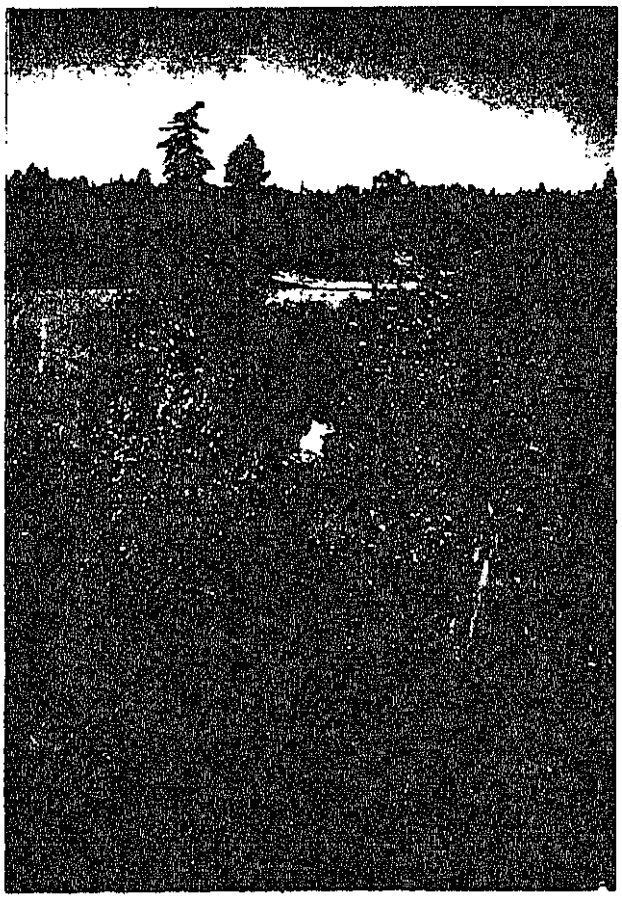
TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP. °F A/W	A/W	TIME
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

TABLE IX - RIPARIAN HABITAT SUMMARY

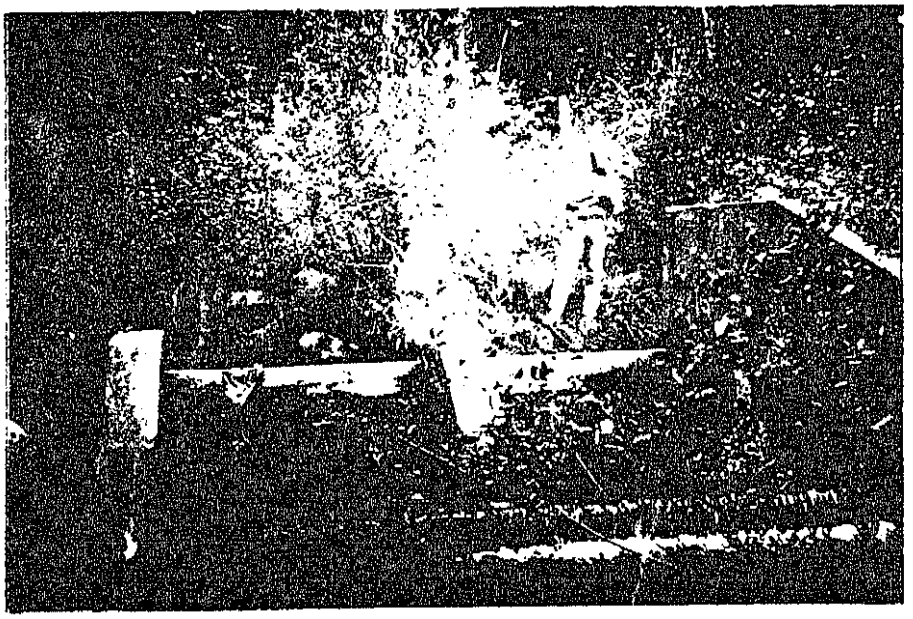
REACH (RM)	RCR	E F.P.	Y (ft.)	VEGETATION H.U.	Overstory Con.	Dec.	AOUATIC Streamclass	Wetland%	Size	Special Habitat
I (5.0-6.4)	7.9		175	5	2	1	I	80	S	2
II (6.4-8.8)	6.0		55	4	4	1	I	30	S-L	1
III (8.8-10.9)	4.6		95	3	3	0	I	1	S	1
IV (10.9-13.0)	4.3		100	4	4	1	I	1	S	0
South Fork (0.0-1.8)	4.9		30	5	3	0	II	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
Dec: # Deciduous species
Wetland: Percent of stream lenwth with adjacent wetlands; (H 50%; M = 25-50%; L 25%)
Size: Size of wetlands
S = small 'less than 1 acre)
L = large fqreater than 1 acre)



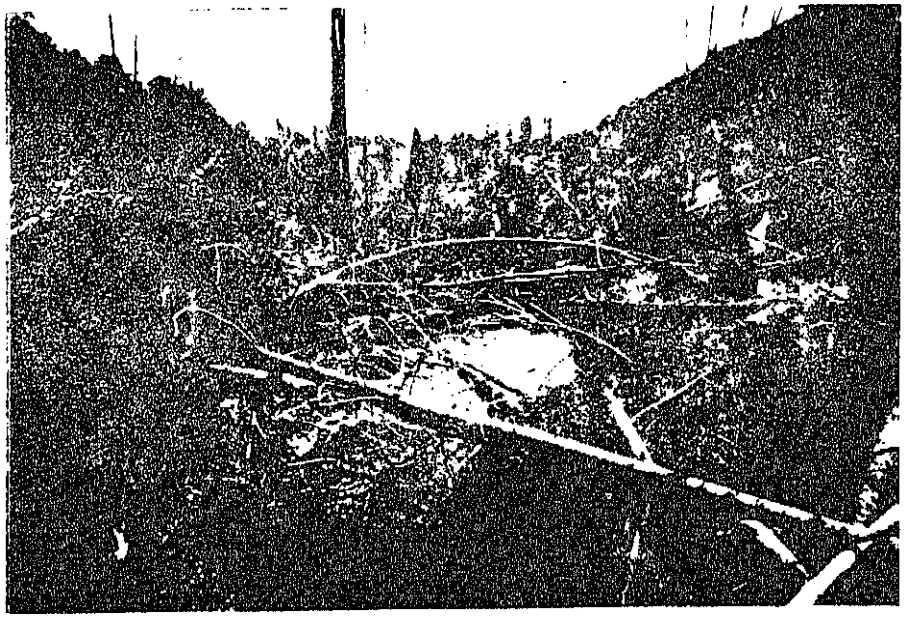
The riparlan habitat In Reach I is rated high quality (RCR=7.9) and includes the large wetland/dry meadow complex shown here (RM 5.0-5.5). The presence of all five habitat units, a good mix of conlferous and deciduous species in the overstory. and an abundance of small wetlands created by beaver ponds 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 traverslng It at RR 5.3 (background).

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



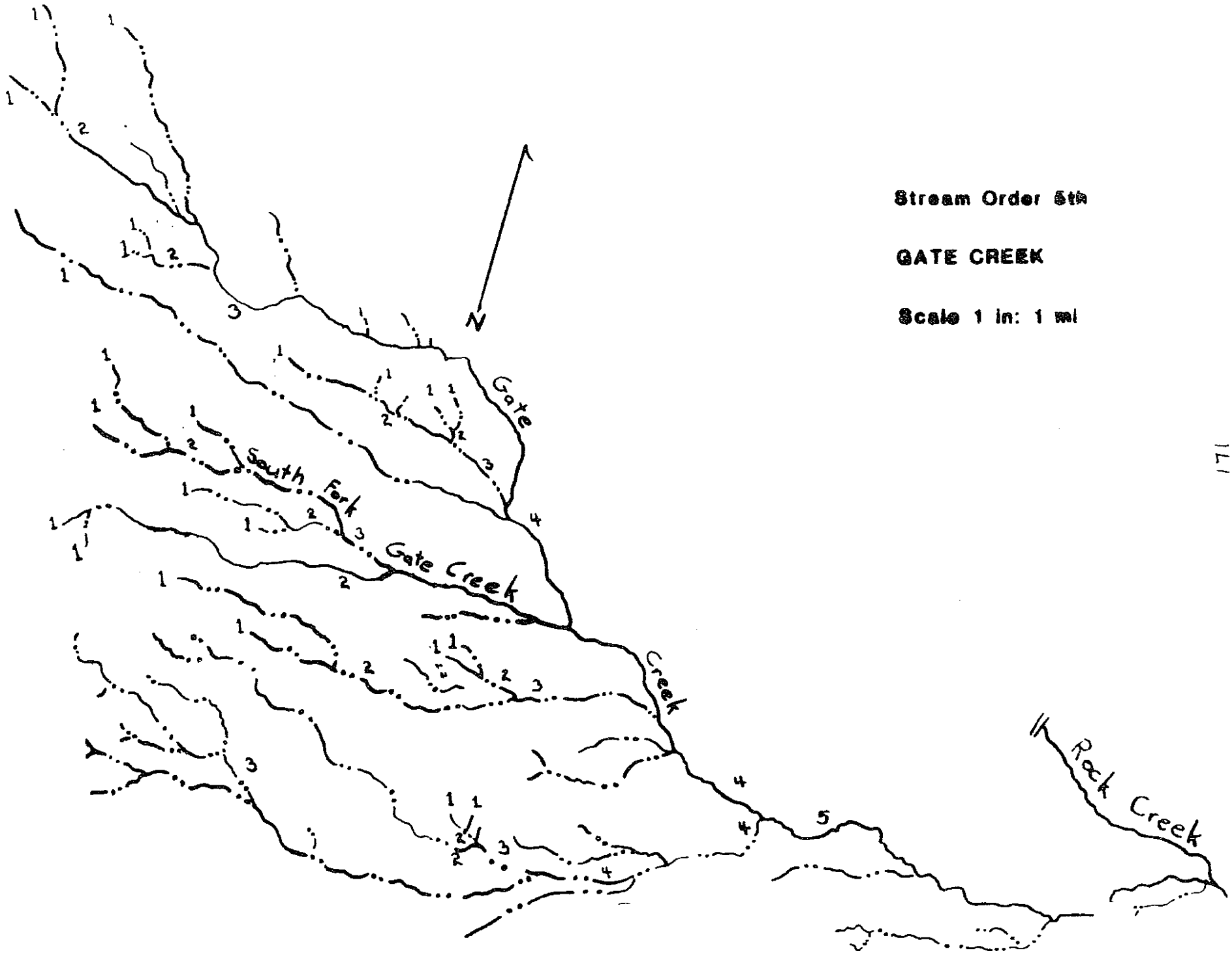
The diverslon dam at RM 8.6 presents a potentlal migration barrier to anadromous fish if they are introduced Into Gate Creek. Modiflcatlon for passage appears easy and would access an additional 4.1 miles of hahltat (400 sq. yards of gravell. Numerous debris jams, especially in Reach II also are partial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

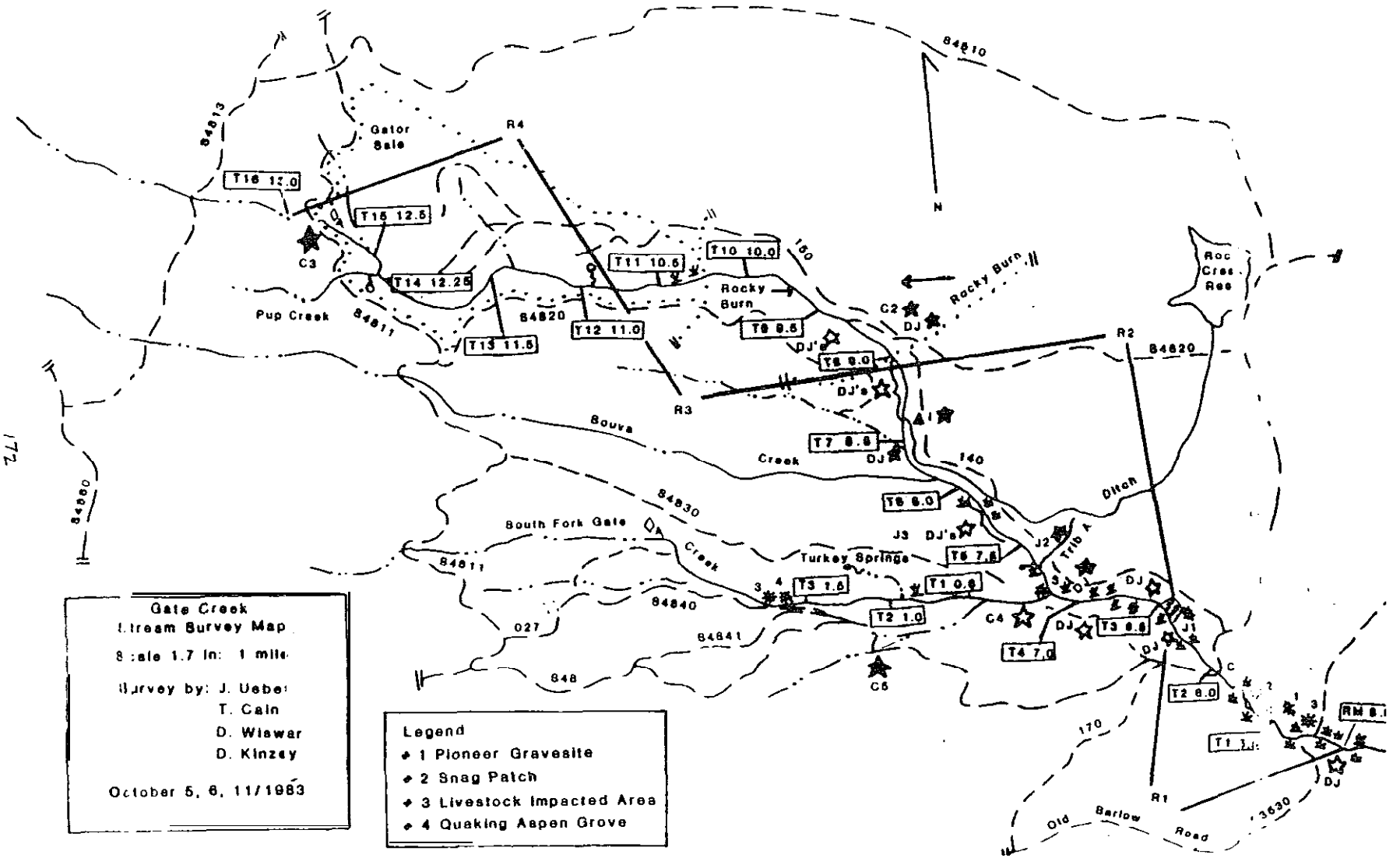
Logging corridors are common across Gate Creek from RM 10.3 to 12.4. Rehabilitation/enhancement opportunites, such as streamside deciduous plantings to increase bank stability and decrease stream sediment loading, exist at these locations.



Gate Creek passes through the 1974 "Rocky Burn" from RM 8.8 to 10.1. Shadinq 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 prioritv for rehabilitation efforts in this area.

A "typical" view of Reach IV (RM 11.1). Ninetv percent of the high-quality pools in this reach are dependent on LWD for their formation. LWD also apperas 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
N
Gate
South Fork
Gate Creek
Creek
Rock Creek


Gate Creek
Stream Survey Map
Scale 1.7 in: 1 mile
Survey by: J. Uebel
T. Cain
D. Wiswar
D. Kinzey
October 5, 6, 11/1983
Legend
1 Pioneer Gravesite
2 Snag Patch
3 Livestock Impacted Area
4 Quaking Aspen Grove
Gator Sale
Pup Creek
Rocky Burn
Bouva Creek
South Fork Gate Creek
Turkey Springs
Trib A
Ditch
Old Barlow Road
Roc Cres Res
N
R1
R2
R3
R4
C2
C3
C4
C5
DJ
DJ's
J1
J2
J3
T1 0.8
T2 1.0
T2 8.0
T3 1.6
T3 8.8
T4 7.0
T5 7.8
T6 8.0
T7 8.8
T8 9.0
T9 9.5
T10 10.0
T11 10.5
T12 11.0
T13 11.5
T14 12.25
T15 12.5
T16 12.0
84810
84813
84820
84830
84840
84841
84811
84860
3630
170
140
160
027
848

BOULDER CREEK

Barlow Ranger District

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

County: Wasco,
Wood River

Dates Surveyed: June 21-28, 1983

Mouth Location:
T5.S, RlO.E, Sec. 11

Trfbutary to: White River

Watershed Area: 14.162 ac.
22.1 sq. mi.

Drainage: Deschutes

Stream Length: 11.4 miles

TRI Compartment:
Echo, 1601
Forest, 1602
Immigrant, 1603

Distance Surveyed:
11.0 miles mainstem
0.3 miles Lost Cr.
0.3 miles Trib. K.

Game Fish: Rainbow Trout
Brook Trout

Low Flow Width (avg.): 15 ft.

Potential Anadromous Species:
Chinook
Coho
Steelhead

Stream Order: IV

Average Fish Habitat Condition Rating: 7.8 (Good)

Average Riparian Condition Rating: 6.7 (High)

BOULDER CREEK

Survey Summary

A. Stream Summary

Boulder Creek, previously known as Crane Creek. is a fourth order tributary of the White River providing aoproximately 15% (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 drainaqe. 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 heavilv influenced by qlacfal 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 lenqth. 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%) 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%) 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%) of any reach, with the substrate dominated by coarse gravels. In the headwater Reach V, gradient increases to 15%, 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 suitahle 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 LWO (60%) and boulders (40%). Off channel rearing area is abundant in Reaches II and IV. Spawning gravels are abundant, totalling 3235 square yards. Over 50% were rated high quality. Reach II (RM ?.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 9.01. Several partial barriers include a road culvert (RM 7.91, numerous log and debris jams (see Table IV), and the Crane Creek Ditch diversion structure (RM 3.1). This latter obstacle to fish miqration was divertinq approximately 70% (25 cfs) of the Boulder Creek discharge at the time of the survey.

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

G. Riparian Zone

The overall Riparian Condition Rating is high (RCR = 7.81. Positive factors include the high number of habitat units (4-5), high coniferous species diversity, extensive wetland development, snaq 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

Rehahilitation and enhancement opportunities center on modifying migration harriers. increasing high quality rearing pool area (especially in Reach III). and increasinq riparian habitat diversity throuqh 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 manaqement 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 14%).

3. The substrate is primarily large boulder/rubble (80%).

4. Riffles dominate the stream area (P:R = 4:6).

5. Stream shading is moderate (50%).

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%.

3. Substrate materials decrease in size class to primarily coarse gravels (45%) and rubble (30%).

4. Pool area decreases from levels observed being 3:7).

5. Stream shading increases tp 70%/

Reach III; RM 3.2 - 8.5:

1. Valley configuration continues to he a wide, flat bottom "V", with a floodplain ranging between 120 and 200 feet.

2. Gradient continues to average 3%.

3. Substrate is predominately boulder (30%) and rubble (30%).

4. Riffles continue to predominate (70%0.

5. Stream shading is low (35%).

6. Small-sized (< ½ acre) strea, adjacent wet lands were found along 25% 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%).

3. Substrate size class decreases to 60% coarse qravel.

4. Pool area increases to 50% of the total stream area.

5. Stream shading is moderate (60%).

6. Extensive large (> 1+ acre) and small (< ½ acre) wetlands are found along 80% of the stream lenqth. Channel braidinq 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%.

3. Substrate is an even mix of rubble and gravel (40 - 45%).

4. P:R decreases to 1:9, the lowest pool development observed in the system.

5. Stream shading increases to very high (95%).

6. Resident and anadromous fish habitat is marginal in lower end of the reach (RM 10.3 - 10.6), non-existant above.

Lost Creek; RM 0.0 - 0.7:

1. Valley configuration quickly changes from a very wide, 'J-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%, RM 0.0 - 0.2) to moderate (6%, RM 0.2 - 0.3).

3. The substrate also changes from heavily silted gravel (RM 0.0 - 0.2) to gravel/rubble dominated (70%) above.

4. Pool area decreases from 50%+ near the mouth to 30% at RM 0.3.

5. Stream shading is high throughtut (90%).

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.h miles of very high quality potential anadromous fish habitat. Additional habitat is provided in numerous channel braids and tributary systems (see Forest Creek Servey). 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 he suitable for rearing juvenile anadromous fish, possiblv Including sockeye salmon. (The lake is annually stocked with juvenile brook trout by the ODFW.) Upstream passage to the lake is blocked by the verv 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%). The pools are hiqh quality, with an average size of 10 square yards and depth ranging from 2-4 ft. Hiqh effective cover is provided by the large boulder substrate and water turbulence. Low flow anadromous holdinq habitat is available in the isolated very large pools 150 square yards area and 3 feet deep).

3. Spawning habitat is good; 80% of the 690 square yards of gravels are of a size class suitable for anadromous fish. Fifty-five percent were rated good qualitv.

4. One complete passage harrier (J2 RM 1.0) and numerous partial barriers including six jams, four chutes, and three small falls obstruct oassaqe throuqhout the reach. Please refer to stream survey mao for locations and descriptions.

Reach II; RM 2.3 - 3.2:

1. The fish habitat rate5 R.l, 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 increase; to 70%. Pools are smaller (4 square yards and more shallow than in the previous reach. Effective covr remains high and is largely a result of accumulated LWD. hiqh quality off-channel rearing area is found in the numerous channel braids of this reach.

3. Spawning habitat Is excellent with 20% (650 square yards) of the total gravel in the system found in this relatively short reach. About 70% of the gravels are suitable for anadromous fish. Sixty percent were rated good quality.

4. A culvert (Cl, 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%) 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 at-e abundant but patchy in distribution, totalling 1096 square yards. About SO% are considered to be high quality, and 75% are suitahle for anadromous utilization.

4. Several migration obstructions occur between RM 3.3 and 6.4. Log jam J7, at RM 5.2, is likely a complete barrier. Five other log jams observed are rated as partial harriers (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% of stream area, with moderte levels of effective cover. Pools are shallow (90% are less than 12" in depth), averaging 8 yards in area. Approximately 80% 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% are of a size class suitable for anadromous fish. Spawning habitat quality is highlt dependent on LWD (75% of high quality habitat).

4. Fish passage appears to he fully blocked at river mile 9.0 by log jam J9. Partial barriers (log jams) exist at river miles 8.6, 9.2, and 9.3.

5. Channel braiding provides abundant hiqh 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% 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 SO sq. yards total observed. Fifty-five percent are of high quality and 60% 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% of the stream area). Pools are small (1 sq. yard) and shallow (1 ft. max depth), but have hiqh effective cover.

3. Spawning habitat is very limited, with only 10 so. yards each of marginal and high qualitv gravels observed.

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

Trib K; RM 0.0 - 9.4:

1. Fish habitat quality rates fair (5.8 HCR). habitat quality varies widely in this area. RM fl.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% 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 var :s total), with only 3 square yards good grave' observed.

BOULDER CREEK

Riparian Habitat Summaryt

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% 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 shading at RM 0.7-0.8 and 1.6-1.7.

Reach I!; 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% 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 larqe wetland development (80% of stream length) is found throughout the very wide flat valley bottom ('X0-1000 ft.) of this glacial U-shsped 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 hoth 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 side (200 ft +I 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 over-story 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; 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 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 log jams are the most common (RM 0.8 - 10.1). Partial removal and side channel development could enhance passage. Passage at several small chute: (B1-2, RM 0.1 - 0.4) and falls (FI-3 RM 0.4 - 0.6) could be enhanced by developing jump pools. Debris removal is necessary at the head of chutes B3-4 (RM 2.2). The culvert Cl (RM 2.9), and diversion dam 01 (RM 3.2), are hiqh and low flow barriers, respectively. The addition of baffles and the development of an inlet resting pool may Improve passage at Cl The diversion dam creates 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 conditioons. 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; 3.5-5.0; 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 berms 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 (l-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.

Lost Creek - Flow Regulation; RM 0.25:

An increase in low flows past the Boulder Ditch diversion would create additional rearing area, better channel definition, and increase the flushing capacity of this small stream.

BOULDER 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"	l-l"	2	0
Reach I (RM 0.0-2.3)	9.0	50	4:6	4	M	10	H	*	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)	7.0	35	3:7	3	L-M	4	M	0	30	30	25	10	5	7
Reach IV (RM 8.5-10.3)	6.3	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
Tribs														
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	l-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 ≤ 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.

Species	REACH I	II	III	IV	V	TRIBUTARIES Lost	K
Rb	H	H	M	M	L	( )	M
BT	( )	( )	( )	L	( )	( )	M

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

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

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0-2.3)	690	386	304
II (2.3-3.2)	650	375	275
III (3.2-8.5)	1096	559	537
IV (8.5-10.3)	689	362	327
V (10.3-11.0)	80	45	35
Trib			
Lost Cr (0.0-0.3)	20	10	10
K (0.0-0.4)	10	3	7
Total	3235	1740	1495

BOULDER CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID I	PASSABLE	RECOMMENDATIONS
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	F1-3	P	Develop jump pools
0.8	Log jam	J1	P	Partial removal
1.0	Log jam	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	Log jam	J3-6	P	Partial removal
5.2	Log jam	J7	N	Develop side channel
6.4	Log jam	J8	P	Partial removal
8.6	Debris jam	DJ	P	Partial removal
9.0	Log jam	J9	N	Partial removal
9.2	Log jam	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 Avail.	Pot	P:R	Rearing Area	Rearing Depth	Spawning 1-3"	Spawning 3-6"	Comments
.-.	.	1.3	4:6	10	2	345	241	4 chutes, 3 jams and 3 small falls are partial harriers
II(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(3.0-8.5)	0	5.3	3:7	4	2	548	328	6 jams are partial to full barriers.
IV(835-10.3)	0	1.8	5:5	8	1	345	0	4 jams are partial to full barriers.
V(10.3-11.0)	0.0	0.4	1:9	1	1	40	8	Anadromous habitat ends at RM 10.7
	1.0	9.7				1,603	707	

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

BOULDER CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	I	L	Dia	
Source									
m - 2 . 3)	30		30	5	Perp	S/M	2	1-2	T
II (2.3-3.2)	60	ii	55	60	Perp	S/M	2	1-2	L
III (3.2-8.5)		55	25	75	Perp	S/M	1-2	1-2	M
IV (8.5-10.3)	40	75	60	80	Perp	S/M	1-2	1-2	
v (10.3-11.0)	70	80	60	90	Perp	S/M	2	1-2	i
Tribs									
Lost (0.0-0.3)	30	90	20	50	Pet-p	S	2		L
K (0.0-0.4)	70	75	90	95	Perp	S/M	l-2	1'2	L

LEGEND: Total q % 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 q 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 CONDITIONS

	SUMMER				BANKFULL		
Reach (R.M.)	w	d	v	Q	W	D	Eloodplain Width (Ft.)
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	zoo+
v (10.3-11.0)	6	.5	2	6	12	1	20
Tribs							
Lost cr. (0.0-0.3)	3	.2	1.5	1	4	0.75	6
K (0.0-0.4)	10	.5	1	5	15	1	270

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

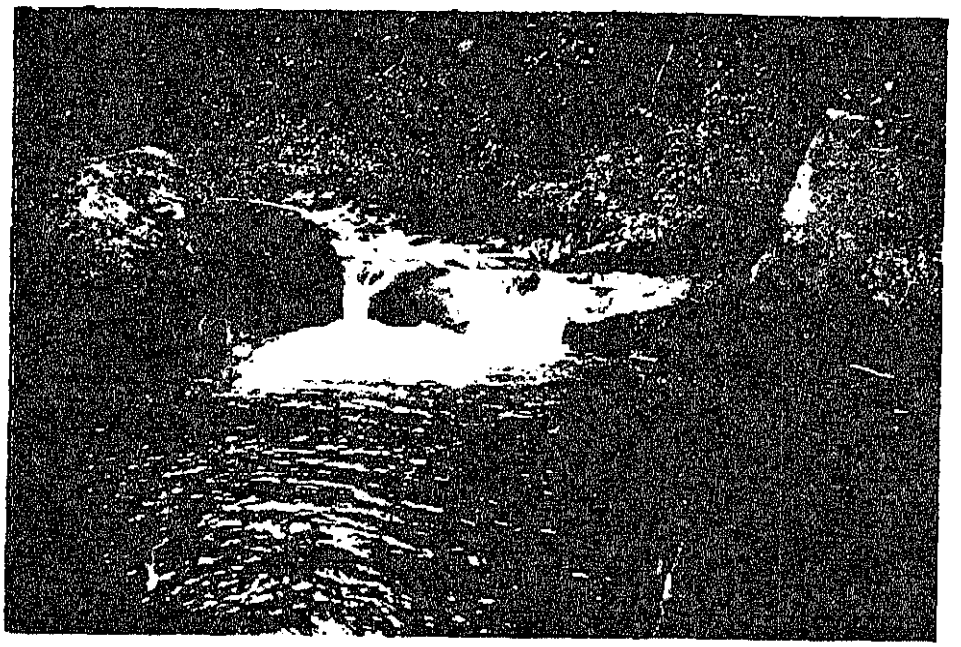
REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP/ /dF A/W	A/W	TIME
I (0.0-2.3)	6/21-22/83	8	50	S	54/48-61/50		1100-1700
II (2.3-3.2)	6/22-23/83	20	80	S	55/47-61/49		1500-1820
III (3.2-8.5)	6/23-6/28/83		35	S	55/45-61/49		1100-1700
IV (8.5-10.3)	6/24/83	10	60	S	57/46		1345-1530
V (10.3-11.0)	6/28/83	6	95	E	57/49		1530
Tribs.							
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

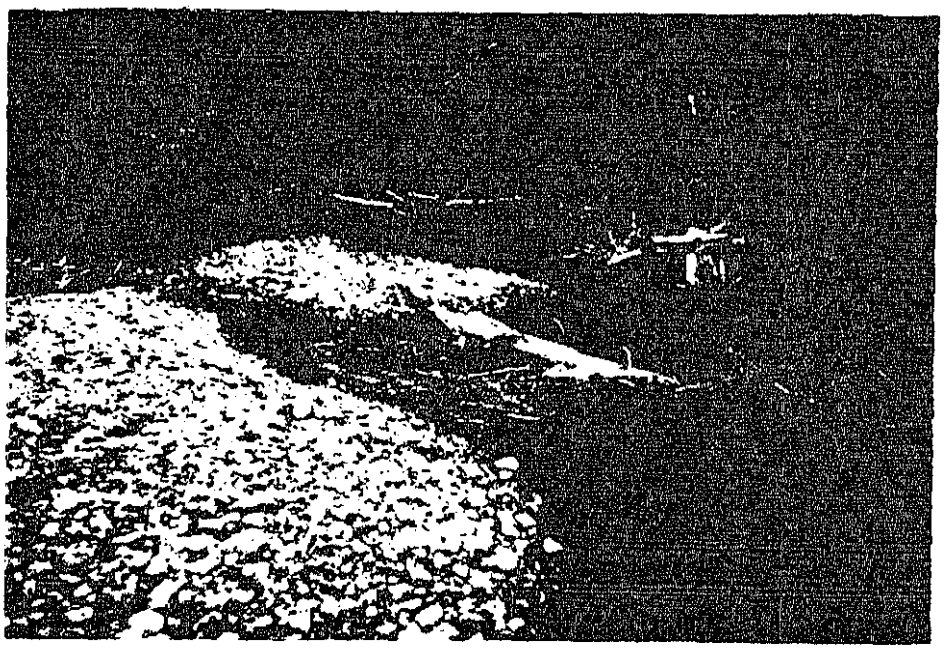
TABLE IX - RIPARIAN HABITAT SUMMARY

REACH (RM)	RCR	F VALLEY .P. (ft.)	VEGETATION H.U.	Overstory Con.	Dec.	AQUATIC 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 (10.3-11.01	5.0	20	3	3	0	III	H	S	1
Tribs									
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

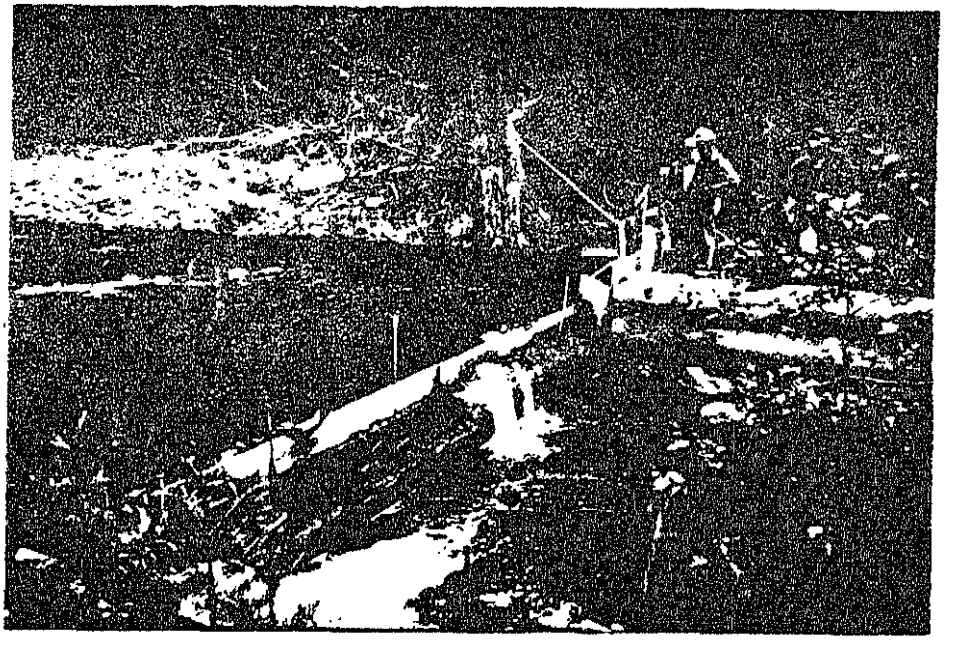
LEGEND: RCR: Riparian Condition Rating
F.P. Floodplain
H.U.I # Habitat Units H ≥ 4; M 2-3; L ≤ 1
Con: # Conifer Species
Dec: I Deciduous Species
Wetland: Percent stream length with adjacent wetlands; (H >30%; M 11-29%; L <10%)
Size: Size of Wetlands
S = Small (less than ½ acre)
L = Large (greater than ½ acre)



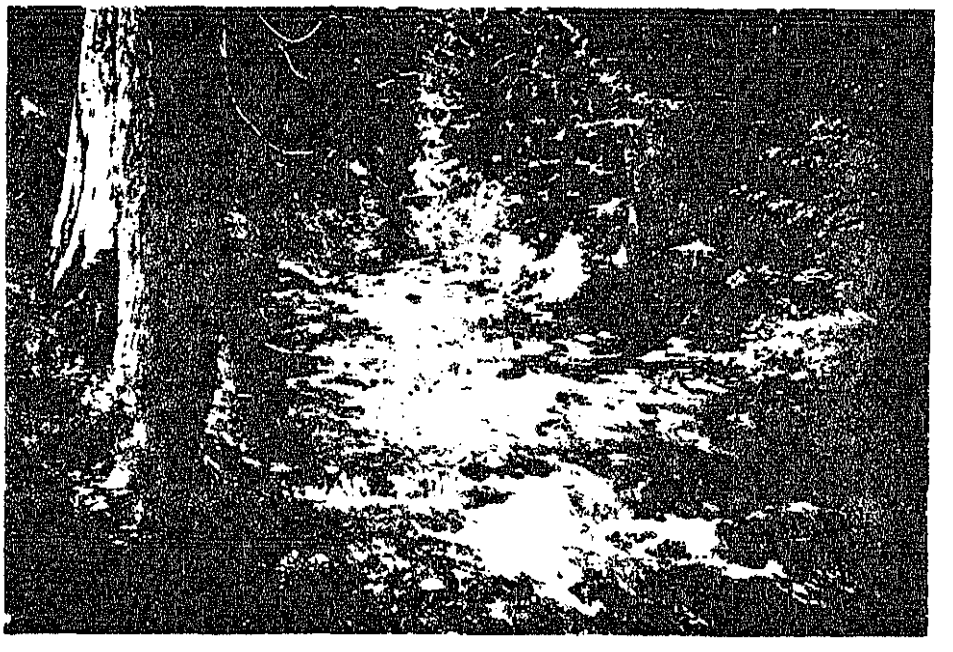
Exceptionally hlgh quality pool development (3-7 ft. deep) is present throughout Reach I (RM 0.0 - 2.31, primarily associated with large boulder channel structure. Several small chutes, falls and logjams in this reach are partfal to full migration harrlers and would be a hlgh priority for passage improvement if anadromous fish are introduced. (Approximatley 3000 sq. yds. of excellent spawning hahitat lie above this point.) Photo at RM 0.4.



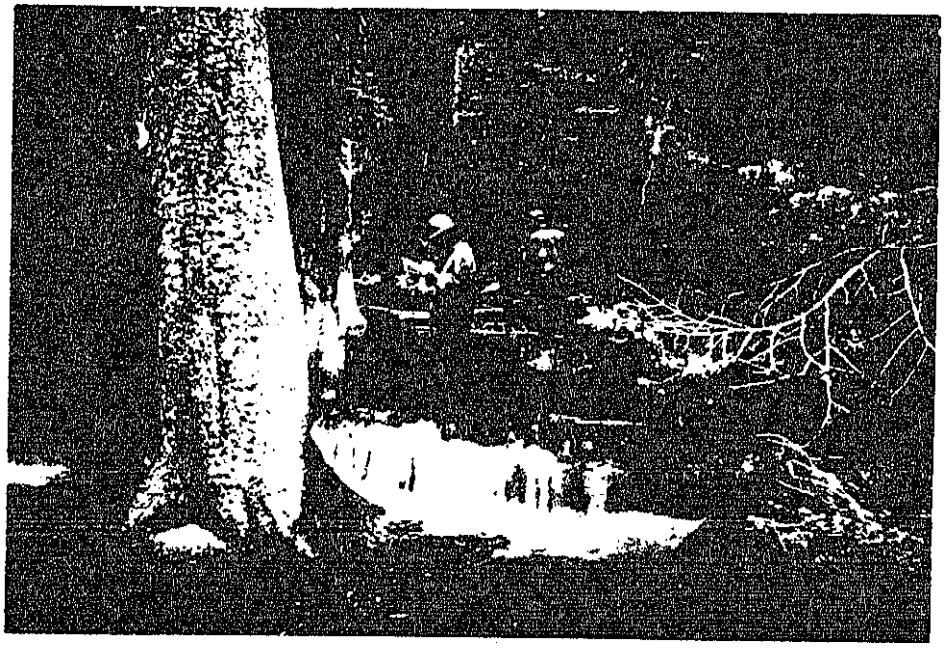
Reach II (RM 2.3 - 3.2) contains the highest concentration (700+ sq. yds./mile) of spawning gravels observed. Large gravel beds of 20+ so. yds. are common. Rearing habitat conditions are verv good, with moderate pool volume and high effective cover from LWD. Channel braiding is prevalent In this area (RM 2.8 shown.)



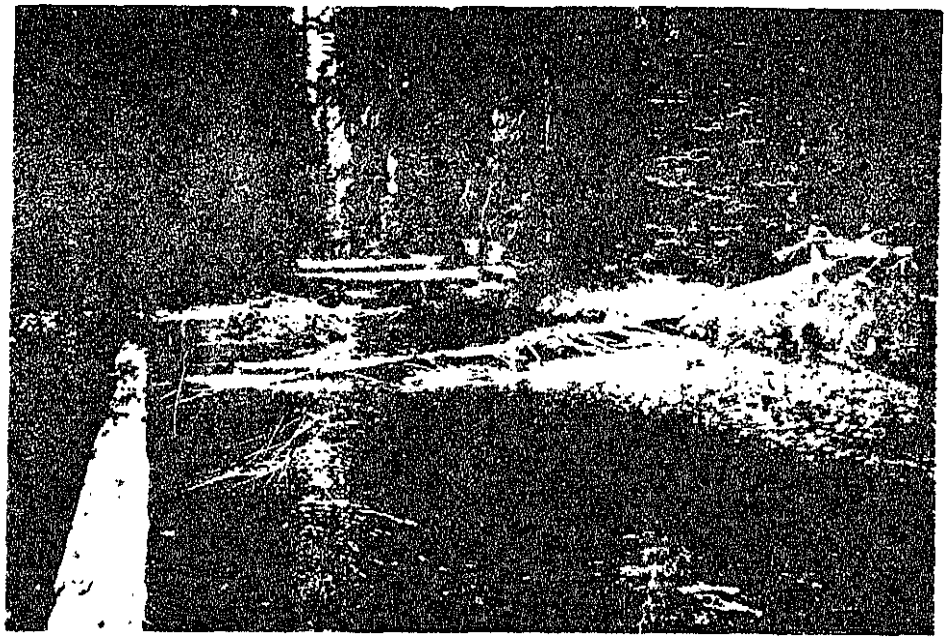
The Crane Creek ditch crosses the stream at RM 3.1, diverting 70% (25 cfs) of the streamflow at that point. Rlparian andfish habitat qualitv Is affected for two miles downstream by the water? withdrawal. The diversion dam presents a partial barrier to fish migration; passage enhancement would likely 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 disturbted throughout, usually associated with logjams. Spawning habitat is very patchy ins distribution, averaging 200 sq. .vds./mlle.

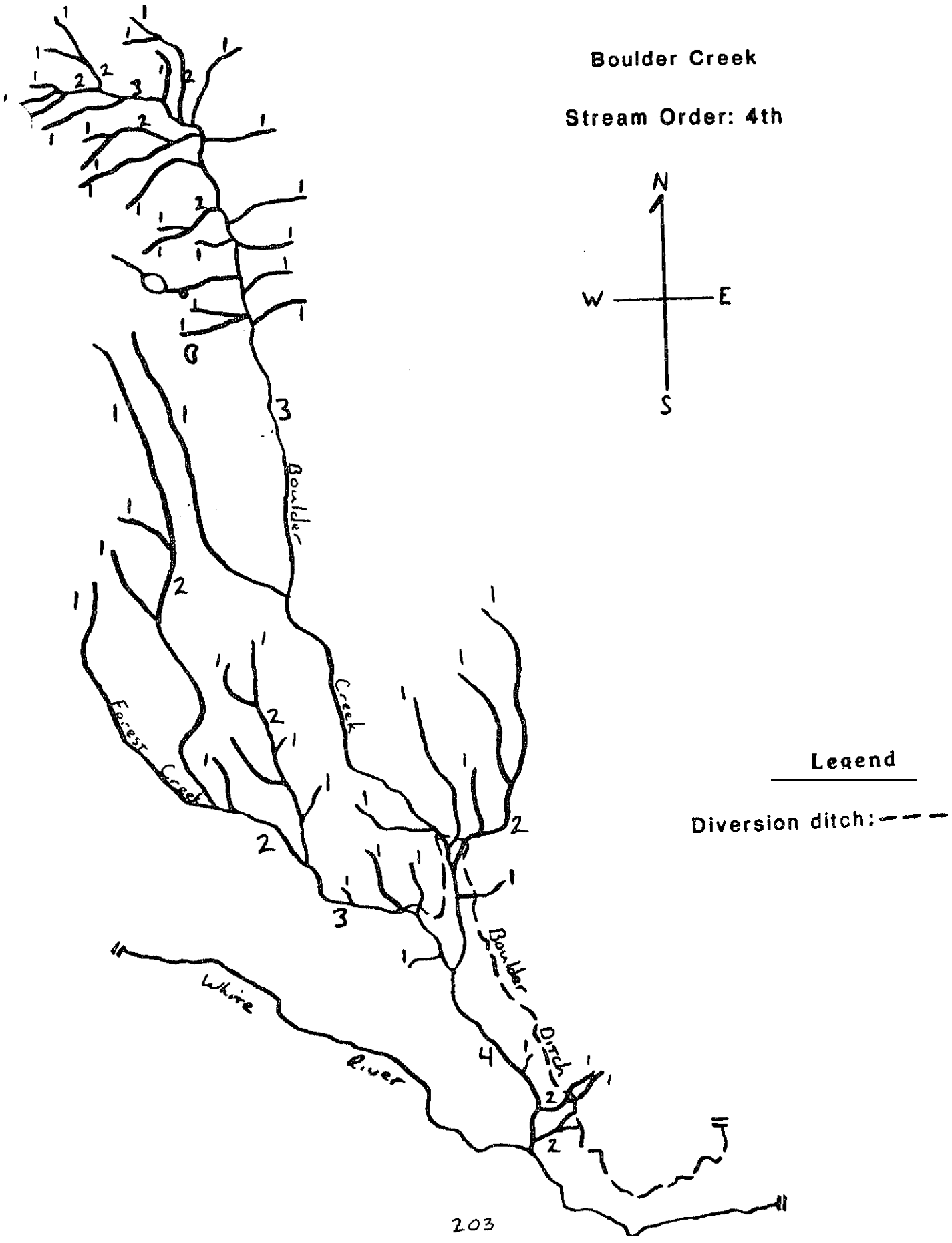


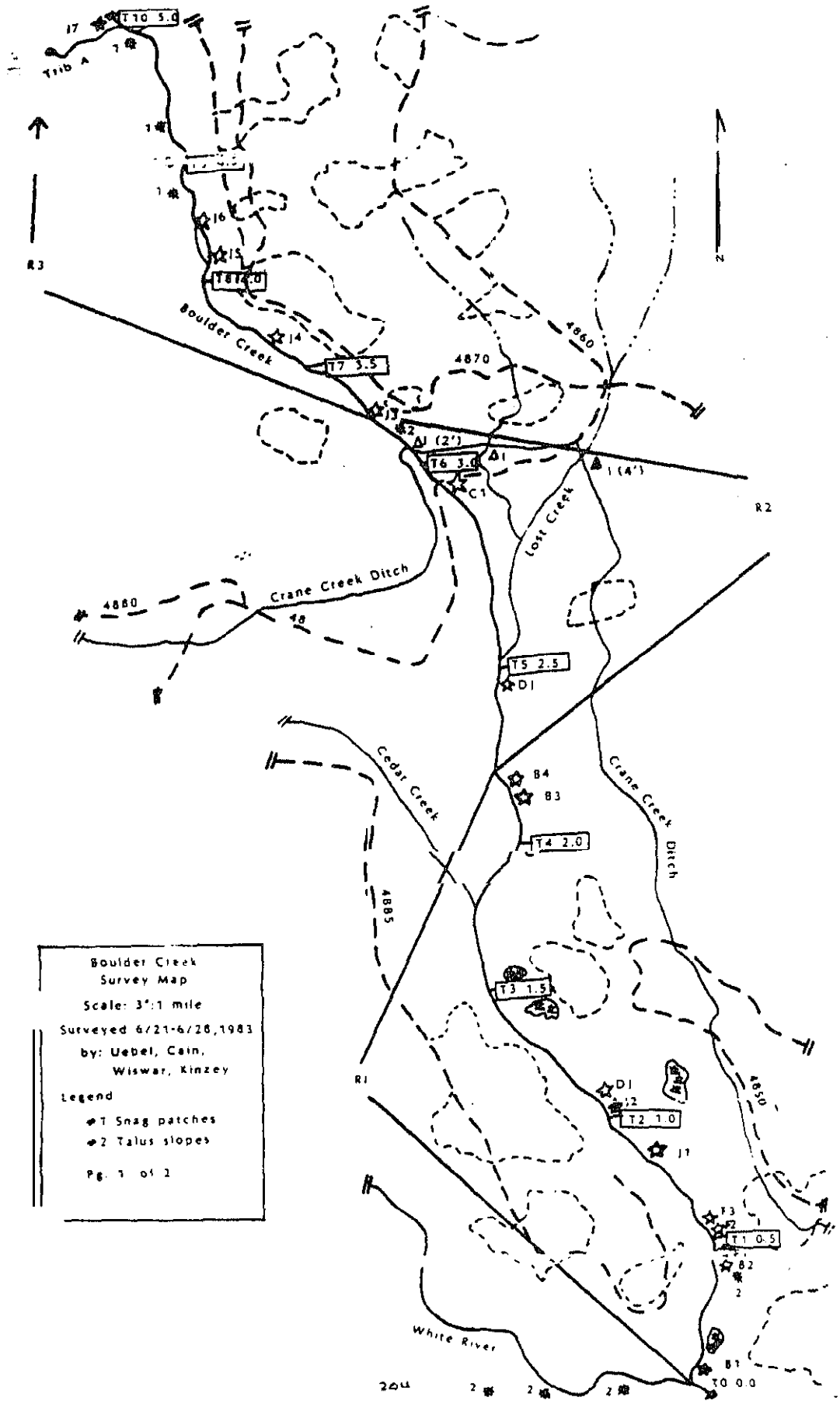
Channel braiding and active meandering are common in Reach TV and are highly influenced by LWD. Excellent spawning and rearing conditions are present in most off-channel areas. Small and Largespringlines are also common in the reach.

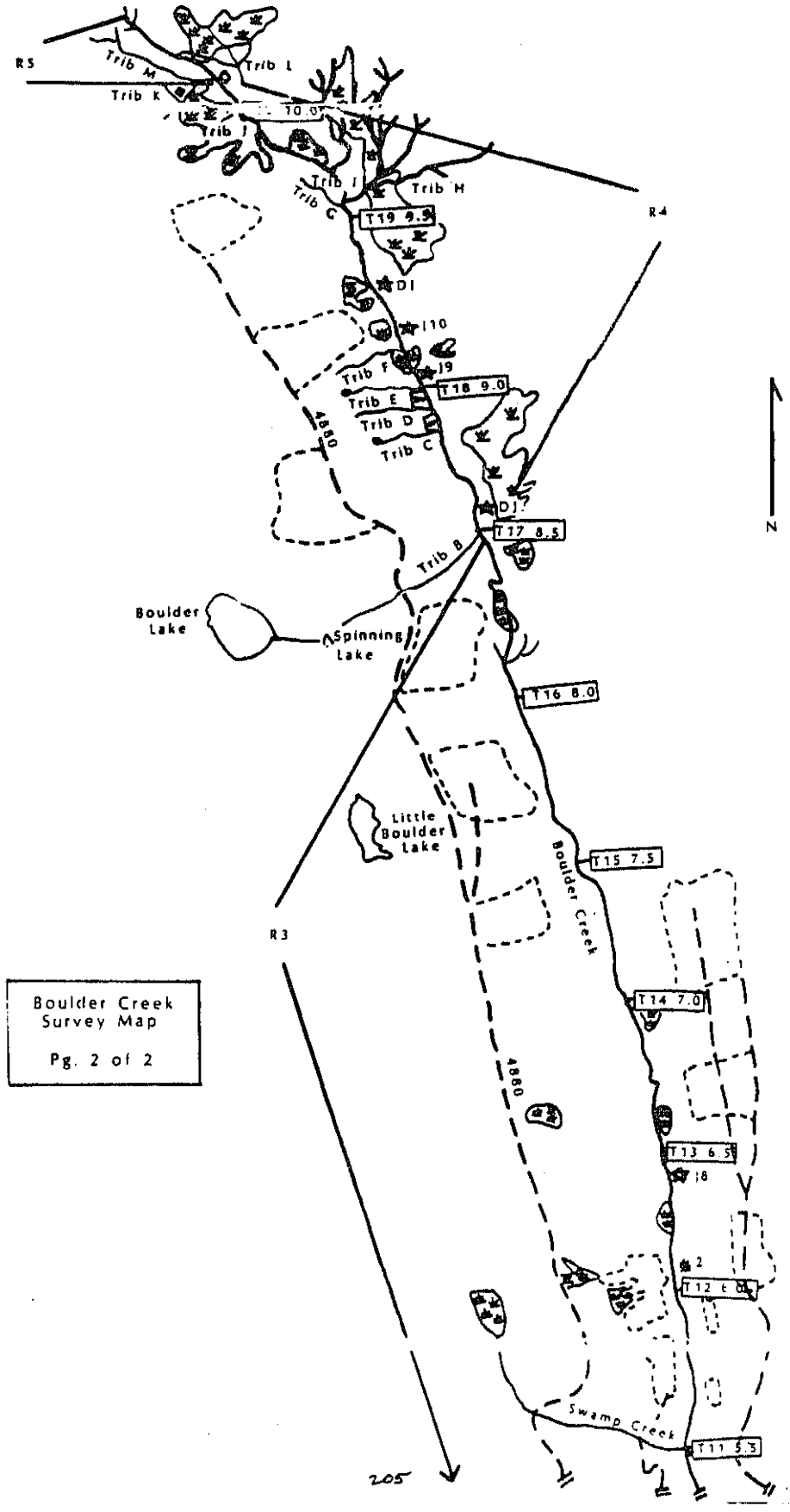


This is a typical view (RM 9.21 of the very high quality fish habitat available throughout Reach IV (RM 8.5 - 10.31. Both pool and spawning habitat development are highly dependent on LWD structure (80 - 90%) In this reach. In the headwater area above (Reach V, RM 10.3 - 11.0), the gradient increases 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 he very heavv. Open meadows of IO-20 acres such as this one at RM 10.0 (shown) are common in thls upper third of the drainage.


Boulder Creek
Stream Order: 4th
N
W
E
S
Boulder
Creek
Forest
Creek
White
River
Boulder
Ditch
Legend
Diversion ditch:


Boulder Creek
Survey Map
Scale: 3":1 mile
Surveyed 6/21-6/28,1983
by: Uebel, Cain,
Wiswar, Kinzey
Legend
T Snag patches
2 Talus slopes
Pg. 1 of 2
Trib A
Boulder Creek
Crane Creek Ditch
Lost Creek
Cedar Creek
White River
R3
R2
R1
N
4860
4870
4880
4885
4850
T10 5.0
T8 2.0
T7 3.5
T6 3.0
T5 2.5
T4 2.0
T3 1.5
T2 1.0
T1 0.5
T0 0.0
A1 (2')
A1 (4')
C1
D1
B4
B3
B2
B1
J1
J2
J3
I7
I6
I5
I4
I3
I2
I1



Boulder Creek
Survey Map

Pg. 2 of 2

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

$R_{I,II,III}$ REACH I and SECTION

Tl 1.0 TRANSECT # and RIVERMILE

OBSTRUCTION BARRIER

J1,2,3, JAN and #

)1,2,3 FALLS, HEIGHT, and I

C1,2,3 CULVERT and I

B1,2,3 CHUTE and #

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

MINE or ROCK PIT SITE

BRIDGE

LANDSLIDE, SLUMP

DEBRIS TORRENT YRACK

SPRING

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

BANK EROSION (EXTENSIVE/SEVERE)

I,2.3, :MISCELLANDOUS

WETLAND HABITAT

S-47 ROAD AND ID NUMBER

EARTHFLW

FOREST CREEK

BARLOW RANGER DISTRICT

Surveyors: Jeff Uehel
Tommy Cain

Countv: Wasco

Mouth Location: T.4S., R.10E., Sec. 35

Dates Surveyed Julv 7-8, 1981

Watershed Area: 5.6 sq. miles
3614 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 Trih. C

TRI Compartments: Echo. 1601
Forest, 1607
-Immigrant, 1603

Low Flow Width (AVg.): 8.0 ft.

Stream Order: 3rd

Game Fish: Rainbow Trout

Potential Anadromous Species: Coho
Steelhead

Average Fish Habitat Condition Rating: 6.0 (Fair)

Average Riparian Condition Rating: 6.2 (High)

FOREST CREEK

Survev Summary

A. Stream Summary

Forest Creek (Previously known as Cedar Creek) is the larqest tributarv svstem of Boulder Creek, contrihutinq approximately 70% (2 cfs) of the flow at their confluence (RM 1.7 of Boulder Cr.\. Over 90% of Forest Creek's flow (6 cfs) is diverted at RM I.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 portlon (approx. 160 ac.) Is privatelv-owned. The Old Barlow Road. Forest Service road S48 and a logqinq spur road cross the stream at RM 0.5, 1.3, and 2.3 respecitvely. Forest Service road S4885 parallels the first mile of stream along.the south side. A total of 3.5 miles, encompassing the mainstem and tiibutaries B and c, were surveved Julv 7-B. 1983. Rainbow trout were observed in moderate numbers from the mouth to RM 2.0.

B. Watershed Characteritics

The basin is a shallow, southeast facing bowl. The valley drainage appears primarily subsurface with onlv a few well-developed surface tributaries observed. Sprinqlines and seeps within 100 feet of the stream margin are the major source of low flows. The tributaries that are present are typically small (< I cfs)., first order streams. Yhe hiqh level of subsurface flows and spring activity results In a verv well regulated mainstem flow reqime. This reduces the stream's sediment flushing capacity and lowers the qualitv of soawninq gravels and bottom composition due to fine sediment deposition. The qradient is low (2-3%) to RM l.K and increases to 4-5% above this point.

C. Geomorphology

The valley configuration is a flat bottom "V" with the vallev floor ranging between 100-700 feet wide. The basin is filled with hiqhlv permeable galcial till deposits, which is likelv responsible for the high deqree subsurface flows. The floodplain width is quite variahle: Reach I, 70-120 feet; Reach II, 120-200 feet; and Reach 111, 30 feet. The sideslooes are moderate (31-50% gradient\ and appear predominantly stable. The drainage has been extensively logged, and this has contributed to some windthrow prohlems where ooeninq of the canopy has occurred in or adjacent to wetlands and/or areas with a hiqh water table (particularly RM 0.0-0.3).

0. Reach Description

Reach I 'RF! 0.0 - 1.6) comprising 50% of the sruveyed mainstem, is low gradient (2-3%) and pool dominated (60%). Reaches II (RM 1.6 to 2.4) and (II (RM 7.4 to 2.9) are higher gradient (4-5%) and riffle dominated. The flow in Reach II (5 cfs) is more than twice that observed in Reaches : or III. Larqe woodv dehris (LWD) is the dominant structural element in the channel in all three reaches.

E. Fisheries

Moderate numbers of rainbow trout (possibly a redband subspecies1 were observed through RM 2.0. The habitat apoears suitable for coho salmon and winter steelhead to RM 2.4. The overall fish Hahitat 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") hut have high cover provided by LWD.

Spawning habitat is scarce and patchy in distribution with 50% of the stream total of 290 sq. yds. of qravel rated as marainal. Nearlv 75% of the good quality spawning habitat is located in Reach I. Hiqh levels of fine sediments were observed in the gravels of Reach I. Fiftv-percent of the gravels are of a size class suitahle for potential anadromous utilization.

Limiting factors apoear to include passage barriers (culverts at R.M. 1.3 and 2.3, and a diversion dam at R.M. 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, mav limit fish production.

F. Riparian Area

The overall Riparian Condition Rating is high (RCR = 6.21. Positive factors influencing this score include the numerous wetland areas along the stream, the even distribution of 4-5 hahitat units and a generally wide (100-200 ft.1 vallev 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. Sang patches are widelv distributed on the stream.

6. Rehabilitation and Enhancement

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

H. Special Interest

Special interest areas include the Old Barlow Road crossing (RM 0.5), the water diversion dam (D_1, RM 1.61, and the verv large springliine area, present at RM 2.1-2.4.

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Reach Summary

Reach I - (RM 0.0-1.6):

1. The vallev configuration is a faltbottom "V" with an average floodplain width of 80 feet.

2. The qradient is low 2-3%.

3. Riffle substrate composition is predominantlv sediment/gravel mix, with 75% of the materials less than 6" in diameter.

4. Pools comprise 60% of the stream area and are larqelv dependent on LWD (70%).

5. Stream shading averaqes 80% and is provided hv a coniferous overstory.

0. Two higher gradient (5%) atvpical sections between RM 0.0-0.1 and RM 1.0-1.3 are rlffle dominated (80%); the latter section also has low shadina (50%), and a predominantlv deciduous overstorv. These sections are primarilv boulder controlled. A 25 year-old clearcut alonq RM 1.0-1.3 has been slow to revegetate resultina in reduced shading and LWD input. A recent oartial-cut adiacent to wetlands along RM 0.1-0.2 appears to have noticeably accelerated windthrow in the riparian area.

Reach 11 - (RM 1.6-2.4):

1. The vallev configuration remains a flatbottom "V" and the floodplain increases' in width (120-200 feet).

2. The gradient increases to 4-5%.

3. The riffle substrate decreases in size (fine sediment dominated) with 95% of the materials less than 6" in diameter.

4. The stream area becomes riffle dominated (80%).

5. Stream shading increases to 90%.

6. An atvpical section similar to those observed in Reach I is peresent (RM 2.2-2.3): riffle dominated (90%), low shading boulder controlled, and a reduced overstorv due to a clearcut.

Reach III - (RM 2.4-2.9):

1. The vallev configuration is a flathottom "V" with a 30 foot wide floodplain.

2. The gradient is similar to Reach II (5%).

3. All of the riffle substrate is less than 6" in diameter with small qravels and sand composing 90%.

4. The stream area is riffle dominated (70%).

5. Stream shading remains high (95%).

6. Flaw is qreatlv 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% of the stream area. Pools are typically small (4 sq. yds.). shallow (less than 12"), with high effective cover from LWD. High qualitv pools suitable for adult anadromous holding are verv limited throughout the reach.

3. Spawning habitat is fair to good. with 210 sq. vards present; and fift,v percent of the gravels were rated maringla In quality. Flftv-five percent of the gravels are of a size class suitable for anadromous species.

4. Numerous debris dams are present and are partial barriers to anadromous fish passage (see survey map). Passage Is blocked at culvert C_1, (RM 1.3) and a diversion dam D_1, (RM 1.6).

Reach II - (RM 1.6-2.4):

1. The habltat 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% of the stream area. The pools are smaller (2 sq. yds.) than the previous reach, and depths are predominantly less than 12". Effective cover is high due to LWD. Few holding pools were observed. Rearing hahitat is dominated by small runs and glides among the heavv debris loading present.

3. Spawning habitat is poor with decreases in qravel abundance (68 sq. yds.) and the percentage suitable for anadromous fish (50% of the qravels are less than 1 in. diameter.) Fiftv percent of the gravels present were rated good quality.

4. Culvert C_2 (RM 2.3) is a velocity and jump harrier.

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 oools (1 so. yd.). Depths are similar to Reach II. The stream is riffle dominated (70%). No holding pools are present.

3. Spawning habitat is very poor. A total of 14 sq. yds. of gravels were counted; 50% were rated good, and onlv 10% were suitable for anadromous species.

A. Numerous small debris lams and root tangles restrict low flow passage.

Trib. B: (RM 0.0-0.8):

1. Fair to good trout hahitat is present. The hahitat appears fair for steelhead, with pools pereominantly small (1-2 sq. yds.) and shallow.

2. Abundant LWO input provides hiqh levels of channel structure and high effective cover.

3. The flow was estimated at 1.5 cfs.

4. Gradient was 2%. and P:R = 4:6.

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Riparian Summary

Riparian development on Forest Creek is heavliy influenced by the extremelv well-regulated flows present.The flow regulation is a result of both natural and man-made features. Deep qlaclal 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 drv periods in a large springline area (RM 2.1-2.41. Surface soil and subsoil horizons appear very premeable 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% of the flows at that point (6 cfs), not only lowering the amount of flowing water downstream, hut aqain 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 ahundant spring activitv in the area result In extensive wetland development (50% 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 activitv and light (dense coniferous canopy) limit the riparian development in Reaches I and III. Habitat diversitv could likel,v be increased in those reaches throuqh some selective patch cutting and/or burning to create small ooeninqs (1-2 acres) near the stream or wetland areas. Care should he taken to select windfirm stands for treatment; heavy windthrow in and alonq a wetland at RM 0.3 (west hank) appears to he associated with an adjacent clearcut.

Reach I; RM 0.0 - 1.6:

1. The riparian habitat is rated moderate (RCR = 5.61.

2. The vallev 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: shruh, oole, small and large saw-timber.

4. Overstory was composed of four conifer species: cedar, hemlock, qrand and Douqlas-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 - 0.14).

Reach 11 - (RM 1.6-2.4):

1. Riparian habitat is rated high qualftv (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 7.1. A large sprinqline on hoth hanks (predominantly in a clearcut on the north bank) from RM 2.1-7.4 contributes approximatelv 5 cfs to Forest Creek. Wetland development is extensive In this area.

6. Tributarv B is a major tributarv (1.6 cfs) to Forest Creek at RM 1.8. Riparian hahitat diversity is moderate due to heavy shadinq by the coniferous overstorv (95%) Understory qroundcover and shrub development is verv low. Several larae old cottonwoods were observed (two felled by heavers about Z-3 years ago).

Reach III - (RM 2.4-2.9):

1. Riparian hahitat is rated hiqh aualitv (RCR = 6.7).

7. Vallev configuration is a wide flatbottom "V" (30-foot wide floodolain, vallev bottom q 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.

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Rehabilitation and Enhancement Summary

Passaqe Enhancement: RM 1.3, 1.6. 7.3:

Three passage barriers are present, the lowest occurring at culvert C_1 (RM 1.3) which restricts access to 1.1 miles of potential anadromous fish A diversion dam (D_1, RM 1.6) and another culvert (C_2, 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 he accomplished using hand tools.

Rearinq Pool and Spawning Hahitat Enhancement; RM 1.6 - 2.g:

Pool size and depth are low In Reaches II and III. Boulder berms or utilizinq the abundant local LWD for log sills could improve pool scour and raise the levels of the existlng pools. These structures could also capture gravels to provide additional spawning habitat in these areas.

Riparian Diversitv Enhancement; RM 0.0 - 1.6, 2.4 - ?.q:

A predominatlv coniferous overstorv exists along most of the stream, especially within Reaches I and III. Openinq up the canoov by small (1- acre) selective patch cuts or burnlnq to increase light oenetration to the understorv could stimulate deciduous revegatation. Cottonwood planting would greatly benefit the riparian habitat, and could be established by planting seedlings In areas with opened canopies and disturbed soils.

Campqround Rehab/Enhancement; RM 0.4

Forest Creek Campground (RM 0.4) is a high recreational use area. Terrestrial and aquatic habitats have been heavilv 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 suitahle 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 dralnage.

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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 (0.0-1.6)	6.1	80	6:4	2	L	3	H	0	*	15	40	25	10	5
II (1.6-2.4)	6.4	90	2:B	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 aradient (%)
- d: Average maximum depth (L < 12", M = 12 - 29". H > 30")
- A: Averaae pool area (sq. yards)
- EC: Effective cover (L < 40%, M = 40-60%, H > 60%)
- BR: Bedrock
- SD: Sand
- 0: Average depth (inches)
- *: Present, hut less than 5%

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TABLE 11 - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT.

Species	REACH I	REACH II	REACH III	Tributaries
Rainbow Trout	M	[illegible]	*	M

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

* = habitat suitable; presence reported but not observed.
( )= hahitat suitahle; mav not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

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

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TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	IO #	PASSABLE	RECOMMENDATIONS*
0.0-2.4	Debris jams	None	P	Partial Removal
1.3	Culvert	C_1	N	Develop jump pool and install baffles.
1.6	Diversion dam	D_1	N	Increase flow over dam, develop jump pool, and screen diversion ditch.
2.3	Culvert	C_2	N	None; low priority for enhancement.

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

* Refer to special case form for barrier characteristics.

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TABLE v - ANADROMOUS HABITAT SUMMARY

Reach (RM)		Miles Avail.	Miles Pot.	Rearing P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
I	(0.0-1.6)	1.3	0.3	6:4	3	1	89	27	None
II	(1.6-2.4)	0	0.8	7:R	7	1	27	7	Potential anadromous habitat ends at RM 2.4
III	(2.4-2.9)	0	0.0	3:7	1	1			None
	Total	1.3	1.1				l - & 3 - t -		

-: Avail.: Miles of hahitat presentlv accessible to anadromous fish if introduced.

Pot.: Additional miles of habitat potentiallv available with complete passage enhancement.

P:R: Ratio of pool area:riffle area.

Area: Average pool area (sq. vds.).

Depth: Average pool depth (ft.).

Spawning: Numher of sq. yds. of gravels observed in the l"-3" and 3"-6" size classes.

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TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	SP. GRAVELS Total (%)	SP. GRAVELS HO (%)	POOL Total (%)	POOL HO (%)	LWD CHARACTERISTICS OR	#	L	Dia	Source
I (0.0-1.6)	85	85	100	100	Var	S-M	7	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	7	1	L

LEGEND: Total = % of total hahitat area dependant on LWO
HO = % ofhiqh quality habitat area dependent on LWD
OR = angle of orientation to flow; perp = perpendicular, var = variable
# = number of logs/structure; S = sinqle loq, M = multi-lop
L = average lenqth of logs, expressed in channel widths
Dia = diameter of average logs in feet.
Source: L = local
T = transported
M = mixture of local and transported

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

Reach (R.M.)		SUMMER W	SUMMER d	SUMMER V	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
I	(0.0-1.6)	6	.4	.8	7	I!	.9	70-120
II	(1.6-2.4)	15	.33	1	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)
- Velocity (feet/second)
i - Average reach flow in cubic feet/second

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TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH	(R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/H_2O TEMP. °F A/W	A/W	TIME
I	(0.0-1.6)	7/7/83	5	80	SE	52/45	-54/45	1300-1630
II	(1.6-2.4)	7/7-8/83	1.5	90	SE	49/40		1830
III	(2.4-2.9)	7/8/83		95	SE	49/41		1015

FOREST CREEK

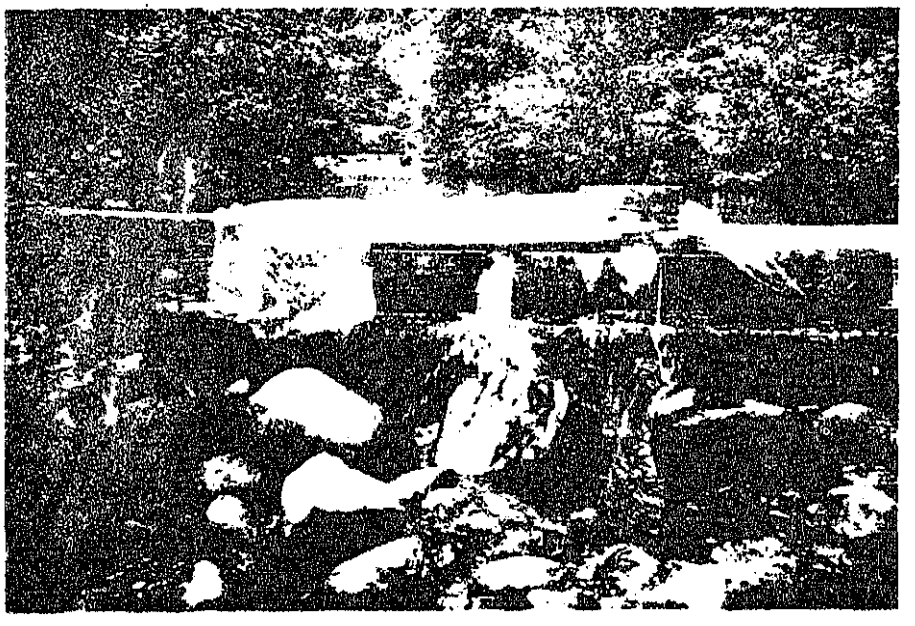
TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY	VEGETATION				AQUATIC			
		F.P. (ft.)	H.U.	Overstory Con	Dec	Stream-class	Wetland %	Size	Sp. Hahitat Units
I (0.0-1.6)	5.8	70-120	A	A	0	I I	25	S	I
II (1.6-2.4)	6.8	170-200	5	4	0	II	50	S	2
III (2.4-2.9)	6.7	304		6	0	II	30	S	2

LEGEND: RCR: Riparian Condition Ratinq
F.P.: Floodplain
H.U.: # Habitat Units (H a 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 - acre)
L = Large (greater than 1 acre)

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.

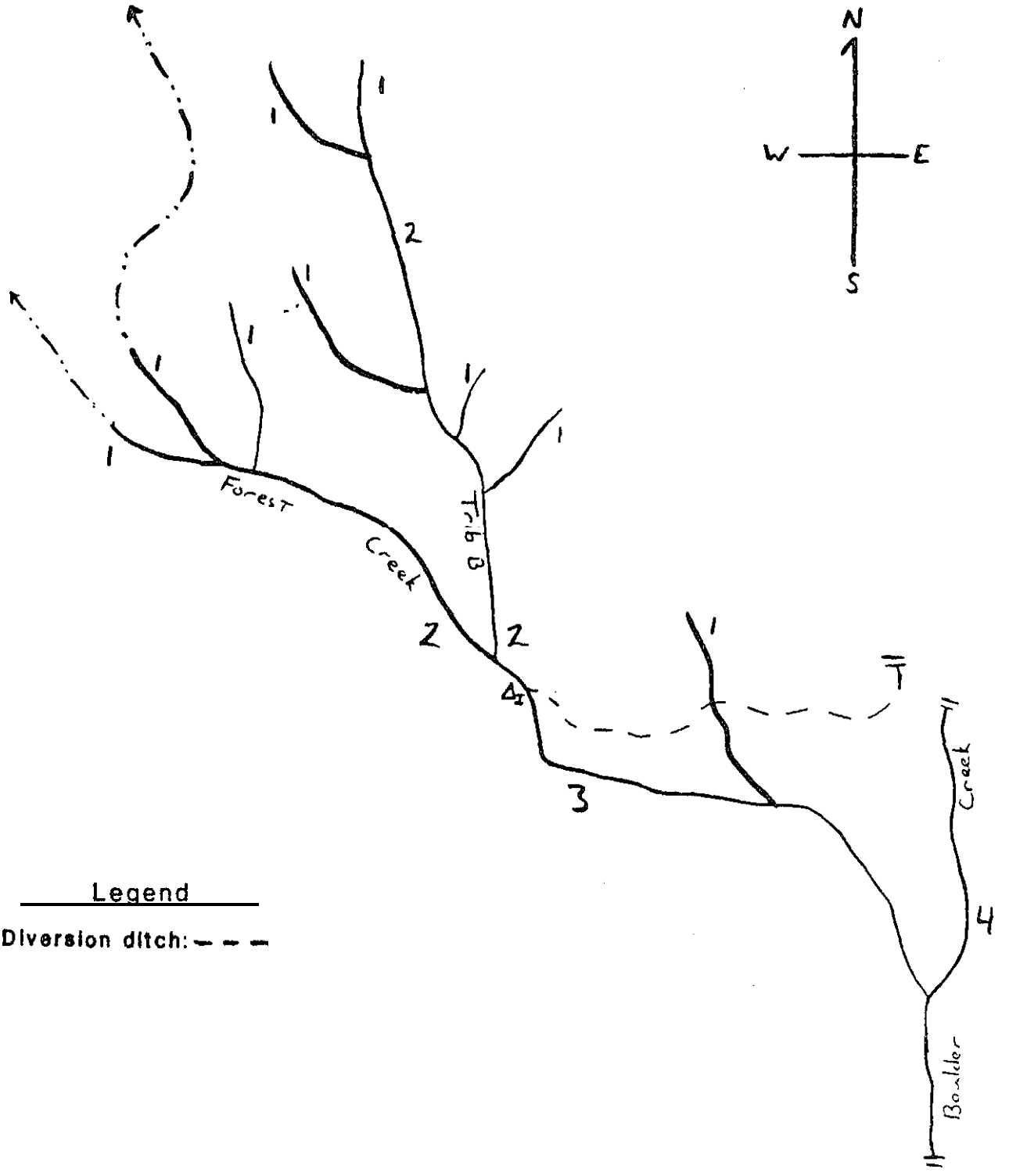
LWD is the major structural component in the Forest Creek channel. Ninety percent of the high quality pools and spawning gravels are dependent on LM. However, debris loading in some areas Is so heavy that it mav block migration (see survey map). Well-regulated flows combined with heavy debris loading 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_1, downstream at RM 1.3. is also a complete barrier. Developing jump pools below these structures would aid fish passage to 1.9 miles of fair to good habitat for steelhead and coho (baffling the culvert would also likely be required). Abut 90% of the flow (6 cfs) is diverted here for irrigation purposes. The lowered flows below this point limit fish and riparian habitat development.

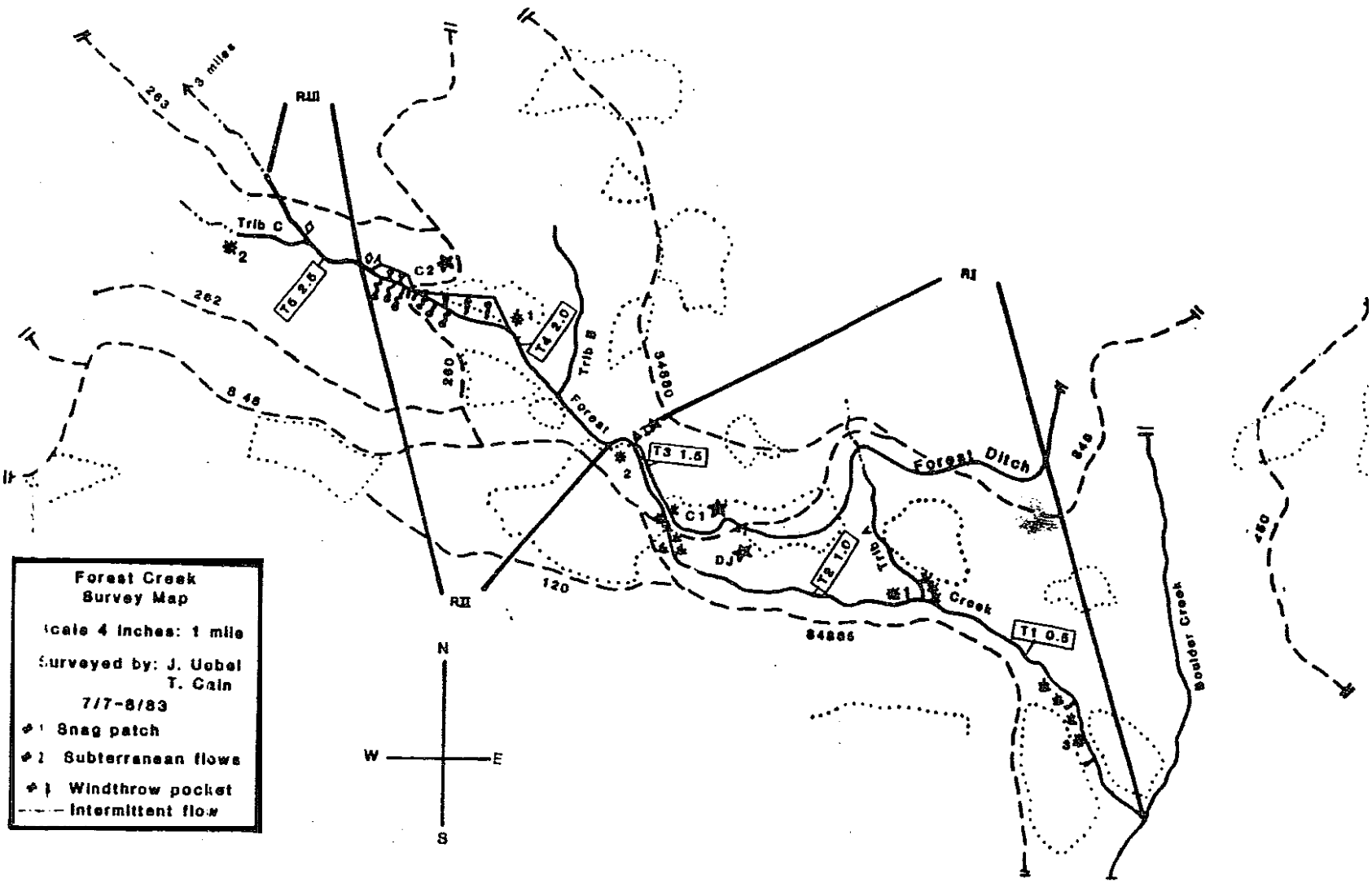
A large springline issues from the valley sideslopes in several partial and clearcut units. RM 2.1-2.4. Approximately 5 cfs is added to the stream at this point. The high amount of groundwater recruitment on Forest Creek contributes to a very well regulated flow regime and cold low flow water Temepratures f41oF). Temperature may be limiting fish production, particularly in the upper reaches.

Forest Creek
Stream Order: 3d



Legend

Diversion ditch: — — —


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
N
S
W
E
RIII
RII
RI
Trib C
Trib B
Forest
Forest Ditch
Trib A
Creek
Boulder Creek
T6 2.5
T4 2.0
T3 1.5
T2 1.0
T1 0.5
C2
C1
DJ
3 miles
263
262
260
120
84880
84885
248
250

- STREAM SURVEY MAP SYMOLS -

CLEAR CUT BOUNDARY

$R_{I,II,III}$ REACH I and SECTION

T_1 1.0 TRANSECT I and RIVERMILE

OBSTRUCTION BARRIER

J1,2,3, JAN and #
F( )1,2,3 FALLS, HEIGHT, and #
C1,2,3 CULVERT and I
B1,2,3 CHUTE and I

DIVERSION STRUCTURE (I = water is used for irrigation purposes1

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

S-47 ROAD AND ID NUMBER

EARTHFLOW

WHITE RIVER

Bear Sorinos and Barlow Ranqer Districts

Surveyors: Jeff Uebel, David Wiswar.
Tom Cain, Doug Kinzey

Countv: Hood River
Wasco

Dates Surveved: October 12-13 and 18-19, 1983

mouth Location:
T4S, R14E, Sec. 9
.

Tributarv to: Deschutes River

Watershed Area:
235,520 acres
368 square miles

TRI Compartments:
Immigrant 1603
McCubbin 210'
Camas 2103
Rimrock 3104
Bonnev 2201
Iron 2202
Grindstone 2203
Sand 9220

Stream Length: 48.9 miles

Distance Surveved:
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 (Fiar)
Mineral Creek: 5.3 (Fair)

Average Riparian Condition Ratinq: White River Mainstem: 7.5 (High)
Mineral Crek: 6.9 (High)

WHITE RIVER

Survey Summary

A. Stream Summary

White Rlver is a maior tributary to the Deschutes River. The confluence is located aporoximatelv 3 miles below Maupin (About RM 471. 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 hv chinook and steelhead below a series of three large impassable falls (140 ft. total1 located 7 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 drainaae area is 235,570 acres. with rouqhlv the upper 70 % located on National Forest System land (the National Forest boundarv crosses White River at RM 25.1) The remainder lies on DDFW. BLM. Warm Springs Indian Reservation and private land holdinqs. The maiinstem is 49 miles lonq, originating in a galcier near the summit of Mt. Hood. Road access to the mainstem is relativelv poor on Mt. Hood National Forest, with stream crossings limited to road 3530 (RM 34.01. 43 (RM 36.5), and Hiqhwav 35 (RM 44.51. Primitive roads 4885 (RM 29.81 and 3530011 (RM 40.51 have low water fords that provide additional access sites.

A total of 73.5 miles was surveyed during the period October 12-19, 1983. This total includes 3 miles of Mineral Creek and 0.2 miles of Deep Creek.

8. Watershed Characteristics and Geomorphology

White River originates in the White River Glacier on the south side of Mt. Hood. It flows throuqh old mudflow and glacial outwash deposits for much of Its length on the National Forest. The stream appears most turhid in summer flows, while hiqhest flows are apoarentlv associated with snowmelt in late winter and spring. It has hiqh sediment loadino and a flashv flow regime. The aspect changes from southeast to east to northeast before flowing into the Deschutes River.

The valley configuration in the lower survev 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 suhstrate composition is predominantly boulder. Two major trihutaries are located in this reach. Boulder Creek (confluence RM 29.01 provides about 5 % of low flows (5 cfsl and clear Creek (entering at RM 29.8) provides approximatelv one-third of low flows (20 cfs) to White River at their confluences.

Above RM 32.6. the vallev configuration changes significanly. The floodplain widens into a broad, glaciated U-shaped vallev. 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 43.1) and Mineral Creek provides about 15 % (5 cfs) at its confluence (RM 40.4). Barlow Creek (RM 36.71 is another major stream flowing into White River in thls upper section. It provides approximately 15 % (7 cfs) of the flow to White River.

C. Reach Descriptions

Five reaches were dellneated on White River, distinguished primarily by vallev configuration, qradient and channel stabilitv. Reach I (RM 25.0-32.6) lies in the White River gorge, a deep (1000 ft.), steep-sided (70-100%) canyon with very low flood-plain development. The channel maintains a consistent 2-3 % gradient, is sharply entrenched hetween the talus sideslopes and is very stahle.

The reaches lying above are located in the very wide (1,000-2,000 ft.) flat valley bottom of glacial outwahs and mudflows The channels of reaches II-v are very transitorv; the sandy/rubble banks and channel combined with the lack of large channel or bank structural components contribute to hiqhlv active meander and very low pool develoament (10 % of the stream area). Relativelv high aradient (4-6 %) 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 virtuallv the entire lenqth 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 II (RM 32.6-40.4) has a very wide (60 ft.), shallow channel and low qradient (2 %); 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 %; Reach IV (RM 43.1-44.6) is a hiqh gradient (6 %) 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, sliqhtly entrenched in the wide, open sandy flats of the qlacier's outwash plain.

D. Fisheries

Fish habitat on the mainstem is rated poor overall '4.5 HCR), Hahitat qualitv is substantially lowered bv the extremelv hiqh sand and fine sedimnt'loadinq present during low summer and fall flows. This material is continuously movlnq downstream both in suspension or as bedload. Heavv temporarv deposition occurs in all slack water areas, and pool volume is decreased by 50 to 75 % Pools average 8 square vards and 1.5 feet deep. Spawning gravels were virutally non-existant in the mainstem (300 square vards in 70 miles), likely covered bv 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 henefits pool habitat quality and gravel cleaning. Mainstem habitat conditions, therefore, appear to favor winter and early sorina spawning fish stocks.

Accessible major tributary systems are likely very important in providing high quality spawning and rearing habitat during the turhid period of summer and fall. Over 100 miles of potential anadromous habitat are present on these streams. In the upper basin, Boulder, Clear, and Barlow Creeks contain over 40 miles of high quality habitat, although minor passage harriers currently restrict passage from the mainstem of White River to over half of these miles. Iron and Mineral Creek svstems are the uppermost major fish-bearinq tributaries in the basin, containing abut 3 accessible miles of fair quality habitat each. Other upper basin tributaries with salmonid habitat accessible from mainstem include Bonnev (1 mile) and Buck II mile) Creeks. Please refer to survey reports for details on all trihutarv svstems in the drainage.

Juvenile resident trout were observed along mainstem stream margins in low to moderate numbers throughout the survev area up to RM 45.3 (3 miles below the glacier). Ve-v poor visibilitv due to high turbidity precluded observation of adult trout. (Two adult rainbow trout were caught at RM 2P.0 in July.) Potential anadromous utilization of the svstem is limited hv the two 6-foot tall impassable chute/falls at RM 31.8. A total of 20 miles of potential anadromous habitat'fincluding the mainstem up to RM 43.1 and Barlow, Iron, Mineral. Bonnev and Buck Creeks) lie uostream of these chutes.

E. Riparian Area

The overall Riparian Condition Rating (RCR) for the mainstem of White Giver is high (RCR = 7.5). Positive factors include a high number of habitat units, a diverse coniferous overstorv composition over most of the survev length, presence of deciduous overstorv species, wide floodplain above RM 77.6 and high development of special hahitat units (talus slopes, rock outcrops meadows, wetlands, snag patches, ponds and spring lines). Negative factors are the narrow floodplain (60 ft.1 in the steep-walled canyon below RM 32.6 and low veqetative 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-IV (RM 32.6-45.3). These usuallv occur along trihutarv stramcourses near their confluence with White River 'i.e.. Iron, Mineral, Bonnev. Red and Barlow Creeks). These areas have exceptionally high habitat aualitv and are heavily utilized hv wildlife. White River is also an important migration corridor for hiq 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. Rehahilitation and Enhancement

If passage is provided for anadromous fish at the White River Falls, several priority enhancement projects would he created. Improving passage at the two bedrock chutes at RM 31.8 would allow anadromous utilization of the 20 miles of mainstem and tributarv habitat lying upstream. Mainstem low flow pool rearinq habitat could be imoroved thrughout the survey area, although Reach II (RM 32.6-40.4) appears to be the highest Oriority site.

Riparian hahitat could he enhanced in Reach I (RM 25.0-32.6) by increasing overstorv diversitv through deciduous tree introduction (especially cottonwood), and by increasing browse and foraoe production for wildlife.

6. Special Interest

The White River on Ht. Hood National Forest is currently managed under interim maintenance guidelines while it is being evaluated for inclusion in the Wild and Scenic River svstem. The river has been broken into three sections which have been nominated for different status; the gorge section (roughly Reach II qualifies for "Wild" status, Reaches II through V qualify for "Recreational" status, and the area extending above the highwav 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 vallev from RM 33.5 to 39.0. The remains of a log-carrvlng 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 78.3-79.8. 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 vallev configuration is a flat-bottom, V-shaped canyon with an average floodplain width of 60 feet.

2. The qradient is Tow (2.5 %).

3. The substrate is boulder dominated (55 %), with a hiqh percentage of sand (25 %).

4. The stream surface area is dominated bv riffles (P:R = 2:8).

5. Stream shadina is moderate (70 %).

6. Channel structure is orovided by houlders.

Reach II; RM 32.6-40.4:

1. The width of the White River floodplain begins tn increase Significantly at RM 37.6, where it opens up into a very wide (200 to 1000 ft.), glacial U-shaped vallev.

2. Stream qradient is low (1.5 %).

3. Channel suhstrate material is comprised of glacial outwash and mudflow material of welded andesite tuff. Sand (35 %) and rubhle (20 %) 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 %), due to the verv 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 7.7 miles of the Iron Creek channel.

2. Stream gradient increases slightly to 3 %.

3. Channel substrate is predominantly boulders and rubble (55 %).

4. Riffles dominate the stream surface area (P:R = 2:8).

5. Stream shading remains low (20 %).

6. Channel and bank stahilitv 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 galcial U-shaped vallev. This reach is a relativelv 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 %).

3. Substrate is predominantly rubhle (40 %).

Reach V; RM 44.6-45.3:

1. The floodplain remains very wide in the qlaclal, U-shaped vallev. The stream is actively meandering in this area, and the channel has changed its course often over time.

2. Stream gradient is low (4 %).

3. Rubble continues to dominate (45 %) the substrate materials.

4. Riffles dominate the stream surface area (P:R = 1:9).

5. Stream shading is verv low (less than 5 %).

Tributary

Mineral Creek; RM 0.0-3.0:

1. Mineral Creek flows alona the west side of the White River floodplain. USGS topographic maps from 1964 and aerial photographs (1978) show that White River and the lower 7 miles of Mineral Creek previouslv shared a common channel. Mineral Creek still flows in that channel; however, the mainstem White River has shifted to the east side of the vallev. 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 %).

3. Channel substrate is predominantly rubble (35 %).

4. Pools dominate the stream surface area (P:R = 6:4).

5. Stream side shading Is low (avg. 30 %). Shading is low from RM 0.0-1.75. Above RM 1.75 shading increases to moderate (60 %) 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 visihility from high turbidity and sediment loadinq.

2. Pool rearing habltat is fair. The stream is riffle dominated (P:R = 2:8). Pool size is moderate (avq. 8 sa. yd.) with shallow to moderate depths. Effective cover provided primarilv bv instream boulders is low.

3. Spawninq hahitat is poor. Only 136 sauare yards of spawning qravels were observed. Seventv-five percent of these are marqinal 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 hiqh water line.

4. Two bedrock chutes near RM 31.8 are fish miqration harriers. Thev are located immediatley below the mouth of Deep Creek. The first chute is a partial harrier measuring 15 feet lona with a 35 % gradient. The second chute consists of two slots. The right channel is smaller and choked with woodv dehris. The left channel is narrow (4 ft.) with verv high stream velocity (25 % 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 lop jam at RM 33.3 and in an off-channel pool at RM 34.4.

2. Spawning habitat is poor. Spawninq gravels total 138 square yarda with approximatelv 75 % of those rated marqinal qualitv. Yost of the qravels are in small deoosits (less than 1 square yard) above the mean high water line. Eiqhtv percent of the total qravels are suitable for anadromous salmonids. All spawning qravels observed are between RM 32.6-34.0, larqelv in the sediment plain formed bv a relic jam at RM 32.6.

3. Rearing hahitat is poor. Pool size is moderate (avg. 12 so. yd.) with depths of about one foot. Effective cover is low and is provided by rubble and boulder suhstrate. The pools are found within larger runs where water velocity is approximatley 3 ft./sec. The influence of LWD in pool develoament is very low (5 %). Most of the larqe woodv debris is carried out of the svstem during high flows. Sediment loadinq in the pools Is heavv.

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 survev due to high turhlditv.

2. Rearing hahltat 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 marqins. Effective cover provided bv surface turbulence and instream boulders is moderate to high. The overall influence of LWD is low (10 %). The number of high quality pools in this reach are low; however. 85 % of them are dependent on LWO for their development.

3. Spawning hahitat is poor. Onlv 24 square vards of maringal qualitv gravels were counted. These are in small pockets, with sediment filling the interstices.

* From Iron Creek survev.

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 survev. likely due to poor visihilitv.

7. Rearing hahitat is poor. Pools are small '7 sq. yds.) with shallow depths and low effective cover. Stream velocity is 3-S ft/sec. causing hiqh turbulence in the pools. The influence of LWO in pool development is low (70 %). No high qualitv pools are present in this reach.

3. No spawning qravels 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 Julv 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 qravels 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 he limited by high iron (and other chemical) concentrations that appear to be present.

2. Rearing habltat Is fair to qood. Pool size are moderate (4 sq. yd.) with low to moderate depths and moderate effective cover. The cover is provlded by instream houlders and ruhble and an algal growth at the hase of the pools. The influence of LWD on overall pool development is low (10 %). LWD is, however, important in the formation of high quality pools. Seventv-five % of these pools are associated with larqe 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 hahitat is poor. Only 13 square yards of marainal 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.

WHITE RIVER

Riparian Summary

Reach I; RM X.0-32.6:

1. The riparian hahitat is rated high (RCR = 6.71.

2. The vallev configuration is a narrow, flat-bottom V averaginq 60 feet wide wlth steep sideslopes (greater than.70 Xl. The stream is in a steep walled canyon through most of this reach.

3. All habitat units are well represented: grass-forb, shrub-sapling, poles, small saw timber and larae saw timber.

4. The coniferous overstorv 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 alonq 40 % of the stream, rock outcrops (RM 25.0-29.0), snag patches and small wetlands along 10 % of the stream . Large wetlands occur at RM 28.3 and RM 28.R.

Reach II; RM 32.6-40.4:

1. The ripatian habftat is rated very high (RCR = 8.8).

2. The valley configuration is a verv wide (200 to 1000 ft.1 floodplain in the galcial, U-shaped White River valley.

3. Four habitat units are present: shrub-seedlinq-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 comnon below RM 34.5. Hemlock is rare. Cottonwood is found along the entire riparian corridor. Tag alder thickets are comnon 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 riparlan habitat is rated high (RCR = 7.51.

2. The floodplain is very wide (200 plus ft.), formina a flat-bottom, U-shaped valley. Wetlands are present along 10 % 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 overstorv is more diverse between these areas (RM 41.9-42.71 and is comprised of western hemlock, Engleman spruce, lodqepole 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 (RM 41.9-42.4).

* Data from Iron Creek sruvey.

Reach IV; RM 43.1-44.6:

1. The riparjan hahitat is rated moderate (RCR = 5.71.

2. The valley configuration continues to be very wide.

3. The number of habitat units in this reach decreases to three. Shrubs-seedlings-saplinqs and poles are common and found throughout; areas with small saw timber and/or grass-forhs 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 acres1 is present at RM 43.0.

Reach V; RM 44.6-45.3:

1. The riparian habitat is rated moderate (RCR = 4.21.

2. The valley configuration continues to be very wide.

3. There are only two habitat units in this section: shrubs-seelings-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 hahitat is rated hiqh (RCR = 6.9).

2. Three habitat units are present: shrub-seedling-sapling, poles and small saw timber.

3. Lodgepole pine dominates the coniferous overstorv 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. Taq alder is common along the channel margins.

4. Special habitats include a T-7 acre wetland and snaq patch at RM 7.3, 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 5.5. 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

Passaqe Enhancement; RM 31.8:

If anadromous fish are introduced to the White River system, the hiqhest prioritv 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.1 Passage could be relativelv 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 llkelv require some blasting in the bedrock. Access is remote (¼ mile awavl, and supplies would likely have to be hand carried into this area of the steep-sided gorge.

Rearinq Habitat Enhancement; RM 25.1-43.1:

Pool habitat qualitv throughout the survey area is relativelv poor durinq low flow periods. Hiqh qualitv pool develoament is usuallv associated with large channel structure such as bedrock outcrops. It appears that pool habitat could he improved using verv large boulder fgreater than 4 ft. diameter1 placements either singly, clustered or in V-shaped herms. 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 heavv equipment access is best in Reach II (RM 32.6-40.4) and pool improvement there would likely be highest prioritv. The road access at Keeps Mill (RM 29.81 would also allow heavv equipment work in that area of Reach I. An interpretive displav could also be developed at Keeps Mill and other campgound areas adjacent to White River on fish and wildlife hahitat 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 manv wildlife species. Small patch hurns (l-2 acres1 on the north bank, esoeciallv near seeps and sprinqs, would likely encourage cottonwood regeneration.

Big game browse and non-game forage shrubs are relativelv scarce in Reach I. Due to the high use this reach area receives as a migration corridor for big game, browse enhancement may he warranted. Wildlife plantings around the Keeps Will area may vield some additional benefits hv providinq wildlife viewinq opportunities in the campground area.

The campground and low water ford at Keeps Mill (RM 29.8) have several denuded areas that are slowly erodinq 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. Seeling and planting could he coupled with wildlife forage enhancement (see above) for maximum benefits. This is a low prioritv 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	4
I(25.0-32.6)	5.1	70	2:B	2.5	L-M	B	L	*	55	10	5	5	25	11
II(32.6-40.4)	3.8	10	1:9	2	L-M	12	L	0	20	20	10	15	35	8
III[1/] (40.4-43.1)	5.1	20	2:8	3	M	1	M-H	0	75	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	B
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

11 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 lenth:riffle lenqth
G: Average qradient (%)
d: Average maximum depth (L ≤ 12", M = 12 - 29", H > 30")
A: Average pool area fsq. yards)
EC: Effective cover (L ≤ 40%, M = 40-60%, H ≥ 60%)
BR: Bedrock
so: Sand
D: Average depth (inches)
*: Present, hut less than 5%

WHITE RIVER

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE/100 FT. 1/

species	REACH I	II	III	IV	V	TRIBUTARIES Deep Cr.	Mineral Creek
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 ohserved.
( )= habitat suitahle; mav not he present

1/: Very high turbidity levels in White River (0-0.5 ft. visibilitvl are llkelv responsible for the low numbers of fish ohserved. Population sampling should be conducted to determine the actual fish species and numbers present.

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

Reach (R.M.)	Spawninq Gravel (Sq. Yds.) Total	Good	Marginal
I (25.0-32.6)	136	37	104
II (32.6-40.4)	138	38	100
III (40.4-43.1)*	74	0	24
IV (43.1-44.6)	0	0	0
V (44.6-45.3)	0	0	0
Mineral Creek	13	0	17
TOTAL	311	70	241

1 Data from Iron Creek survev. Julv 7-8 and 11-12, 1983.

WHITE RIVER

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID, #	PASSABLE	RECOMMENDATIONS*
RM 31.8	Bedrock chute	B_1	P	Modify for passage.
RM 31.8	Bedrock chute	B_2	N	Modify for passage.

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

*Refer to special case form for harrier characteristics.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
I(25.0-32.6)	6.7	0.9	2:8	8	2	88	20	
II(32.6-40.4)	0.0	7.8	1:9	12	1	74	35	
III(40.4-43.1)*	0.0	2.7	2:8	1	3	14	5	
			1:9		1		0	
IV(44.6-45.5)	0.0	0.0	1:9	2	1	0	60	
Mineral Creek	0.0	3.0	6:4	4	1	13	0	
TOTAL	6.7	14.4				189	60	

* Data from Iron Creek survey, Julv 7-B and 11-12, 1983.

LEGEND: Avail.: Miles of habitat presentlv 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 - LWO HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HQ (%)	Total (%)	HO (%)	OR	I	L	Oia	Source
I(25.0-32.6)	10	15	1	10	Var.	S-M	1	l-2	M
II(32.6-40.4)	10	10	5	5	Var.	M	1	l-2	T
III(40.4-43.1)*	10	0	10	85	Var.	M	l-2	1-2	M
IV(43.1-44.6)	0	0	20	0	Perp.	S+M	-1	1-?	L
V(44.6-43.5)	0	0	0	0		--	--	--	--
Mineral Creek	0	0	10	75	Pet-p.	S	1	1-2	M

* Data from Iron Creek survev.

LEGEND:
- Total: Percent of total hahitat area dependant on LWO
- HO: Percent of high quality habitat area deoendent on LWO
- OR: Angle of orientation to flow; Peru = perpendicular, Var = variable
- I: Numher of logs/structure; S = single log, M = mulit-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 AN0 HYOROLOGTCAL FEATURES FOR SUMMER AND BANKFULL CONDITIONS

	SUMMER				BANKFULL		
Reach (R.M.)	W	d	v	0	W	D	Floodplain Width (Ft.)
I(25.0-32.6)	25	1.5	2	75	35	2.5	60
II(32.6-40.4)	20	1	3.5	50	25	3.5	200 +
III(40.4-43.1)*	15	1	5	45	20	2	200 +
IV(43.1-44.6)	6	0.8		24			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 survye.

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

WHITE RIVER

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

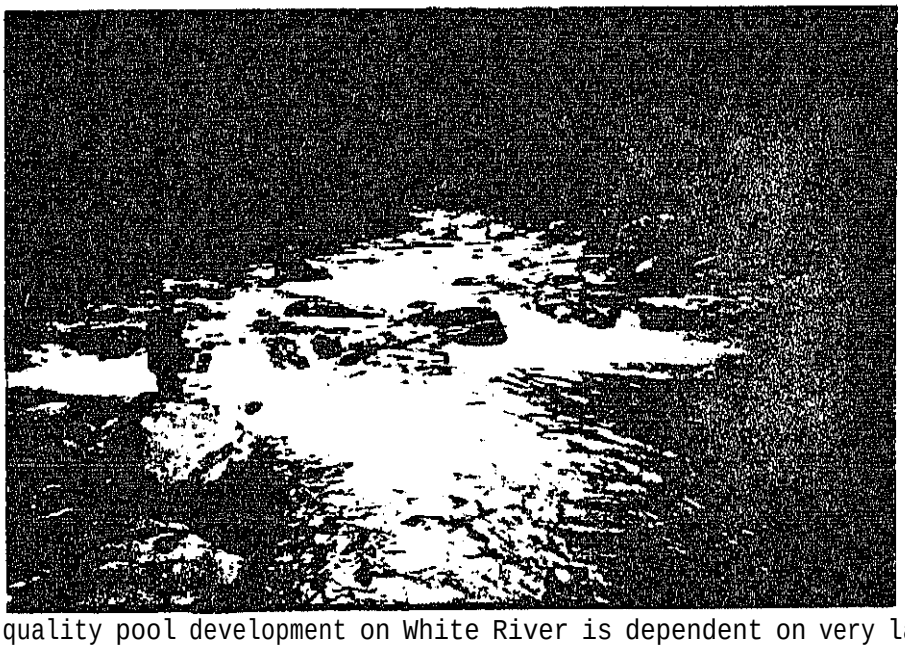
REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP. °F AM	AIR/WATER TEMP. °F PM	TIME
X(25.0-32.61	10/12-19/83	70	70	E	57/47-47/41		1330-1630
II(32.6-40.4)	10/12-19/83	35455	10	S SE	63/50-46/43		1130-1715
III(40.4-43.1)	7/7, 11/83	24	20	SE	54/46-40/46		1145-1645
IV(44.6-45.3)	10/19/83	20	0	SE	49/46	1400-1310	500
Mineral Creek	10/13-19/83	5	30	SE	49/44-41/41		1335-1705

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH (RM)	RCR	VALLEY F.P. (ft)	VEGETATION H.U.	Overstory Con.	Overstory Dec.	AQUATIC Streamclass	Wetland%	Size	Special Habitat
I(25.0-32.6)	6.7	60	5	5		I	L	S	4
II(32.6-40.4)	8.8	200 +	4	4	7	I	L	L, S	4
						II			2
IIV(43.1-44.6)	5.7	200 +	3	2	0	II	L	S	1
V(44.6-45.3)	4.2	200 +	2	3	1	II		-	0
Mineral Creek	6.9	200 +	4				II	L, S	2

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

Reach I (RM 25-32.6) lies In the deep. steep-sieded White River gorge. Floodplain developmetn is verv 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 smal'1 wetland/springs are Special habitats commnly found in the reach. This large springline area at RM 28.8 has been heavilv 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 25-32.6) but very rare in the upstream reaches. Much of the stream's pool volume in summer low flows is filled with temproary deposits of sand and silt. Photo at RM 25.8.

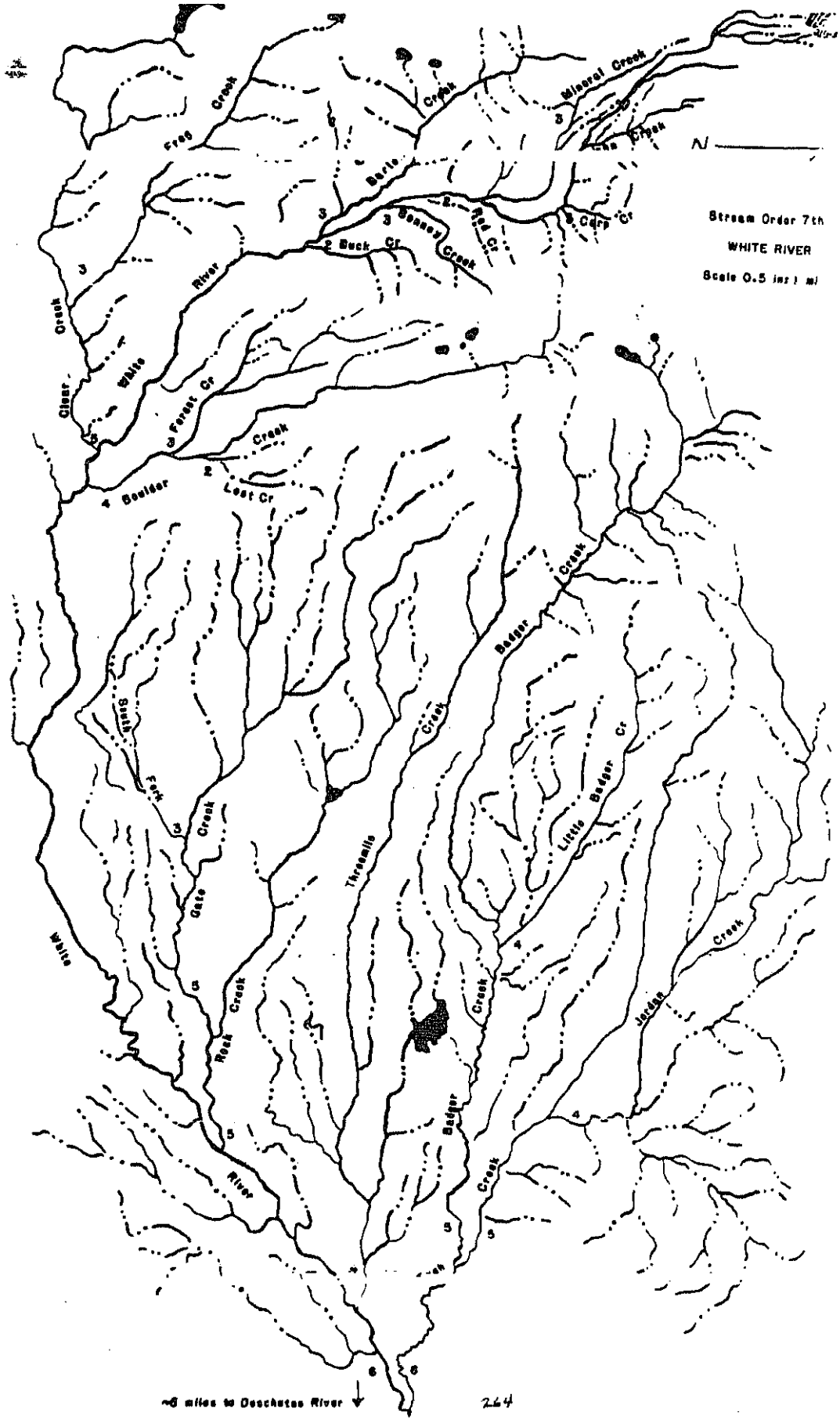
Two 6 foot high chutes block resident and potential anadromous passage at RM 31.8 (upper barrier shown). Twentv miles of fair to good quality tributary and mainstem habitat lie above this ooint. No other migration obstructions were observed on the mainstem survey area (RM 25-45). Passage enhancement Options include jump pool or fishway development.

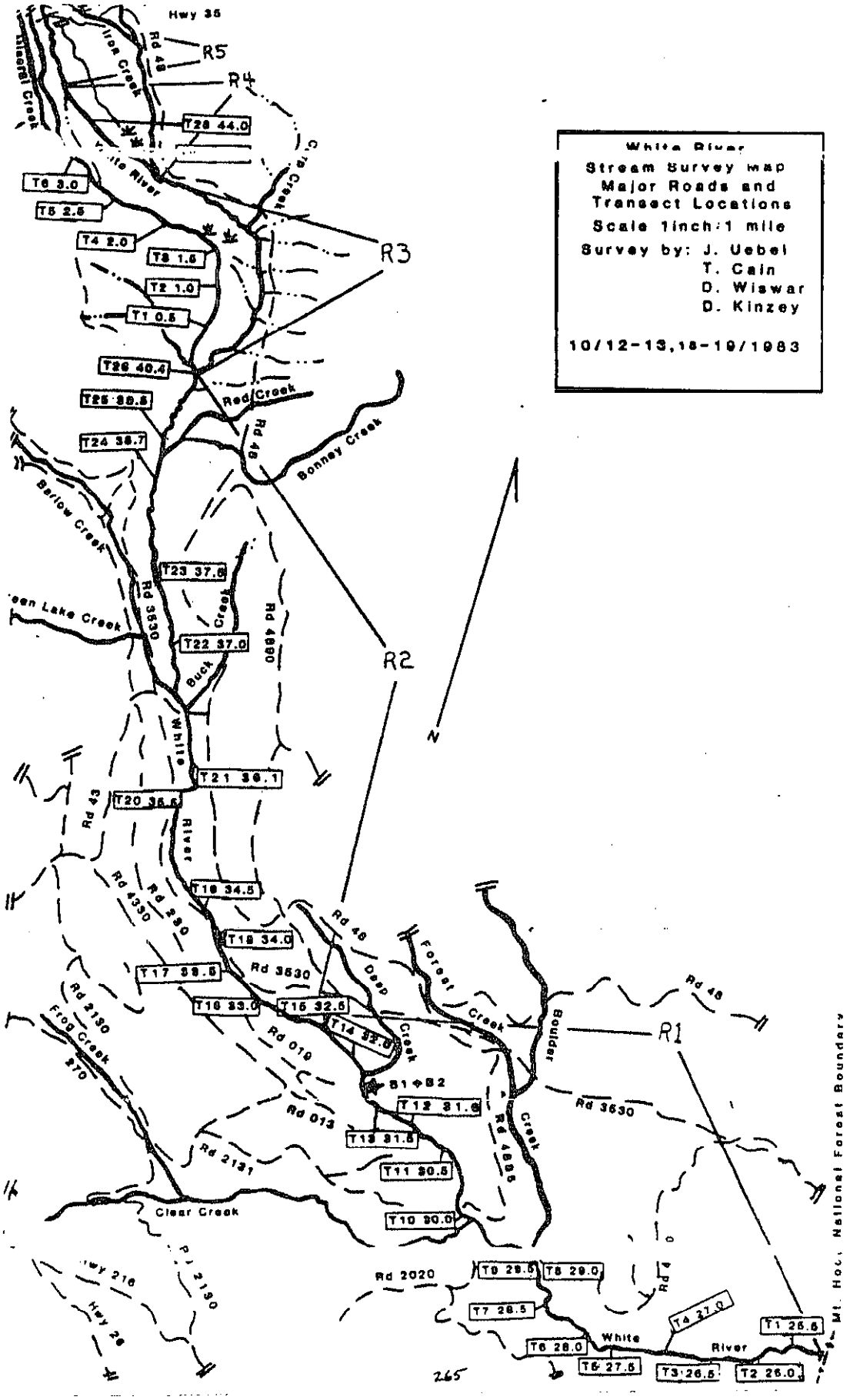
White River In Reach 11 flows In a very wode, galciated, U-shaped valley. Gradient is low over a substrate comprised primarily of sand and rubble "he stream surface area is dominated by fast flowing riffles and runs. The riparian zone contains lodgepole pine, spurce, larch, Doglas-fir. cottonwood and tag alder. (Photo at RM 36.4)

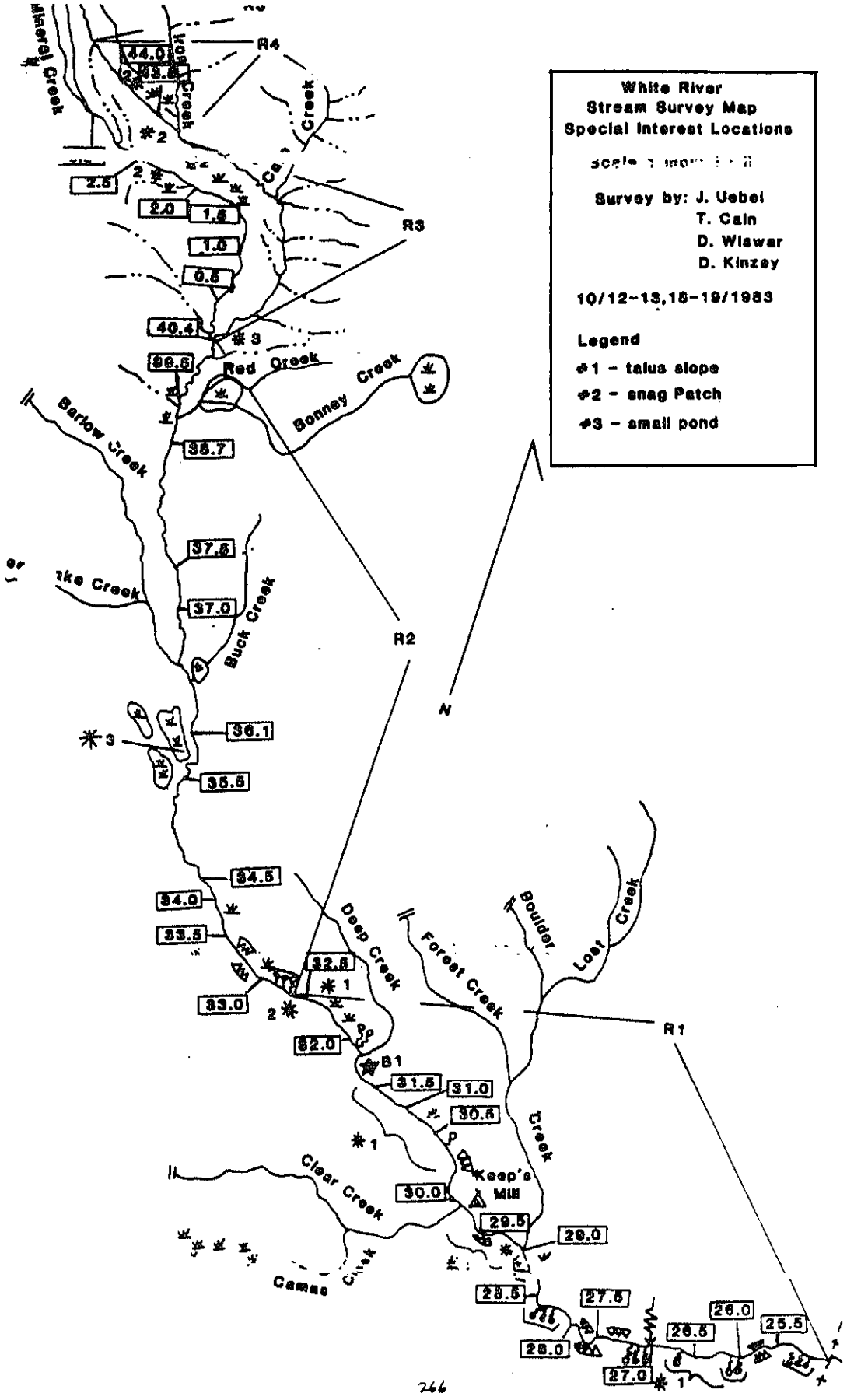
Large wetland development is hlgh alonq the west side flood plain from RM 35.4 - 36.3. This wetland at RM 36.0 has a small oond associated with it, Deer and elk sign was ahundant. Wetlands and sprins are common along stream margins throughout the survey area (RM 25.0 - 45.3).

White River has recently captured the lower 2.7 miles of Iron Creek. Above the confluence 'Reach IVI, 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.

Rearinp habitat in Mineral Creek is fair to good. Pools dominate the stream surface area (P:R=6:4). Pool size si moderate (4 sq. vds.) with shallow to moderate depth and moderate effective cover. Cover is provided hv instream boulders and rubble. and a dense algal growth on the pools substrate. This view is at RM 0.2.


Stream Order 7th
WHITE RIVER
Scale 0.5 inr 1 mi
N
Frog Creek
Burlie Creek
Mineral Creek
Cipes Creek
Bonney Creek
Red Cr
Carr Cr
Buck Cr
White River
Clear Creek
Forest Cr
Boulder Creek
Lost Cr
Badger Creek
Little Badger Cr
Jordan Creek
Threemile Creek
Gate Creek
Rock Creek
Badger Creek
White River
~8 miles to Deschutes River


White River
Stream Survey map
Major Roads and
Transect Locations
Scale 1inch:1 mile
Survey by: J. Uebel
T. Cain
D. Wiswar
D. Kinzey
10/12-13,18-19/1983
Hwy 35
Rd 48
R5
R4
R3
R2
R1
T28 44.0
T6 3.0
T5 2.5
T4 2.0
T3 1.5
T2 1.0
T1 0.5
T26 40.4
T25 39.5
T24 38.7
T23 37.6
T22 37.0
T21 36.1
T20 35.5
T19 34.5
T18 34.0
T17 33.5
T16 33.0
T15 32.5
T14 32.0
T13 31.5
T12 31.0
T11 30.5
T10 30.0
T9 29.5
T8 29.0
T7 28.5
T6 28.0
T5 27.5
T4 27.0
T3 26.5
T2 26.0
T1 25.5
S1 & S2
Red Creek
Bonney Creek
Barlow Creek
Rd 3630
Buck Creek
Rd 4890
White River
Rd 43
Rd 4350
Rd 290
Deep Creek
Forest Creek
Boulder Creek
Rd 4895
Rd 010
Rd 013
Rd 2130
Frog Creek
Rd 2131
Clear Creek
Rd 2020
Hwy 216
Hwy 26
Mt. Hood National Forest Boundary


White River
Stream Survey Map
Special Interest Locations
Survey by: J. Uebel
T. Cain
D. Wiswar
D. Kinzey
10/12-13,18-19/1983
Legend
1 - talus slope
2 - snag Patch
3 - small pond
R1
R2
R3
R4
N
Barlow Creek
Buck Creek
Red Creek
Bonney Creek
Deep Creek
Forest Creek
Boulder Creek
Lost Creek
Clear Creek
Camas Creek
Keep's Mill
B1
44.0
43.5
40.4
39.5
38.7
37.5
37.0
36.1
35.5
34.5
34.0
33.5
33.0
32.5
32.0
31.5
31.0
30.5
30.0
29.5
29.0
28.5
28.0
27.5
27.0
26.5
26.0
25.5
2.5
2.0
1.5
1.0
0.5

CLEAR CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: Jeff Uebel
Tom Cain
David Wiswar

Dates Surveved: July 20, 27-28, lo83
August '-3. 1983

Tributary to: White River

Drainage: Deschutes

TRI Compartments: Clear 2707
Duke 2103
Bearpaw 2105
Camas 2103

Game Fish: Rianbow Trout
Brook Trout

Potential Anadromous Species: Chinook
Coho
Steelhead
Sockeye

County: Wasco

Mouth Location:
T. 5 S., R. 10 E., Sec. 11

Watershed Area: 23,000 acres
36 sa. miles

Stream Lenoth: 11.8 miles

Distance Surveved:
7.8 miles mainstem
1.5 miles Camas Creek
1.5 miles Clear Lake Tribs.

Average Low Flow Width: 14 ft.

Stream Order: V

Average Fish Habitat Condition Ratina: 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% 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% 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% located on National Forest Systems Land and 20% (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 generallv a shallow "U" shape. Side slopes are gentle (0-30%), except for the first reach which is a flat bottom "V-shaped" gorge with moderate to steep side slopes (50-70%) composed of rock cliffs and talus slopes. The stream gradient graduallv decreases from 4-5% in the gorge at the mouth to 1-2% at RM 11.8. Floodplain width is variable ranqing 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 onlv two major tributaries, Camas 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% and predominantly boulder substrate, Reach II is 3% and gravel/rubble, while Reach III is 2% and small gravel and sand. Reach I and II, reoresenting over 65% of the stream area, are riffle dominated while Reach III is pool dominated (70%).

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 comparitively limited, however, in the first two reaches. The &mount 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 1700 yards of gravel (90% of the stream total) was found in this reach. Excessive water temperatures could limit fish production in Reach III. Temperatures were measured as high as 650F. This is of particular interest given the generally cool, damp summer of 1983. Fish passage is blocked in Reaches I and II by three log jams, 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 alonq 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 log jams (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 spawnina 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 apoarently 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 configuratlon is a deep (400 ft.), flat-bottom "V" gorge with an average floodplain width of 90 feet.
2. The gradient averages 4%.
3. The substrate is boulder dominated (80%).
4. The stream area is primarily riffle (70%).
5. Stream shading is low (30%).
6. Channel sturcture 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%.
3. The riffle substrate size class decreases with gravel/rubble materials predominant (65%).
4. Pool area increases, but the stream remains riffle dominated (60%).
5. Shading increases to 60%.
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%.
3. The riffle substrate size class decreases with 90% of the materials having diameters less than 6".
4. Pool area increases to 70% 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 side floodolain (RM 0.0-0.21 to a broad U-shape with a floodplain width of 1,000 + feet in Camas Prairie (RM 1.2+). The transltional area (RM 0.2-1.2) is a flat bottom V with an average floodolaln width of 40 feet.

2. A very hiqh gradient section (20-35%) is present from the mouth to RM 0.2. The gradient gradually lowers to 4% by RM 0.5. The gradient continues to decrease to very low (1%) 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% 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%) from the mouth to RM 1.2. Essentiallv no overstory exists within Camas Prairie and shading is qreatlv reduced (5%). This apparentlv 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. Electroshock sampling at RM 8.5 in 1982 showed a species compositoin of 75% brook trout and 25% 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 IO miles of tributary habitat (see Frog Creek survey). An additlonal 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 termal problem could occur in Reach III where temperatures were measured as high as 650F. This is apparently due to the warm spill from the lake surface. The surface temperature of the lake was 670F. Other limiting factors include passage barriers (log jams 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%) 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 resrdent 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% (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 (450) 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, 9HCR = 7.81.

2. Rearing habltat quality is good although the area is riffle domiated (70%). 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% of the 46 sq. vds. of gravels observed were rated marginal quality due to poor channel placement. Ninety-five percent of the gravels are of a size suitable far anadromous utilization (l-6").

4. Log jam 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% Pool size remains moderate (avg. 13 sq. yds.) and average depths decrease to l-2 feet. Effective cover continues to be high and is provided by LWD, overhanging brush, slingig moss mats, and water turbulence. Excellent rearing habitat is also found in numberous channel braids. Although pool area increases to 60% at the upper end of this reach, the pool quality decreases dut to diminishing flows closer to the diversion-dam at RM 7.8.

3. Spawning habitat is excellent. Over 90% (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 log jams 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. vds. 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% 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 11.61. The dam (50 ft. high) is a total barrier and is the upstream limit potential mainstem anadromous fish habitat. Sockeye salmon could potentially be reared in Clear Lake. Fair to qood spawning and rearing habitat for both resident and anadromous fish was observed the lower 0.5 miles of lake tribs. D, E, F. Approximately 200 so. yards of gravels were observed in the tribs. (especially Trib. D), with 50% suitable for anadromous fish and SO% of the total of marginal quality.

Camas Creek; RM 0.0-1.5

1. The fish hahitat is rated poor to fair quality (HCR=5.0).

2. Pool rearinq habitat is poor from the mouth to RM 1.2. The stream is riffle dominated (70%) and pools are small (1 sq. yd.) and shallow (12"). Moderate to high effective cover is provided by LWD and overhanginq veqetation. Within Camas Prairie, pool rearing area is qreatlv increased (P:R=9:1) hut hiqh water temperatures (76°F) preclude usage as summer rearing habitat. (Water temperatures are 540F at RM 1.0.

3. Spawning habitat is poor with qravels 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% were rated marginal quality. Sixtv percent are of a size class suitable for potential anadromous utilization.

4. Hiqh gradient cascades (20-35%) from RM 0.0-0.2 restrict upstream fish migration into Camas Creek. To access the 1.0 miles of potential anadromous hahitat 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 fisherv.

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 habitatunits, 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. Lvcopodium 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 flatbottom "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 overstorv 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% of the length), rock cliffs (40% of the length), and small wetlands (10% of the length). Small isolated snag patches are also present.

6. A dense deciduous understorv occurs along the stream margin.

Reach II; RM 1.5 - 7.6:

1. The riparian habitat condition increases to 9.1, (very high).

2. The vallev configuration widens to a "U" shape and the average floodplain width increases to 160 feet.

3. All five habitat units are present.

4. The overstorv composition ranges hetween 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. 8 (RM 7.0-7.3) has partirularlv diverse habitat types Braiding is extensive on hoth mainstem an.3 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 verv high, (RCR = 8.6).

2. The vallev configuration and floodplain is similar to Reach IT.

3. All five habitat units 'are present.

4. The coniferous overstorv conmosition is similar to Reach 11. No deciduous species were seen in the overstorv.

5. Small and large wetlands occur throughout. A larqe meadow occurs between RM 0.6-9.8. Small snag patches and individual snaqs are present-along the entire lenath.Talus slopes and rock outcrops are present but limited. A muskeq 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

Rioarian diversity is good with a qood balance of 4-5 habitat units from the mouth to RM 1.7. Camas Prairie)RM 1.2+ is a larae wetland/dry meadow complex which forms the head of Camas Creek. No overstory exists within the meadow. The overstorv below Camas Prairie to the mouth is predominantlv composed of conifers (Douglas-fir, true fir, and ponderosa pine) with occasional alder. A thick deciduous understory exists in this section especiaqlly from RM 0.0-0.2 and 0.5-0.8 Speical habitats observed include rock cliffs (RM 0.0-0.2), 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/Enhancement Summary

Passage Enhancement; RM 1.4, 1.8. 2.5:

Log jams 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 suitahle 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 @ 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 impassahle harrier. 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, RM 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 comparitively simple due to the low gradient (l-5%) and well regulated flow regimes present. However, extensive wetland development in Reach II, and verv 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, RM 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 comparitively low priority even if anadromous fish were introdocted 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

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 (0.0-1.5)	7.8	30	3:7	4	M	17	H	0	80	15	5	0	0	11
II (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 ≤ 12", M = 12 - 29", H ≥ 30")
A: Average pool area fsq. yards)
EC: Effective cover (L ≤ 40%. M 40-60%, H ≥ 60%)
BR: Bedrock
SD: Sand
D: Average depth finches)
*: Present, but less than 5%

CLEAR CREEK

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

Species	REACH I	REACH --ii--	REACH 111
Rainbow Trout - a	H	H	M
Rainbow Trout - j	L	ı	*
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; mav not be present

CLEAR CREEK

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

Reach (R.M.)	Spawninq Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0-1.5)	46	20	26
II (1.5-7.8)	1714	595	1119
III (7.8-11.8)	98	20	78
TOTAL	1858	635	1223

CLEAR CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS
1.4	Logjam	J_1	N	Partial Removal
1.8	Logjam	J?	P	Partial Removal
2.45	Logjam	J3	P	Partial Removal
7.8	Diversion Dam	D_1	N	Increase flow over dam, develop lump pool. and screen the diversion ditch.
11.8	Clear Lake Dam	D_2	N	None

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

*Trout migration barrier onlv: anadromnus fish could pass obstacle.

CLEAR CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

Reach (RM)	Miles Avail.	Miles Pot.	Rearina P:R	Rearina Area	Rearina Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
I (0.0-1.5)	1.4	0.1	3:7	17	2.0	18	26	Log jam blocks
II (1.5-7.8)	-	6.3	4:6	13	7.0	960	774	upstream access
III (7.8-11.8)	-	4.0	7:3	55	2.0	39	5	at RM 1.4.
Tribs.								
B (0.0-0.5)		0.5	5:5	1	1.0	75	0	Small trib. (1 cfs)
D (" ")		0.5	5:5	2	1.0	30		" II II
E (" ")		0.7	4:6	1	1.0	47	1	" " (Some inter-mittent flow)
F (" ")		0.3	6:4	1	1.0	14	7	" II II
Total	1.4	11.9				1,128	307	

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

CLEAR CREEK

TABLE VI - LWO HABiTAT OUALITY INFLUENCE

Reach (R.M.)	SP. GRAVELS Total (%)	SP. GRAVELS HO (%)	POOL Total (%)	POOL HO (%)	LWD CHARACTERISTICS OR	#	L	Oia	Source
I (0.0-1.5)	IO	10	10	10	Var	S-M	l-2	?+	T
II (1.5-7.8)	75	85	50	fin	Var	S-M	l-2	l-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 dependant on LWO
HO = % of hiqh quality habitat area dependent on LWO
OR = angle of orientation to flow: Perp = perpendicular, Var = variable
# = numher of logs/structure; S = single log, M = multi-log
L = average length of loos, expressed in channel widths
Oia = diameter of average loos in feet.
Source: L = local
T = transported
M = mixture of local and transported

CLEAR CREEK

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

Reach (R.M.)	SUMMER w	d	v	Q	BANKFULL W	0	Floodplain Width (Ft.)
1 (0.0-1.5)	17	1.7	1.2	24	23	2	70-1 20
II (1.5-7.8)	11	.6	1.1	[illegible]	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)
= Velocity (feet/second)
i = Average reach flow in cubic feet/second

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

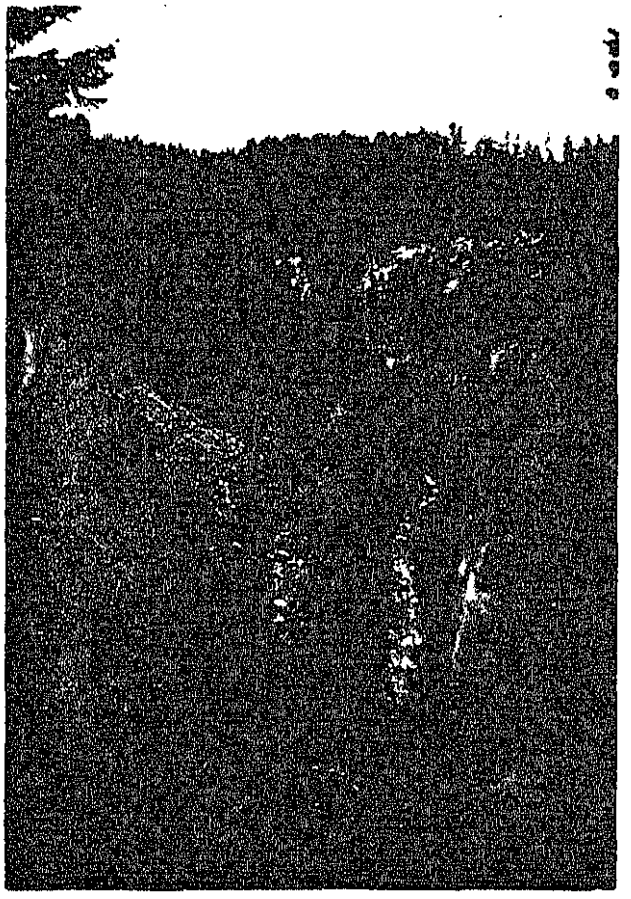
REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/H_2O TEMP.0 F A/W	A/W	TIME
I (0.0-1.5)	7/20,27/83	24	40	i	63/54-68/54		1500-1900
II (1.5-7.8)	7/12-13/82 7/27-28/83	7	50	E	63/42-82/52		1000-1900
III (7.8-11.8)	7/28/83 8/2-3/83	28	50	E (7.8-9.5) S (9.5-11.8)	68/60-68/65		1100-1745

CLEAR CREEK

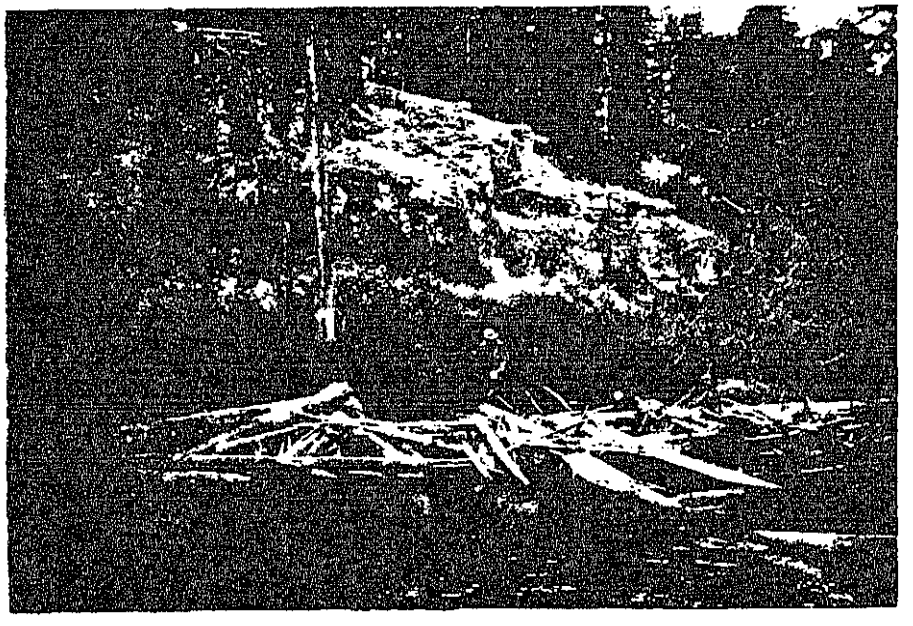
TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM		RCR	VALLEY F.P. (ft.)	VEGETATION Overstory Con.	Dec.	AQUATIC Stream-class	Wetland %	Size	Sp. Habitat Units
I	(0.0-1.5)	7.6	90	5	0	J	25	s	3
II	(1.5-7.8)	9.1	160	i	1	J	40	S-L	3
III	(7.8-11.8)	8.6	150	5	0	1	95	S-L	?

LEGEND: RCR: Riparian Condition Rating
F.P.: Floodplain
H.U.: Habitat Units High > 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
5 = Small (less than 1 acre)
L = Larqe (greater than 1 acre)

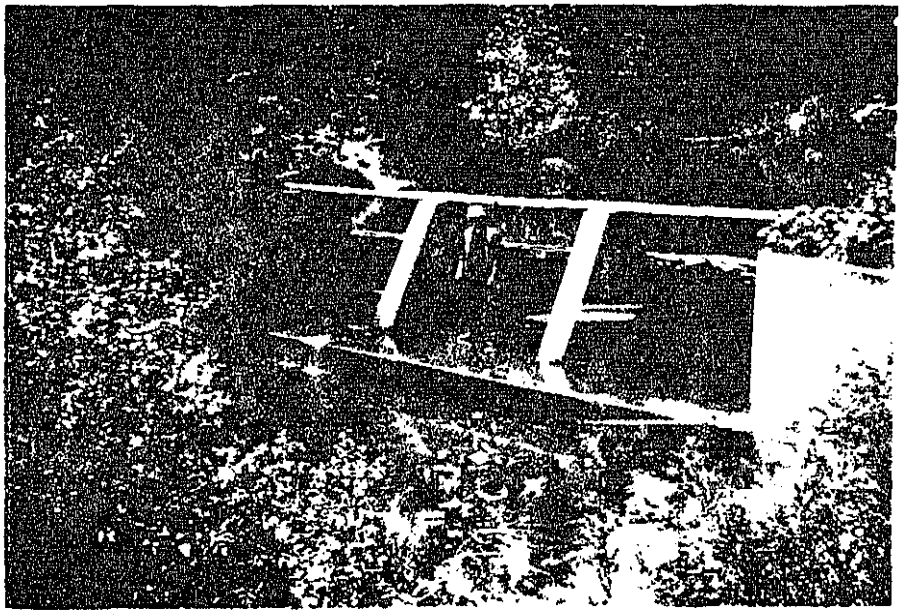


Reach I of Clear Creek (RM 0.0 - 1.5) lies in a deep canyon with steeo sideslopes of heavy timber interspersed with open talus and bedrock cliffs, Localized wetlands and snag ostches are well distributed In the riparian a rea of this reach. The stream area is riffle-dominated (70%) with numerous ver y high quality pools interspersed.

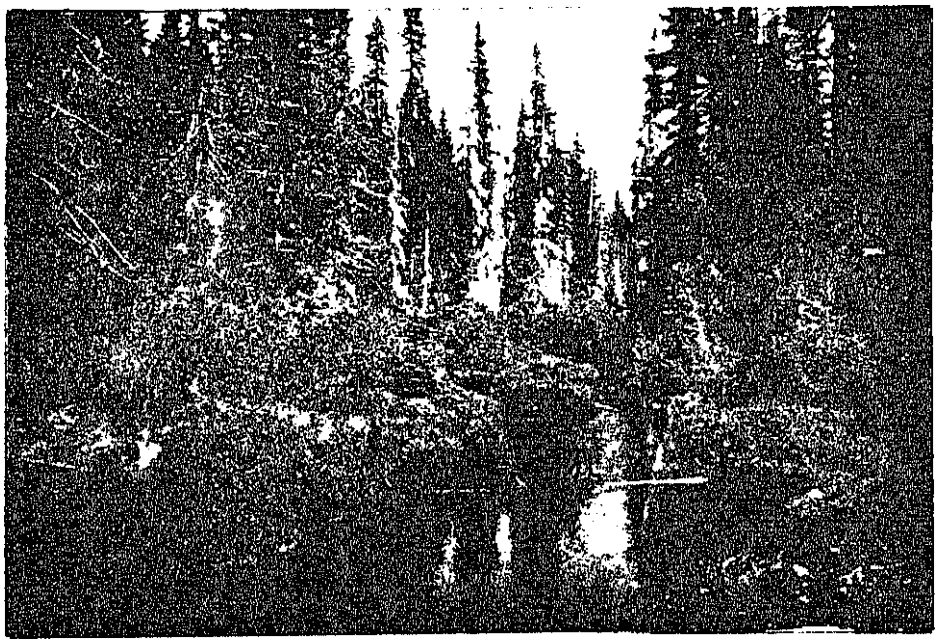


Jam J3 (RM 2.5) is the uppermost of three small logjams limiting upstream migration to the excellent habltat of Reaches II and III. If anadromous fish are introudced Into the White River System, passage enhancement at these Jams would be a high priority Care should be taken to preserve the excellent habitat associated with the jams. Note the hlqh quality reparian habltat development In the background.

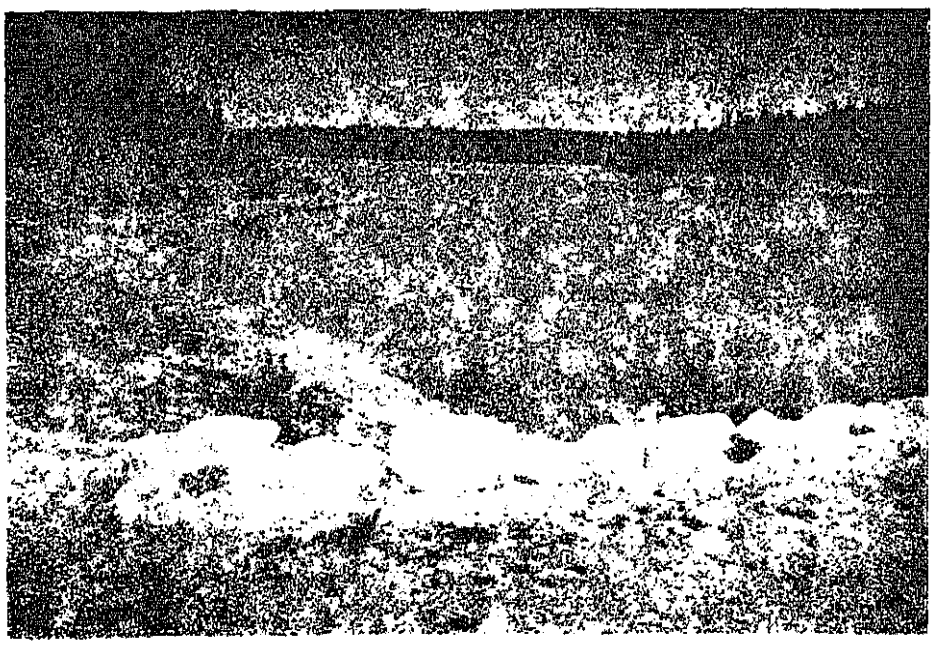
View of Camas Creek at RM 1.4, in Camas Prairie. This stream is a tributary to Clear Creek (at RM 1.3). It is not accessible to upstream migrating fish from the mainstem due to the sustained high gradient cascades at Its mouth. The stream has fair-good habitat conditions for resident trout. The "orairie. 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 bv this water withdrawal. The structure is a total barrier to upsteam fish mioration. Four miles of exceotionallv 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 - 2.51.



Typlcal view (RM 11.4) of the extensive, high qualitv riparian and fish hahltat conditions present throughtout Reaches II and III on Clear Creek (RM 1.5 to 11.41. Beaver ponds, wetlands, and snag patches are numerous along the stream channel in both reaches. fish hahltat is dominated by glides and pools (70% of the stream area1 In Reach III (shown); Reach II Is riffle-dominated (70%) and contains 90% of the total spawning qravels observed in the mainstem (1,800 sq. yards).

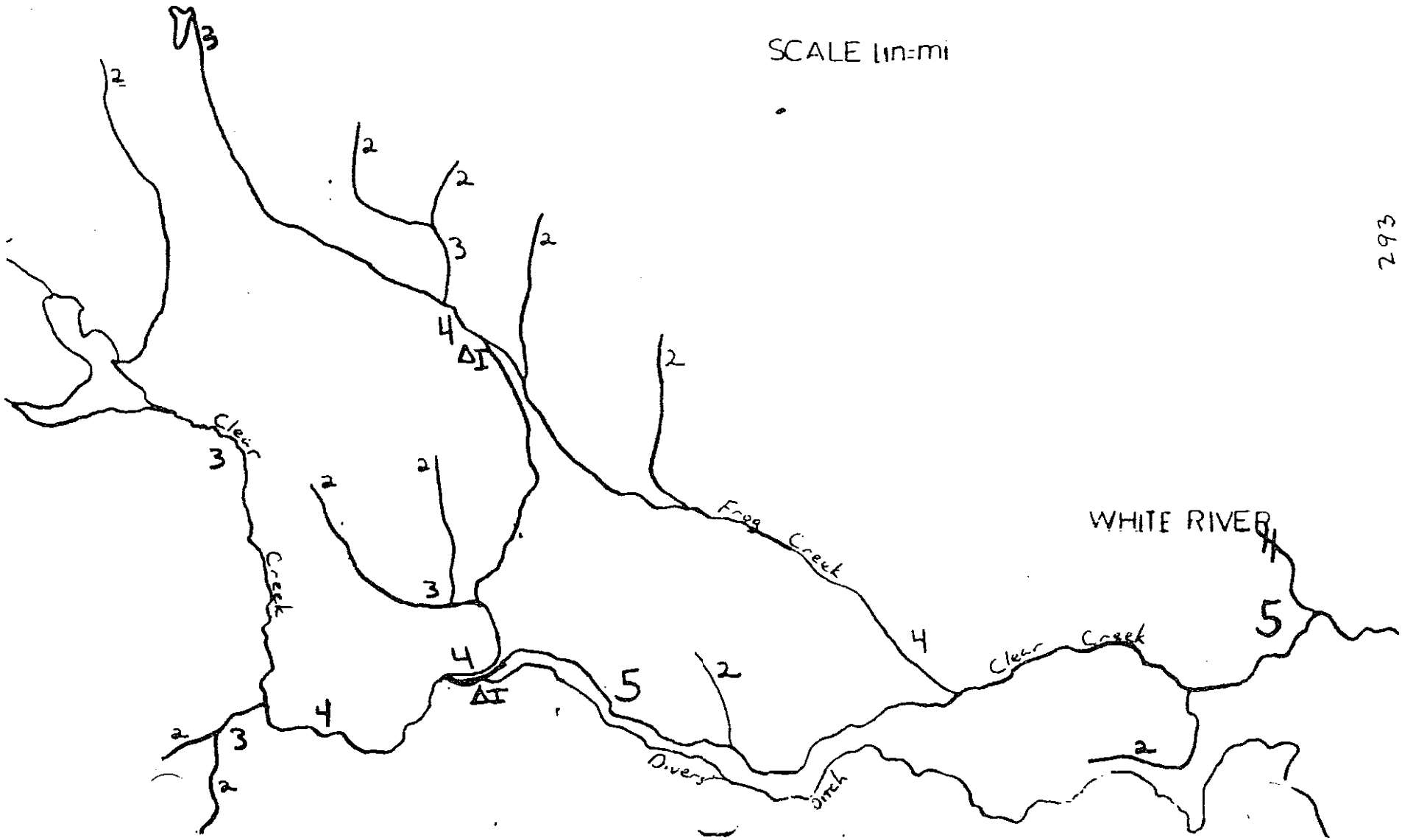


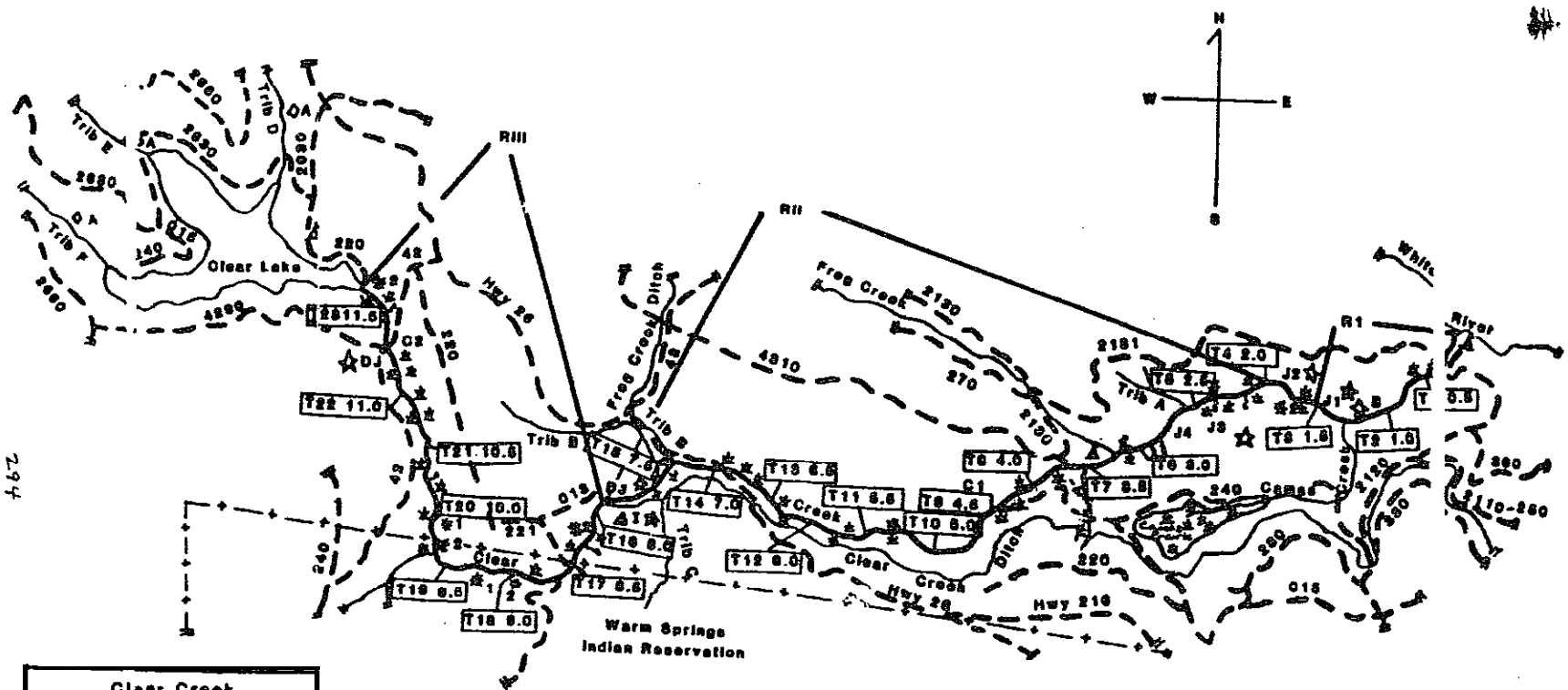
A flftv foot dam at RM 11.8 creates Clear Lake (550 acres) and also presents a completed barrier to upstream fish migration. The lake currently supports resident brook and rainbow trout, and Is also stocked with trout by the ODFW In response to heavy recreational fishing pressure on the lake. This impoundment appears suitable for rearing juvenile anadromous fish (chinook. coho, steelhead, and sockeye).

Clear Lake tributary F, at RM 0.2. Fiar to good quality habitat conditions for resident trout (and ootentiallv for coho, sockeye, and steelhead) exist on Clear Lake tribs 0, 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





Clear Creek
Survey Map

Scale: 1 inch: 1 mile

Surveyed by: J. Uebel
T. Cain
D. Wiewar

7/20, 27- 28/83 and
8/2-3/83

#1 Sensitive Plant
Lycopodium annotinum site
#2 Snag patches

Note: : Transects 7-14 (RM3.0-7.0) were completed during the 1982 survey of Clear Creek by Uebel and Godbout

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

$R_{I,II,III}$ REACH # and SECTION

T_1 1.0 TRANSECT I 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 I

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

S-47 ROAD AND ID NUMBER

EARTHFLOW

CLEAR CREEK
BEAR SPRINGS RANGER DISTRICT
MT. HOOD NATIONAL FOREST

Surveyors; Kevin Godbout, Jeff Uebel

Date Surveyed: 7/12-13/82

Tributary to: White River

Drainage: Deschutes

TRI Compartment:
Clear, Duke, Bearpaw, Camas
2206 2106 2105 2103

Game Fish: Brook trout
(Steelhead)
(Coho)

county: wasco

Mouth Location: T5S, R10E, Sec 11

Watershed Area: 36 square q 11les
23,000 acres

Mainstream Length: 12 miles

Distance Surveyed: 4.0 miles

Low Flow Width (Average): 18 feet

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% to Whtie River's low flow at their confluence (T.5S., R.10E., Sec. 11). On July 12. 1962. at river mile (RM) 3.5, the flow was estimated et 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%) of the stream lies within National Forest System Lands on the Bear Springs Ranger District. Approximately 20% of the drainage area lies in the Warm Springs Indian Reservation (RR 6.3 to 9.6).

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 FM 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 (RR 3.2), contributes 15% of the low flow (3 cfs). One other perennial tributary was observed in the survey area.

Clear Creek flows through a very wide (20D ft.+), U-shaped, flat-bottomed valley at a relatively constant 3% gradient. This results in a wide (200 ft.) floodplain.

The entire survey section RM 3.0 to 7.2 is relatively hanogeneous. and is identified as a single reach. Typically, this well-regulated stream flows over a gravel/rubble substrate. Overall stream shading is low (50%). 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%) 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 Rfver systw 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) possess interspersions of excellent quality coho salmon and winter steelhead habitat. Judging from past surveys and the results of thfs 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, 1976) 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). Posftfve factors include: high amounts of effective cover; ample spawning habitat; good base flows (averaging 10 - 12 cfs); and moderate numbers of juvenile and adult brook trout. These factors are primariy responsible for the high rating.

Pool area averages 40% 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 diminsh in the lower flows at the upper end (RM 6.0 - 7.2) of the reach.

Spanning habltat is abundant in the surveyed reach, although patchy in dlstrfbutfon. Most of the gravels (95%) were found below RM 6.0. Over 60% 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 sire class ruftable only for anadromous ffsh utilization.

The stream stabflity is rated 4s very stable (SSR 9.6). This high rating is due to: the Clear Lake dam and an irrfgatfon diversion contributing to a well-regulated flow regime; high streambank and channel substrate stabflfty (low amount of bank erosfon (5%) and substrate detachment (10%)); 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 qualfty is rated as very hfgh (RQR = 9.3). Major factors contributing to thfs ratfng include: the U-shaped valley resulting in wfde (120-200') floodplain development; hlgh 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 (provfded by a mixed coniferous and deciduous overstory associated with a variety of age and size classes). Addftlonally, ground cover Is hfgh (90%).

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/ehancement opportunities are abundant in this reach. Improving pool area, depth, and also spwing gravel availability in the boulder dominated sections RM 4.4 - 5.2 and 6.0 - 6.3 is the hfghest 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 ride of this east-west orientated stream q 4y keep water temperature at desirable current levels (50° F). The presence of continuous wetlands from RM 3.0 - 6.5 idnicate that management empahasizing streamside buffer zones are appropriate. Protection appears to be a high priorlty for these wet areas, which likely act as water storage sites. provldlng well-regulated stream flows snd a high' diversity of wildlife habitata.

Yhe major limiting watershed factor Is the diversion of the entire low flow for Tygh Valley Irrigation. This my limit the width and development of the true riparian plant community below the diversion end 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 suports moderate numbers of brook trout. An irrigation diverison at RM 4.7 diverts 100% of low flows at that point, tylng it into the Clear Creek canal system.

Reach Summary
CLEAR CREEK

Reach I: RM 3.3 - 7.2

1 Stream shading Is low (50%). wlth an east-west orientation.
2 Gradient is 3%.
3 Riffle dominates 60% of the stream area.
4) Riffle substrate is dominated by gravel/rubble (66%) with diameters averaging 1" - 12".
5) The valley conflguration 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%.
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. RR 3.3 - 4.4 contains over 60% of the total 1455 square yards observed on Clear Creek. Only 5% 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 wfnter 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). Spwaning habitat observed translates to 150 square yards/mile.

Riparian Habitat Summary
CLEAR CREEK

The reparian area quality Is very high (RQR 9.3). This high rating is the result of: the wide to very wide valley botoom width resuling in a well-developed floodplain (120-200 ft.+); a perennial base flow and habitat to suppat both resident and anadromous salmonids; the presence of high value wildlife wetlands (over 50% 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 a e/size classes (seedlin /sapling, pole small and large sawtimber). Additionally ground cover is high (90%), and consists of mixed rass/forb shrub habitat units (sedge, fern, salmon berry, and Oregon grape). This c&tributes 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/sire classes. As in Clear Creek, this stream maintains a wide and dense true zone of riparian vegetation.

Meadow Stabilization - RR 3.5

At RM 3.5, fn the vicinity of the Clear Creek campground, a channel braid meanders through a meadow area. Heavy recreational use it causing sane bank erosion. A plantfn 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 (RR 6.0 - 6.7) may be advisable. Planting of trees and construction of barriers may be options. Thfs could serve to reduce harassment In high valuable riparian and wildlife production areas.

Spawning Enhancement: RM 4.4 - 7.2

Spawning habltat 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 habftat. There 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 thfs 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. RR 3.3 - 3.6 lacks structure, and large log or gabion sills, or boulder berms, could increase pool area from the exlsting P:R ratio of 2:8. Creation of one or more large deep pools adjacent to the campground (RR 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 1ogs to consolidate flows and promote scour, as well as the installation of K-dams (see spawning enhancement, above). could improve pool quality fn these areas.

Stream Stability Summary
CLEAR CREEK

The stream is very stable. The stream stability rating (SSR) Is 9.8. Major factors which contribute to this rating include: the mll-regulated flow regime due to the Clear Lake dam, and Tygh Valley irrigation diversion; streambanks which are rail-vegetated (90%) and contain a moderate amount of bank rock with diameters greater than 1 ft. resulting in little (5%) streambank erosion; low channel substrate detachment (10%) due to a lack of channel scour promoting high substrate stability; and a high mount of channel structure due to large woody debris creating long and deep pools throughcut the reach.

Stream channel structure and the basic elements of fish habitat arc heavlly dependent on LWD. Over 40% 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 wall-regulated flow regime. The transporation 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 contrlbute to this rating Include: a knell-regulated flow regime; stable streambanks; high substrate stabllty; and good channel structure. Like Clear Creek, this stream appears to be dependent on LWD for flsh habitat and stream stability.

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 (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
- 6 = Average gradient (%)
- 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%)
- = Bedrock
- ii - Sand
- D = Average depth (feet)
- * = Present, but less than 5%

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

SPECIES	REACH	TRIBUTARIES
	I	Frog Creek
Brook trout - a	L	L
Brook trout - j	M	M
(Steelhead)		
(Coho)		

LEGEND:
- L = Low (0-5), M = Moderate (6-50), Ii = High (50+)
- a - Adult, j = Juvenile
- * = Habitat suitable; presence reported but not observed
- ( ) = Habitat suitable; but major passage work needed for utilizatic

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

REACH (R.M.)	SPAWNING GRAVEL (SQ. YDS.)		
	Total	Good	Marginal
I (3.3-7.2)	1440	455	985
Frog Creek (0.0-0.1)	15	5	10
TOTAL	1445	460	995

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM .M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS
		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 . .	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
	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 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
* = None observed

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

REACH . .	SUMMER				BANKFULL		
	W	d	v	Q	W	D	Floodplain Width (Ft.)
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)
.. = Velocity (feet/second)
Q = Average reach flow In cubic feet/second

TABLE VII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP.° F	TIME
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

REACH R.M.	RCR	VALLEY		VEGETATION				AQUATIC		
		F.P.(ft.)	H.U.	G.C.%	Understory Con.	Overstory Dec.	Streamclass	Wetland%	Size
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 ≥ 5. M = 3-5. L ≤ 3)
- G.C. = Ground cover percentage
- Con. = Number of conifer species
- Dec. = Number of deciduous species
- Wetland - Streamlenngt 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)

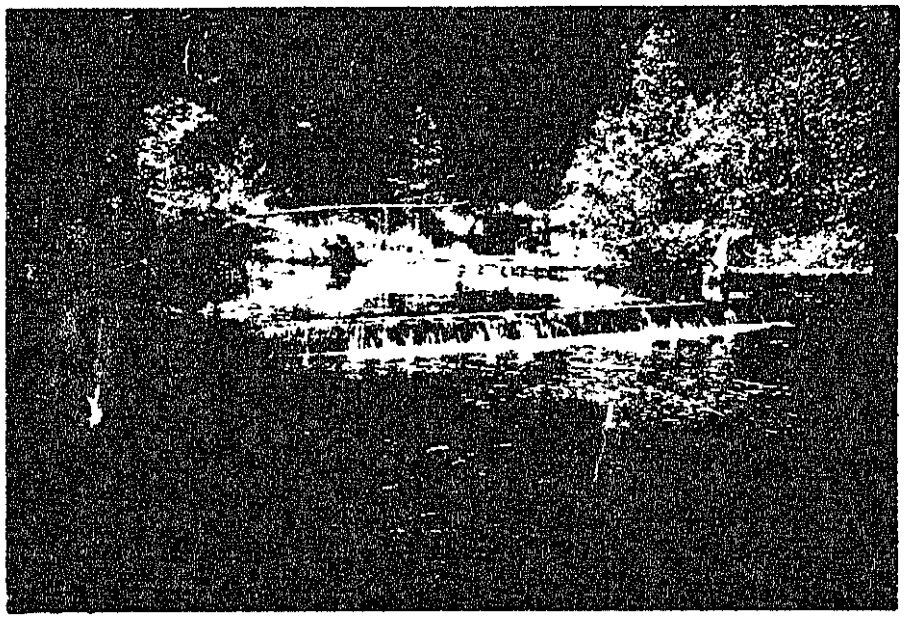
TABLE IX - STREAM STABILIN SUMMARY

REACH (R.M.)	SSR	FLOW REGIME			STREAM BARKS			CHARNEL SUBSTRATE			
		Ratio MF:LF	LWD Ornt	LAT CUT	ER	RC	VEG	DTCH	TORE	IMBRC	VEG
I (3.0-7.5)	9.8	1:1	R	L	L		LH	L	MD	H	VRP
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 wldth and the seasonal low flow width
LWD ORNT	- Large woody debris orientation (11 parallel:R Random)
LAT CUT	- Lateral cutting (H $\geq$ 80%, M = 20-80%, L $\leq$ 20%)
ER	= Bank erosion (H $\geq$ 50%, M = 20-50%, L $\leq$ 20%)
RC	- Rock content (Diameter I ft.) (H $\geq$ 65%, M = 30-65%, L $\leq$ 30%)
VEG	= Vegetative cover (Ground cover I root matrix) (H $\geq$ BOX, M = 50-80%, L $\leq$ 50%)
DTCH	- Percent detached (H $\geq$ SD%, M 20-50%, L $\leq$ 20%)
TONE	= B-(Bri ht), MB-(Moderately bright), MD-(Moderately dull3, 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)

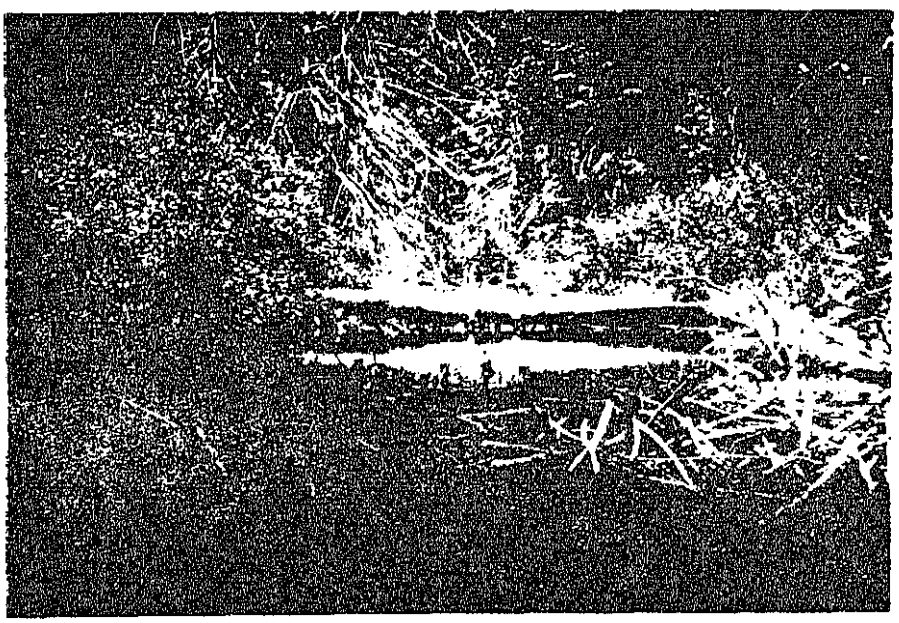
*Data oh channel structure not included due to modification of data collection & evaluation procedures



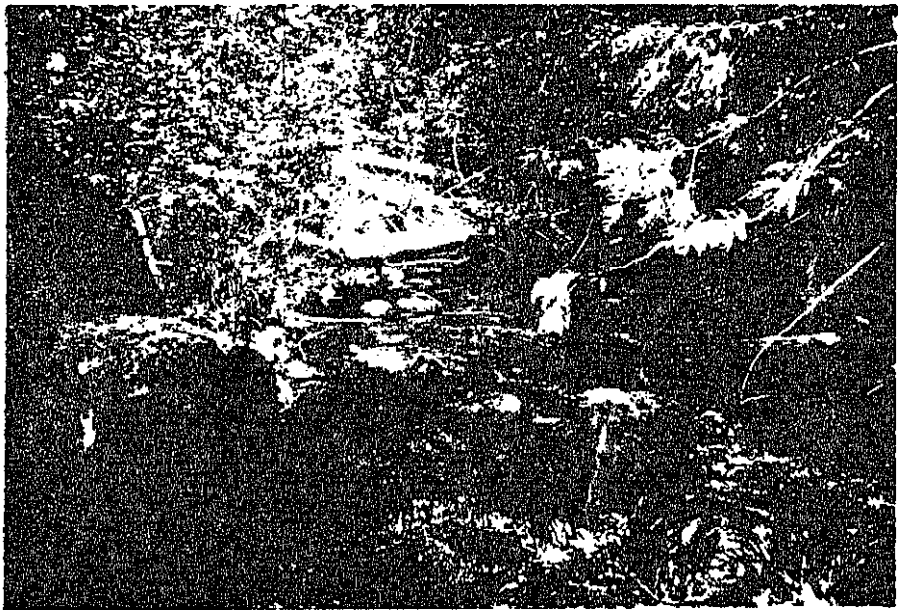
The basic elements of flsh habitat and channel structure are heavily dependent upon large woody debrls. Pool development Is high as 40% of the stream area Is in pools. They average 15-20 sq. yds. In depth and 2 ft. deep In areas.

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 mlxed deciduous/coniferous and second growth overstory, and a high groundcover factor (90%) contribute to the high score.

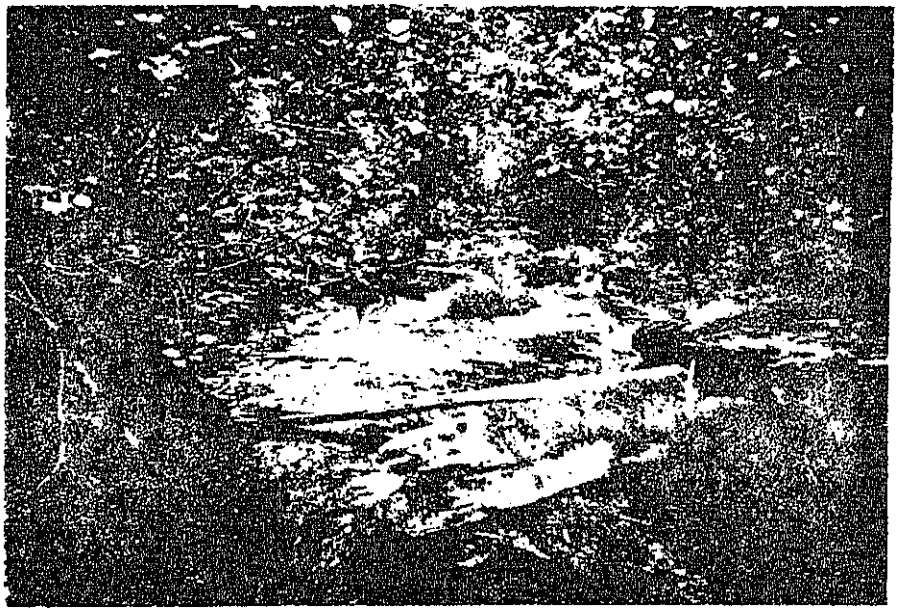
This pool at R.M. 5.95 Is suitable for rearing coho salmon. This drainage possesses excellent quality coho salmon and winter steelhead habitat and could be the major producing dralnage in the White River system should passage over the White River Falls be established.



Recent beaver activity is present at R.M. 3.7. Wildlife use of the stream appears heavy as deer, elk, coyote, and bobcat signs were noted.



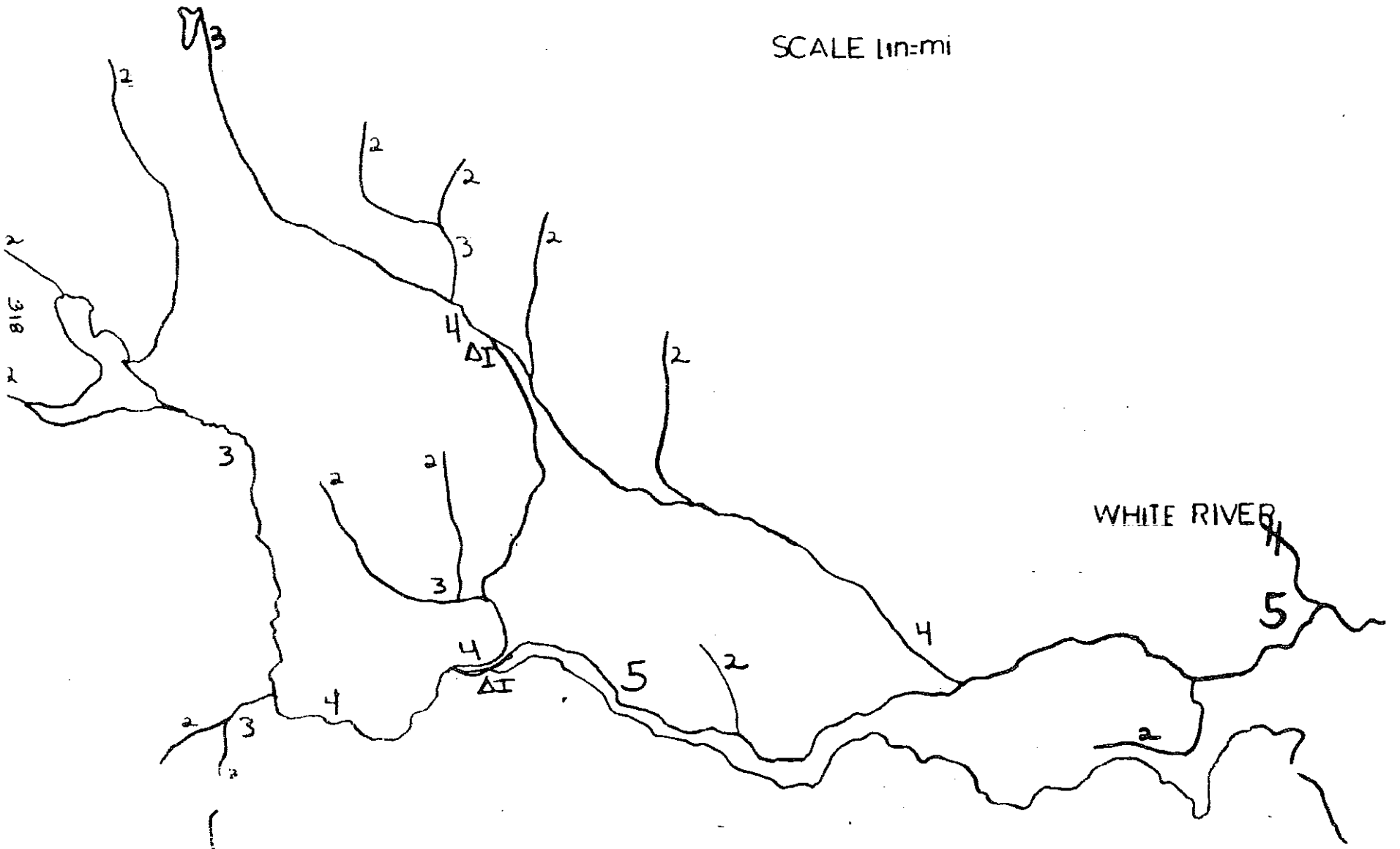
At R.M. 3.2. Frog Creek enters the main stem. It is similar to Clear Creek in the high quality of the aquatic and terrestial habitat present. The limiting factor on both these systems appears to be the diversion of low flows for Tygh Valley Irrigation.

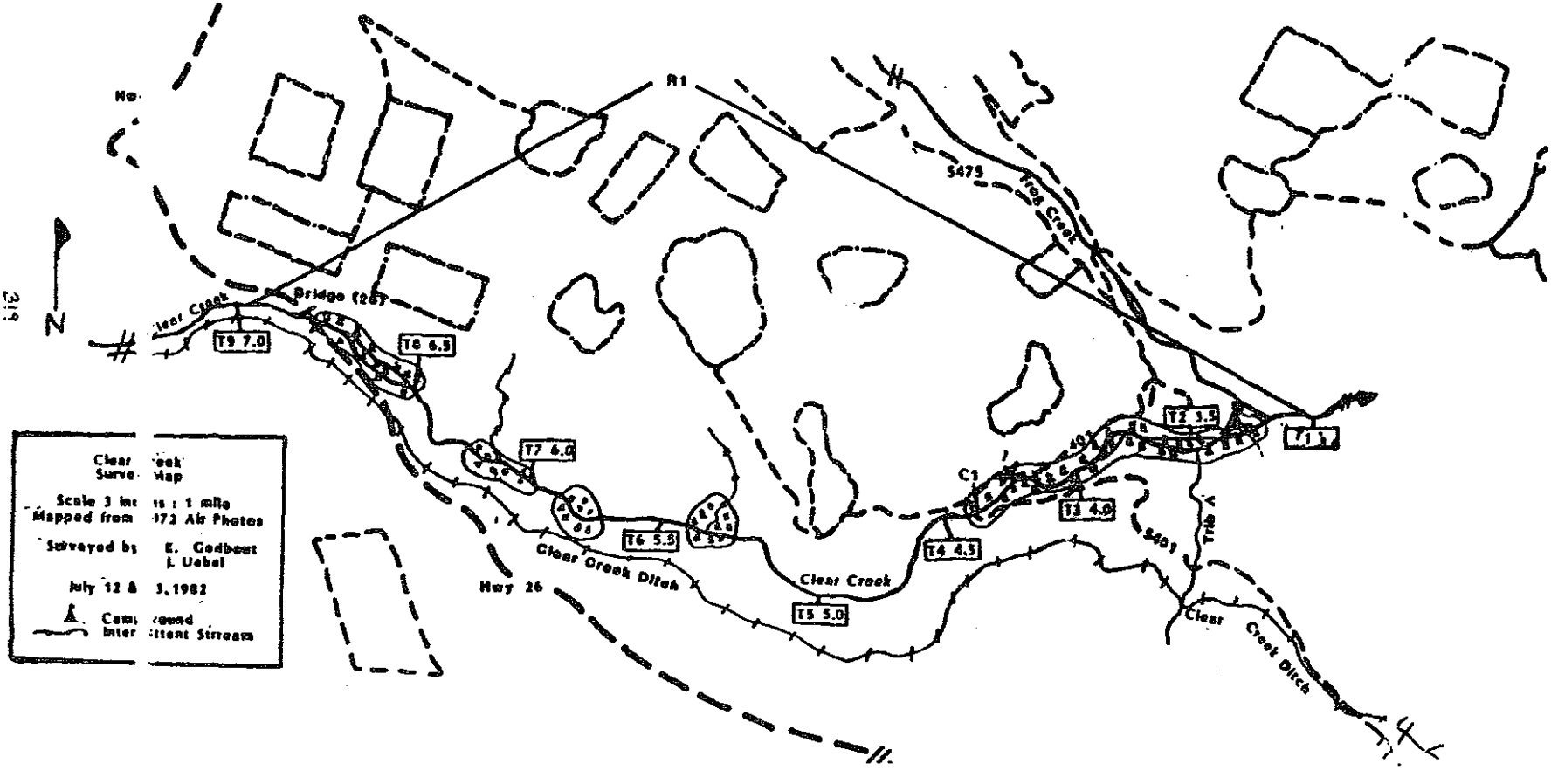


This site at R.M. 4.8 shows the atypical reach area found on 20% of the survey RM 4.4-5.2 and 6.0-6.3. An Increase in gradient (5%). boulder substrate, and decreased riparian diversity and fish habitat are characteristic of this area.

STREAM ORDER 5th
CLEAR CREEK

SCALE 1in=mi




N
R1
S475
Frog Creek
Bridge (26)
T9 7.0
T8 6.5
T7 6.0
T6 5.5
T5 5.0
T4 4.5
T3 4.0
T2 3.5
T1 3.
C1
Clear Creek Ditch
Clear Creek
Hwy 26
S401
Clear Creek Ditch
Scale 3 in
Mapped from
Surveyed by
E. Godbout
J. Uebel
July 12 &
3, 1982
Intermittent Stream

FROG CREEK
BEAR SPRINGS RANGER DISTRICT

surveyors: Davfd Wfswar
Doug Kfnzev

County: Wasco

Mouth Location:
T5S.,R10E, Sec. 8

Dates Surveyed: July 20-21 and 26-28, 1983

Tributary to: Clear Creek

Dralnage: Deschutes

Watershed Area:
8,107 Acres
12.7 Sq. Mi.

TRI Compartments:
Frog 2106

Bearpaw 2105
Camas 2103

Stream Length: 8.5 Miles

Distance Surveyed:
Mainstem; 8.5 Miles
Tributary A; 0.2 Miles
Trfhutary B; 0.8 Miles

Game Ffsh: Rainbow trout
Brook trout

LOw Flow Width (Avg): 6 Feet

Potential Anadromous Species:
Coho Salmon
Steelhead Trout

Stream Order: III

Average Fish Habitat Condition Ratfng: 6.7 (Fair-Good)

Average Riparfan 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 From Creek Ditch. This flow reduction affects fish habftat and rlparfan 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 pofnt. Frog Lake Campground lfes adjacent to the lake and to U.S. Highway 26. Resfdent 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%) to moderate (50%) qradients. 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 diverslon 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 mainstein and one for Trihutarv B. Differences are subtle and based primarily on substrate composition, amounts of silt deposition, and flow. Channel hraiding was common to all reaches.

3. Fisheries

The Overall rating of the fisheries habitat is fair to good (6.7 HCR). Pools are dominant fn all reaches. with pool-to-riffle ratios between 6:4 and 7:3. On 35% 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% suitable for utilization by trout species and 35% potentially suitable for anadromous salmonids. Spawning gravel concentration Is highest in Reach I (45%). where gravel beds range from one to 5 square yards in area (see Table III). Spawning beds in other reaches are generally less than one square yard. Very hiqh sediment loading and moss growth on gravels greatly reduce avallable 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 (4-5), 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%).

3. Substrate is primarily sand and gravel (75%).

4. Pools dominate the stream area (P:R = 7:3).

5. Stream shading is high (90%).

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 700 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%).

3. Substrate size decreases and is heavily dominated hv the gravel-sand size classes (95%).

4. Pool-to-riffle ratio decreases slightly (P:R = 6:4).

5. Stream shading continues to be high (90%).

Reach III; RM 4.6 - 6.7:

1. The valley configuration continues to be a flat-bottom V, with a floodplain width ranging hetween 30 feet to greater than 200 feet.

2. Gradient remains low (2%).

3. Substrate size classes continue to decrease. Nearly 100% are below 6" in diameter.

4. Pool-to-riffle ratio shows a slight increase (P:R = 7:3).

5. Stream shading continue\ to be high (90%).

Reach IV; KM 6.7-7.8

1. Floodplain width continues to fluctuate between 30 and greater than 200 feet.

2. Gradient remains low (2%).

3. The dominant substrate size class is gravel (40%).

4. Pool-to-riffle ratio remains 7:3.

5. Stream shading decreases to 75%.

Tributary A; RM 0.0 - 0.2:

1. Valley configuration is narrow (floodplain 60 feet) with gentle (less than 30%) sideslopes.

2. Gradient is low (2%).

3. Substrate is rubble dominated (80%).

4. Pools cover half the stream area (P:R = 5:5).

5. Stream shading is 100%.

Tributary B; RM 0.0 - 0.6:

1. Valley configuration is a flat-bottom V with a moderately wide (80 feet) floodplain.

2. Gradient is low (3%).

3. Substrates are gravel dominated (70%).

4. Pools-dominate the stream area (P:R = 6:4).

5. Stream shading is high (90%).

FRO6 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% (298 square yards) of the total gravels are in the 0.5 to 1.0 inch size class, with the remaining 40% (198 yards) in the 1.5 to 3 inch size class. LWO influences retention of 80% of the total gravels and 90% of those considered high quality. Spawning beds of five square yards in size are common.

3. Rearing habltat 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 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 0.6. It is 40 feet long with a 4.5% gradient. Velocity at the time surveyed (low-flow) was 5 feet/second.

Reach II; RM 1.7 - 4.6:

1. The fish habitat quality decreases somewhat, remaining good (HCR = 6.7). Flow is greatlv reduced from RM 3.0-4.5 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% are in the 0.5 to 1 inch size class. Ninety percent are dependent on LWO. The substate in this reach is predominantly gravel (75%); 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 RN 3.5. The structure is 40 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% 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" deep) during summer flows. No jump pool Is provided for the 3 foot 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. Seventv 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 Conditinn Rating is fair (HCR = 4.A).

2. Althouqh 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" deep with high effective cover.

3. Eighty-seven yards of spawning gravels were counted Approximately 95% 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 imnediately 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% of stream length.

Although much of this drainage has been logged (see map), full retention buffer strip areas averaging 100 feet on either hank 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% of stream length) small wetlands occurring around and between channel hraids.

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 over-story 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% 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 1.7 - 4.6:

1. The riparian habitat decreases to moderate quality (RCR = 5.8).

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 than for Reach I (poles).

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% 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 overstorv 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 700 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 overstorr is composed of cedar and hemlock. Pacific yew overhangs the stream channel and areas immediately upslope.

Trlbutary B; RM 0.0 - 0.8:

1. The Riparian Conditlon 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 miqration obstructions include the three culverts and the diversion structure on the mainstem. and a log ford on Tributarv 6.

Culvert #1 (RM 0.8) is a partial barrier with a gradient of 4.5%; 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 miqratlon. 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 (RM 0.0-1.7) is limited. Increasing stream flow RM 1.7-4.6 may improve spawning habitat conditions, by lowering sediment loading and levels of aquatic veqetation. Installing channel structures for gravel retention may improve spawninq areas above RM 4.6. Introducing qravels may be required at gravel catchment sites due to the low bedload movement throughout the stream lenqth.

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: Presentlv, 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 generation 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	L4		H		5	20	35	30	10	4
II (1.7-4.6)	6.7	90	6:4	2	L3		H	-	*	10	40	35	15	3
III (4.6-6.7)	6.9	80	7:3	2	L3.5		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 3%)
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.

Species	REACH I	ii	111	IV	Tributary A	TRIBUTARY B
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)

Reach (R.M.)	Spawnino Gravel (Sq. Yds.) Total	Good	Marginal
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 f0.0-D.8)	87	47	40
TOTAL	1076	631	445

FROG CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM	(R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS
Frog Creek	0.8	Culvert	C_1	P	Velocity barrier (length 40 ft., 4.5% gradient, low flow velocity 5 ft./sec.), baffle.
Frog Creek	3.55	Culvert	C_2*	P	Partial high flow barrier. (length 90 ft., 1.5% gradient, low flow velocity 2 ft./sec.). baffle.
Frog Creek	4.6	Diversion Structure	D_1	N	Improve jump pool.
Frog Creek	6.8	Culvert	C3	F	Create jump pool
Tributary B	0.28	Log ford	L_1	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.

FRO6 CREEK

TABLE V - ANADROMOUS HABITAT SUMMARY

Reach (RM)	Miles Avail.	Miles Pot.	Rearing P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
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	0	7:3	1	0.5	35		
Trlb. A (0.0-0.2)	0.2	0.8	5:5	0 5	0.5	0	i	
Trib. B (0.0-0.8)	0	0.0	6:4	i	0.5	- 4	0	
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.)	SP. GRAVELS Total (%)	SP. GRAVELS HQ (%	POOL Total (%)	POOL HQ* (%)	LWD CHARACTERISTICS OR	#	L	Dia	Source
I (0.0-1.7)	80	90	85	0	Perp	S-M	l-2	l-2	L
II (1.7-4.6)	90	95	95	0	Perp	S-M	l-2	l-2	L
III (4.6-6.7)	95	loo	95	0	Perp	S-M	l-2	l-2	L
IV (6.7-7.8)	100	loo	100	0	Perp	S-M	1-2	l-2	L
Tributary A.	100	100	100	0	Perp	S-M	1-2	l-2	L
Tributary 8.	100	100	100	0	Perp	S-M	1-2	I-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

Reach (R.M.)	SUMMER w	SUMMER d	SUMMER v	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
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	a	.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

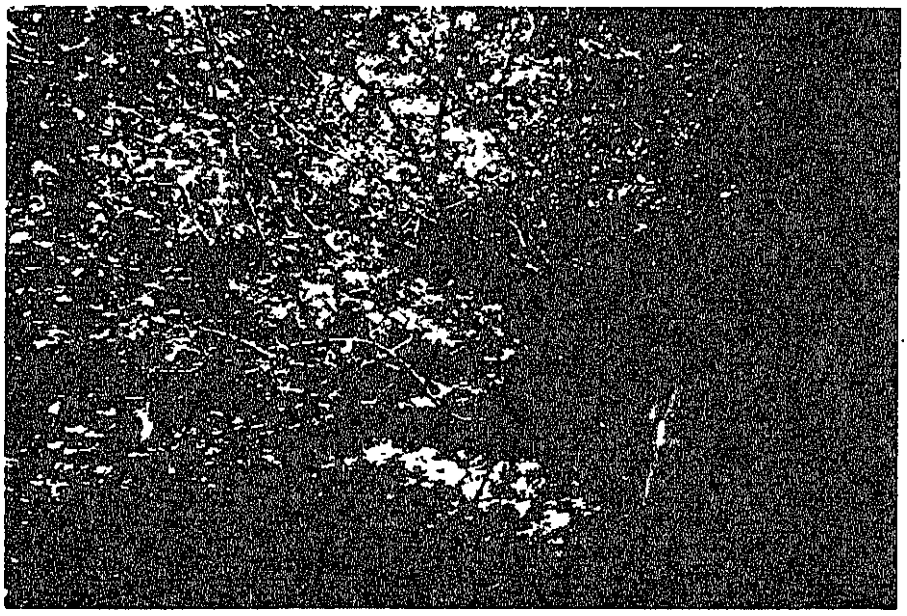
REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/H_2O TEMP. °F A/W	A/W	TIME
I (0.0-1.7)	7/20/83	6	90	SE	55/49	58/51	1530-1845
II (1.7-4.6)	7/21,26/83	i	90	SE	58/46	64/49	1130-1700
III (4.6-6.7)	7/26-27/83		80		57/42	61/44	1730-1815
IV (6.7-7.8)	7/27/83	1	75	SE	57/46		1400-1500
Tributary B.	7/28/83	3	80	S	64/43		1300

FROG CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATIDW H.U.	Dverstory Con.	Dec.	Stream-class	Wetland %	AQUATIC Size	Special Habitat
I (0.0-l. 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
Tributary A. (0.0-0.2)	3.2	60	2	2	0	3	--	--	0
Tributary 6. (0.0-0.8)	4.6	80	5	2	0	2	--	--	0

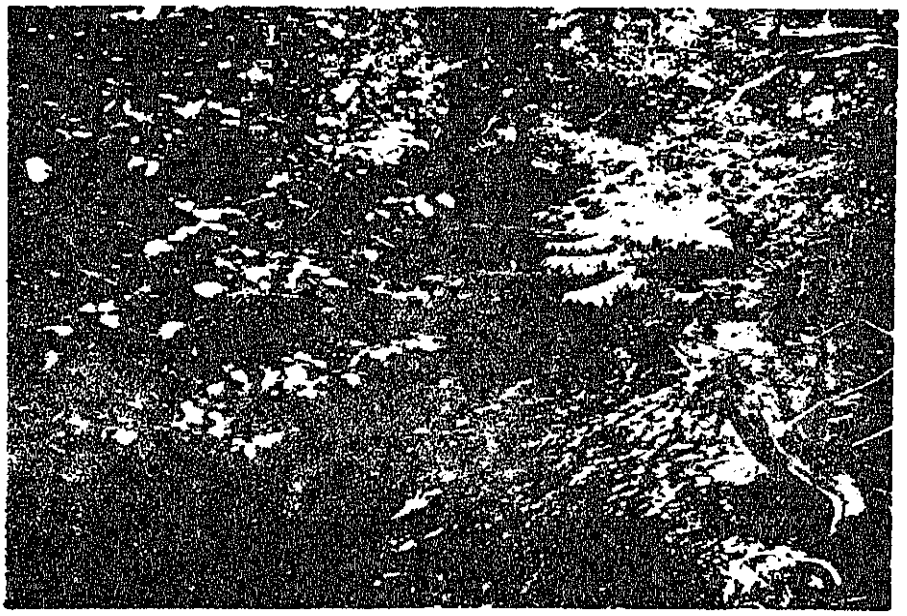
LEGEND: RCR: Riparian Condition Rating
F.P.: Floodplain
H.U.: # Habitat Units Ii ≥ 4; M 2-3; L ≤ 1
Con: # Conifer Species
Dec: # Deciduous Species
Wetland: % stream length with adjacent wetlands;
H ≥ 50%; M = 25-50%; L 4 25%
Size: Size of wetlands
S = Small (less than 1 acre)
L = Large (greater than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



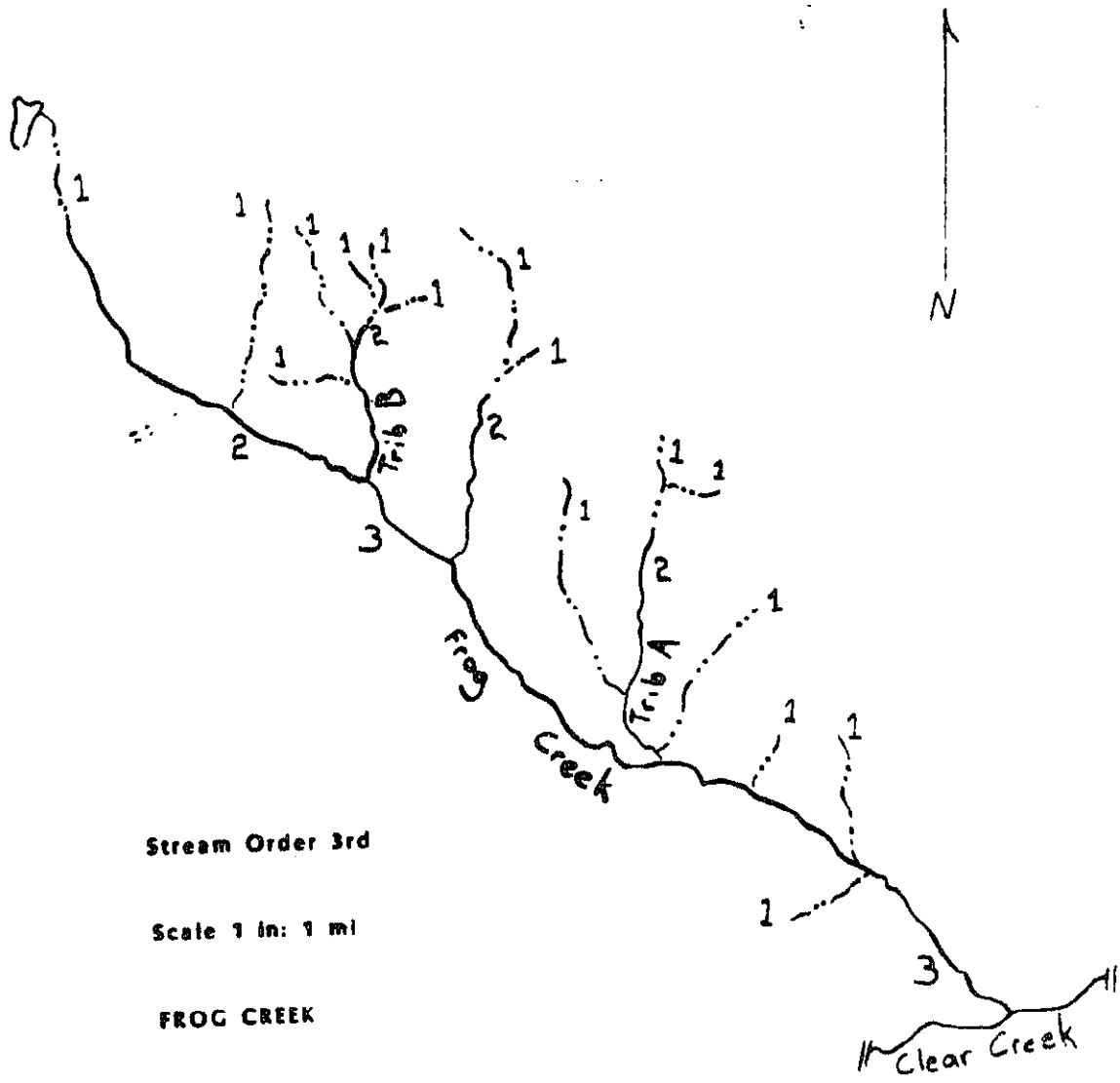
True riparian vegetation Is dominated by dense tag alder and Pacific yew along much of the stream In Reach, III fabove the ditch diversion at RM 4.6). Channel structure is provided by moss covered hummocks of decavlng logs, often supporting new growth. Channel braiding Is very common.

The Influence of LWD continues to be hi h in Reach IV (photo at R.M. 7.31 although channel braiding is reduced. iverage 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 retentfon is high (80%). Rearlng 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.



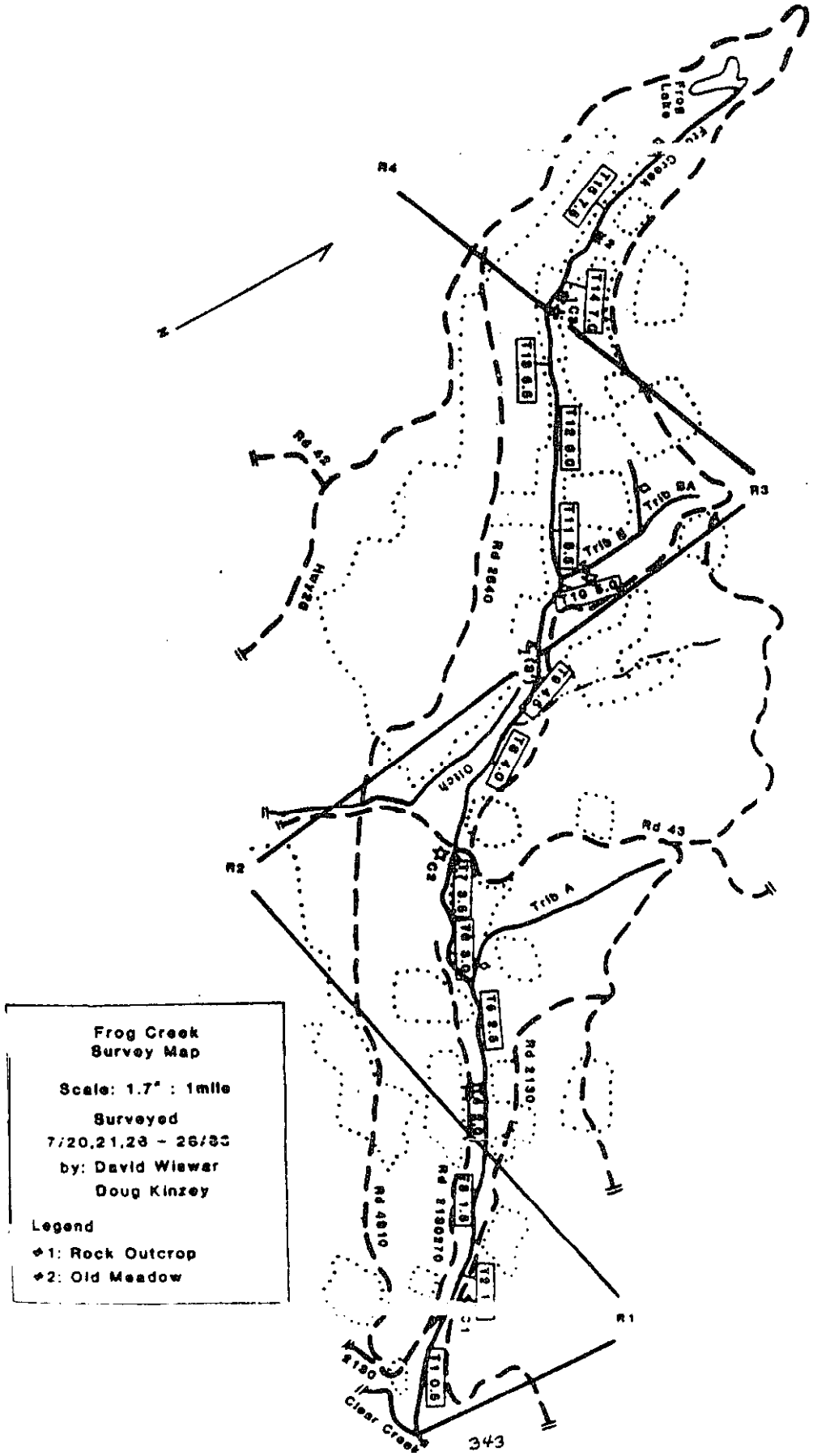
Channel braiding In Reach II is common and is highly influenced by LWD. The gradient Is low (2%), and the channel substrate Is comprised of small-size gravel and sand. Eighty-five percent of the spawning gravels (189 sq. yd.) are suited for resident trout utilization.



Stream Order 3rd

Scale 1 in: 1 mi

FROG CREEK


Frog Creek
Survey Map
Scale: 1.7" : 1mile
Surveyed
7/20,21,23 - 26/93
by: David Wiewer
Doug Kinzey
Legend
#1: Rock Outcrop
#2: Old Meadow
R1
R2
R3
R4
Rd 43
Rd 2640
Rd 2150
Rd 4010
Rd 2150.70
Trib A
Trib B
Trib BA
Ditch
Clear Creek
Frog Lake
Creek
T1 0.6
T2 1.0
T3 1.6
T4 2.0
T5 2.5
T6 3.0
T7 3.6
T8 4.0
T9 4.6
T10 5.0
T11 5.6
T12 6.0
T13 6.6
T14 7.0
T15 7.6

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 1.0	TRANSECT I and RIVERMILE
OBSTRUCTION	BARRIER
J1,2,3,	JAM and #
)1,2,3	FALLS, HEIGHT, and #
C1,2,3	CULVERT and #
,2,	CHUTE and #
	DIVERSION STRUCTURE (I = watar Is used for irrigation purposes)
	MINE or ROCK PIT SITE
	BRIDGE
	LANMLIOE, SLUMP
	DEBRIS TORRENT TRACK
.	SPRING
	UPPER LIMIT OF FISH PRESENT (A = limlt of potentlal anadromous fish habitat)
	BANK EROSION (EXTENSIVE/SEVERE\
	1,2,3, :MISCELLANEOUS
	WETLAND HABITAT
S-47	ROAD AND ID NUMBER
	EARTHFLOW

BARLOW CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

Dates Surveyed: August 9-11. 1983

Tributary to: White River

Dralnage: Deschutes

TRI Compartments:
Bonney 2201
Grindstone 2203
Bird 2204

Gamefish: Rainbow trout
Brook trout

Potential Anadromous Species:
Coho Salmon
Steelhead trout
Chinook Salmon

County: Hood River
Wasco

Mouth Location:
T.4S, R.9E., Sec. 24

Watershed Acres: 6,692 acres
10.5 sq. mi.

Stream Length: 7.1 miles

Distance Surveyed:
Yainstem: 6.8 miles

Low Flow Width (Avg.) 10 feet

Stream Order: III

Average Fish Habltat Condition Ratinq: 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% (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 lenqth. Oregon State Highway 35 crosses the headwaters at Barlow Pass and Forest Service Road 43 passes near the month. Four Forest Service campgrounds are located along Barlow Creek. These include Barlow Crossinq 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 camwites are also heavily used along the stream. Rainbow and brook trout were observed to RM 6.0.

B. Watershed Characteristics and Geomorphologv

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%). Valley walls are moderately steep to steep (60-90%). Stream gradient is low throughout the stream's length (2-4%), 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% (3 cfs) of the flow at its confluence with Barlow Creek (RM 4.9). Numerous ephemeral streams drain the highlv dissected west slope of Barlow Ridge. Larqe 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. Reach Descriptions

Four reaches were identified along the malnstem 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% 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%) 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 effectlve cover. Spawning gravels total 893 square yards with 80% potentially suftable'for utilization by anadromous salmonids. Seventv 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 coon. 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 hlgh in the upper reaches. High quality pool formation is heavily dependent on LWD (70-90%) 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 habltat In Barlow Creek appears well-suited for and steelhead trout, chinook and coho salmon.

E. Rlparian Area

The rlparian habitat conditions are rated high (RCR = 7.11. Positive factors include a wide floodplain, high number of habltat 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 proximitv of the Barlow Road to the stream. Loss of riparlan vegetatlon 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 dlrected 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 limlting factor.

BARLOW CREEK

Reach Summary

Reach I; RM 0.0 - 2.7:

1. The floodplain width is greater than 200 feet fn a very wide (200+ ft.1 glacial, U-shaped vallev. (Barlow Creek flows in the White River floodplain).

2. Stream gradient is low (2%).

3. Channel substrate is comprised of gravel and rubble.

4. Pools domlnate the stream area (P:R = 7:3).

5. Stream shaciing is moderate (60%).

Reach 11: RM 2.7 - 5.4:

1. The valley shape changes to a very wide, flat-bottom V-conflguration. Floodplafn wldths range from 80 to greater than 200 feet.

2. Stream gradient remains low (3%).

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%).

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 vallev floor below RM 6.0. At RM 6.0 the stream braids into a large meadow.

2. Gradient is low (2%).

3. Gravel and sand are the predominant channel substrate.

4. The stream area is dominated bv pools (P:R = 7:3).

5. Stream shading is moderate (50%).

Reach IV; RM 6.4 - 6.8:

1. Valley configuration Is V-notched with steep (> 70%) sideslopes. Floodplain width averages 75 feet.

2. Gradient is stepped and highly influenced by LWD; the gradient ranges from 7-17x.

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%).

Tributaries

Four trihutaries of Barlow Creek were surveyed. Palmateer Creek is the only one that appears to contain fish habitat; however, its hiqh gradient (11%) would preclude the introduction of any anadromous species. It is a major water source for Barlow Creek, providing approximately 40% of the flow (3 cfs) at their confluence (RM 4.91.

Green Lake Creek (RM 0.71 had 0.5 cfs flowing in a 4-foot wide channel. Substrate is small woody debris, leaf litter and alga?.

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% of the flow (1.5 cfs) at its confluence with Barlow Creek (RM 5.5). Stream hanks are hiqh (> 4 ft.) and highly susceptible to erosion; the channel width is 5 feet wide and tie flow reqime is flashy.

BARLOW CREEK

Fish Habitat Summary

The overall Fish Habitat Conditlon Rating is good (HCR =7.3). Positive components of the score included good baseflow, ample spawning habltat in Reaches I and II (RM 0.0 - 5.41, 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% (343 sq.yd.) are good quality. Approximately 50% of the total are in the 1.5-3 inch size class and 45% in the 3-6 inch size class. Spawning beds of 5+square yards are common. LWD influenced formatlon of 60% of all the beds and 70% of those considered high qualitv.

3. Rearing habitat is good in this reach. Pools dominate the stream area (P:R = 7:3). Pool size averages I4 square yards with moderate depths (1.5 ft.1 and moderate effective cover. Small, shallow pools (< 1 sq. yd.) and low velocity riffles are common alonq 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. LWO influences only 30% of the pool formation: however. ninety 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 velocitv above the jam is 4-5 ft./sec.

Reach II; RM 2.7 - 5.4:

1. The fish habitat qualitv is rated good (HCR =7.5). Rainbow and hrook trout were observed in moderate numbers.

2. Spawning oravels total 175 square yards with most (80%) found below RM 4.0. The gravel beds are smaller (1-3 sq. yd.) than these 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% of the I rds and 50% of those considered high qualitv

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. Fiftv percent of all the pools present are influenced by LWD. and 70% 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 Logiam #7 (RM 4.0) is a partial barrier based on the height 14 ft.), length (6 ft.) and shallow jump poo' 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 apoears passable in all flows.

Reach IV: RM 6.4 - 6.9:

1. The fish habitat qualitv 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%). 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. Eiqhtv 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% gradient.

BARLOW CREEK

Riparian Habltat 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 verv wide (greater than 200 feet), flat-bottom IJ-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 larae (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 slightlv to 7.6.

2. The floodplain width fluctuates between greater tnan 200 feet at the start of the reach and 60 feet bv the end, forming a "at-bottom U-shaped valley.

3. All five habitat units are present.

4. The coniferous overstory is dominated bv cedar, hemlock, and true fir (noble and silver), with lesser amounts of Douglas-fir and lodgepole pine. Red alder is the onlv overstorv deciduous species and was observed only in the upper mile of this reach.

5. Two special habitats occur up in this reach are the rocky outcrops at RM 2.7, and the dry alder meadow (4 to 5 acres) at RM 4.5.

React! III; RM 5.4 - 6.4

1. The Riparian Condition Rating increases to verv 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-shaoed 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 diversitv is limfted 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 = 3.71.

2. Two factors contributing to the poor rating are the narrow (30 fee? wide) V-notch valley configuration, and a lack of special hahitats.

3. Four habitat units are present, with the shrub-serdling-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 153 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:

Rehabllitation efforts directed at lessening streamside impacts of the Barlow Road and its associated campgrounds and undeveloped sites could benefit this system. Presently, degradation of streamhanks and vegetation are evldent 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 bush 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 spawnlna 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) mav be partial low-flow barriers. Monitoring passage at these structures, and subsequent alteration (easily accessed by the Barlow Road) mav 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 ≤ 12", M = 12 - 29", H ≥ 30")
A: Aver-age pool area (sq. yards)
EC: Effective cover (L ≤ 40%, M 40-60%, H ≥ 60%)
BR: Bedrock
SD: Sand
D: Average depth (inches)
*: Present, hut it?:: than 5%

BARLOW CREEK

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

Species	REACH I	II	III	IV
Trout fry	H	H	M	( )
Trout - j	M	M	L	( )
Trout - a	M	M	L	( )
Rainbow trout - a	*	( )	L	( )

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

* = habitat suitable; presence reoorted but not observed.
( )= habitat suitahle; may not be present

TABLE III - SPAWNING GRAVEL (SQUARE YARDS!

Reach (R.M.)	Spawning Gravel (Sa. Yds.) Total	Good	Marginal
I 10.0 - 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)	18	9	9
TOTAL	893	484	409

BARLOW CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	IO #	PASSABLE	RECOMMENDATIONS*
0.95	Logjam	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	Low flow barrier, monitor for passage
3.17	Logjam	J6	F	Monitor for passage
4.0	Logjam	J7	P	Monitor for passage
4.9	Logjam	JB	F	Monitor for passage
6.3	Culvert	Cl	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 Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
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	
III (5.4-6.4)	1.0	0.0	7:3	6	1.0	11	1	
IV (6.4-6.8)	0.4	0.0	6:4	1	0.5	4	0	
Total	6.8	0.0				421	317	

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 [illegible] ved in the 1"-3" and 3"-[illegible] size classes

BARLOW CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		pooL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HO (%)	Total (%)	HO (%)	OR	#	L	Dia	Source
I (0.0-2.7)	60	70	30	90	Perp	S+M	1-2	1-2	M
II (2.7-5.4)	75	80	50	70	Perp	S+M	1-2	1-2	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: % of total habitat area dependant on LWD
HO: % of high quality habitat area deoendent on LWD
OR: angle of orientation to flow; Perp = perpendicular, Var = variable
#: number of logs/structure; S = single log, M = multi-log
L: average lenqth 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

	SUMMER				BANKFULL		
Reach (R.M.)	w	d	v	Q	W	D	Floodplain Width (Ft.)
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	4	12	1.5	40 - 200+
IV (6.4-6.8)	4	.2	2	1.5	6	1	30

* Data compiled from transect measurements.

LEGEND: W,w: Stream width (ft)
D,d: Stream depth (ft)
v: Velocity (feet/second)
Q: Average discharge (feet/second)

BARLOW CREEK

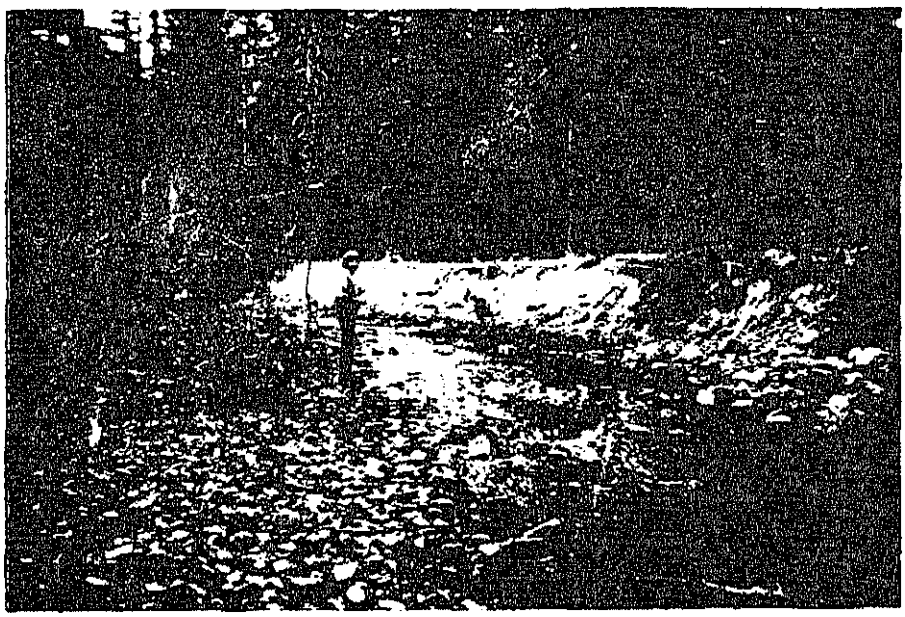
TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP. ° F A/W A/W	TIME
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

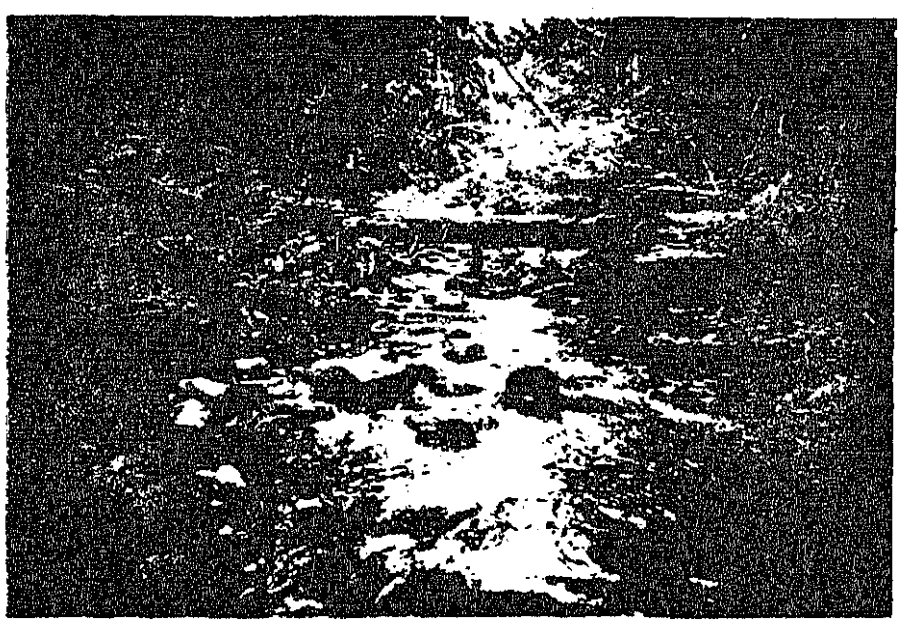
TABLE IX - RIPARIAN HABITAT.SUYMARY

REACH RM	RCR	VALLEY	VEGETATION			AQUATIC			
		F.P. (ft.)	H.U.	Overstory Con.	Overstory Dec.	Streamclass	Wetland%	Size	Special Habitat
I (0.0.-2.7)	7.1	200	5	5	1	II	L	L	1
II (2.7-5.4)	7.6	150	5	3	1	II	M	L, S	2
III (5.4-6.4)	8.2	130	3	2	1	II	H	L, S	3
IV (6.4-6.8)	3.8	30	4	4	1	II	-	-	0

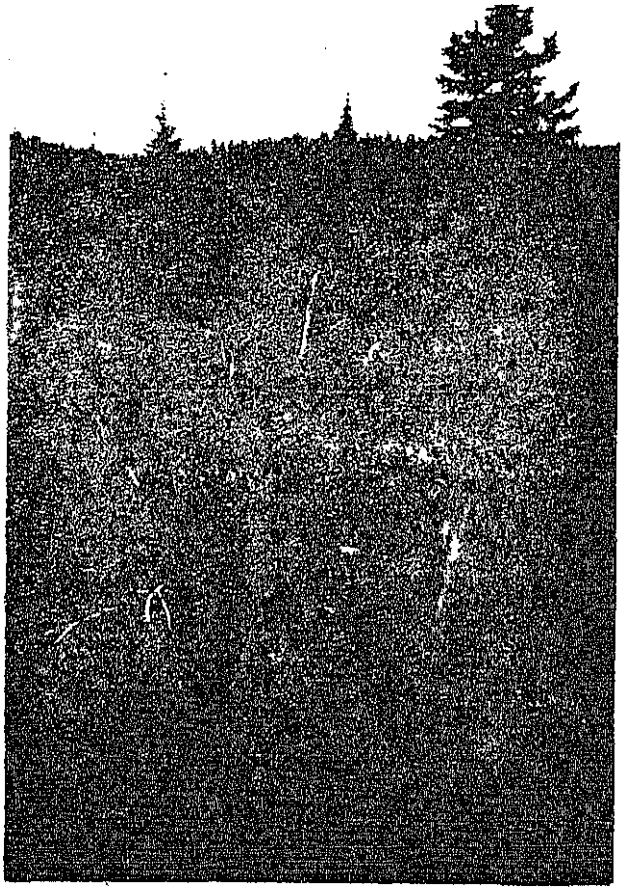
LEGEND: RCR: Riparian Condition Rating
F.P.: Floodplain
H.U.: # Habitat Units: H $\geq$ 4; M 2-3; L $\leq$ 1
Con: # Conifer Species
Dec: # Deciduous Species
Wetland: % stream length with adjacent wetlands; H >50%; M: 25-50%; L < 25%
Size: Size of Wetlands
S = Small (less than 1 acre)
L = Large (greater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



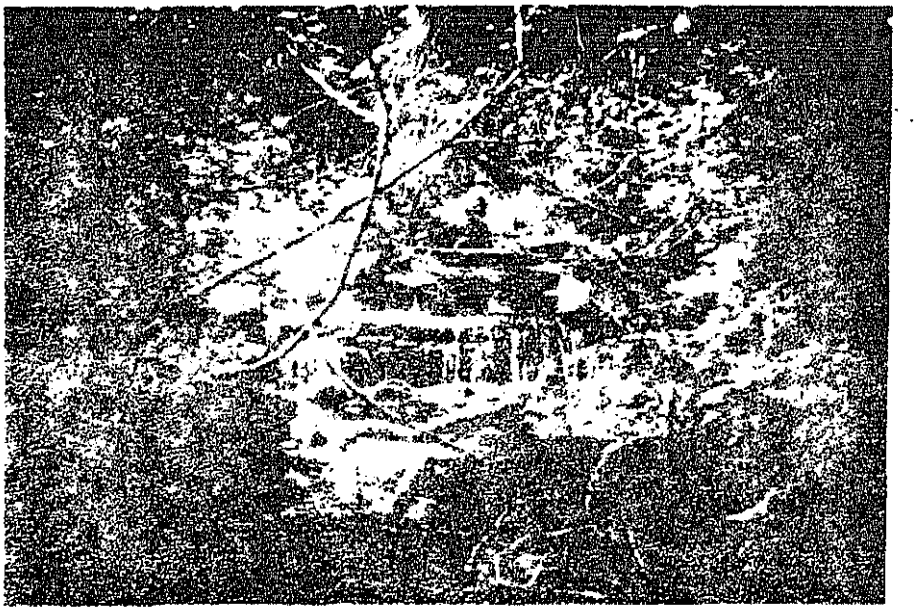
Barlow Creek in Reach I (shown at R.Y. 2.0) flows through the broad White River floodplain. The stream gradient is low (2%) over a gravel and rubble substrate. Pools dominate the stream surface area (P:R = 7:3). Spawnlng habitat Is abundant with over 600 square yards of spawning gravels counted (95% are suitable for anadromous salmonids utilization).



Riffle area increases in Reach II (P:R=4:6). Small boulders are the predominant channel structural componant in this area. Average pool area decreases 50% fra 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.

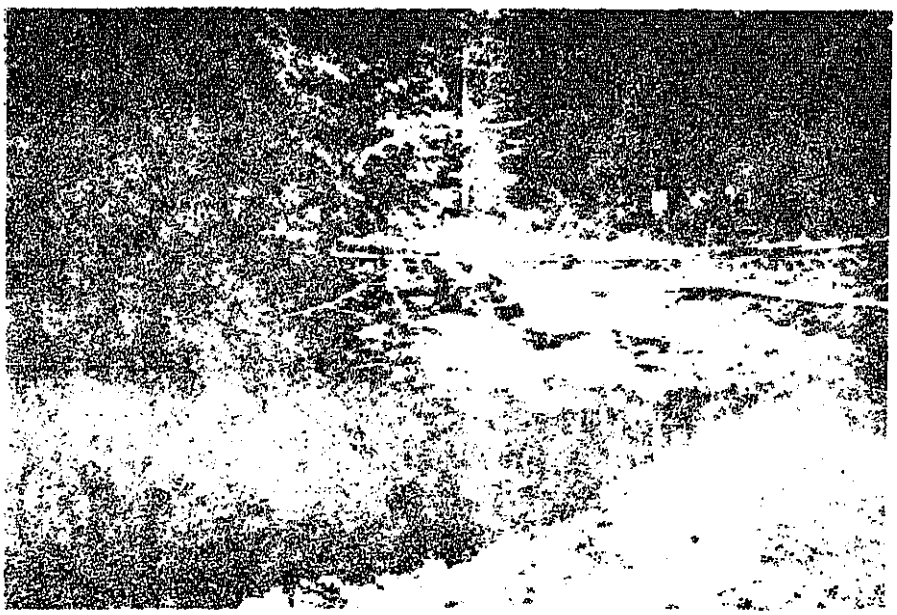


At RM 6.0 Barlow Creek braids out Into a large sedge meadow, Numerous beaver channels are present. The Old Barlow Road parallels the east side of the area. and Devil's Half Acre Campground is also adjacent. Although riparian habitat is very high quality, wildlife utilization (especially big game) may be affected by the apparently heavy recreational usage of the area.

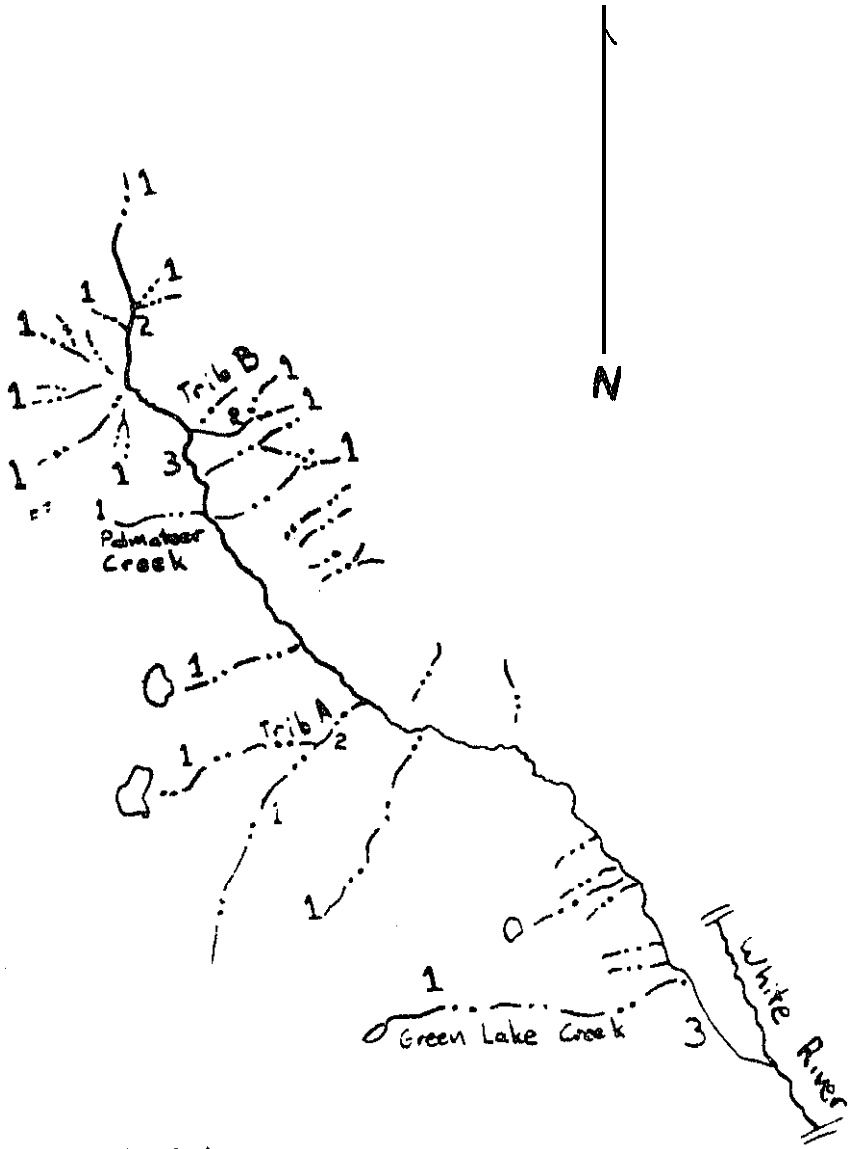


The presence of large woody debris, moderate gradient (7%) and high shading characterize Reach IV (photo at R.M. 6.5). The channel substrate is dominated by boulder and rubble. Rearing habitat Is fair; pools are small with shallow to moderate depths.

Palmateer Creek provides about 40% (3 cfs) of the flow at its confluence with Barlow Creek (R.M. 4.81. It has a hlgh gradient (11%), and fish habitat appears marginal. Pools are small with shallow deoths. and channel structure is largely from locally introduced large woody debris.



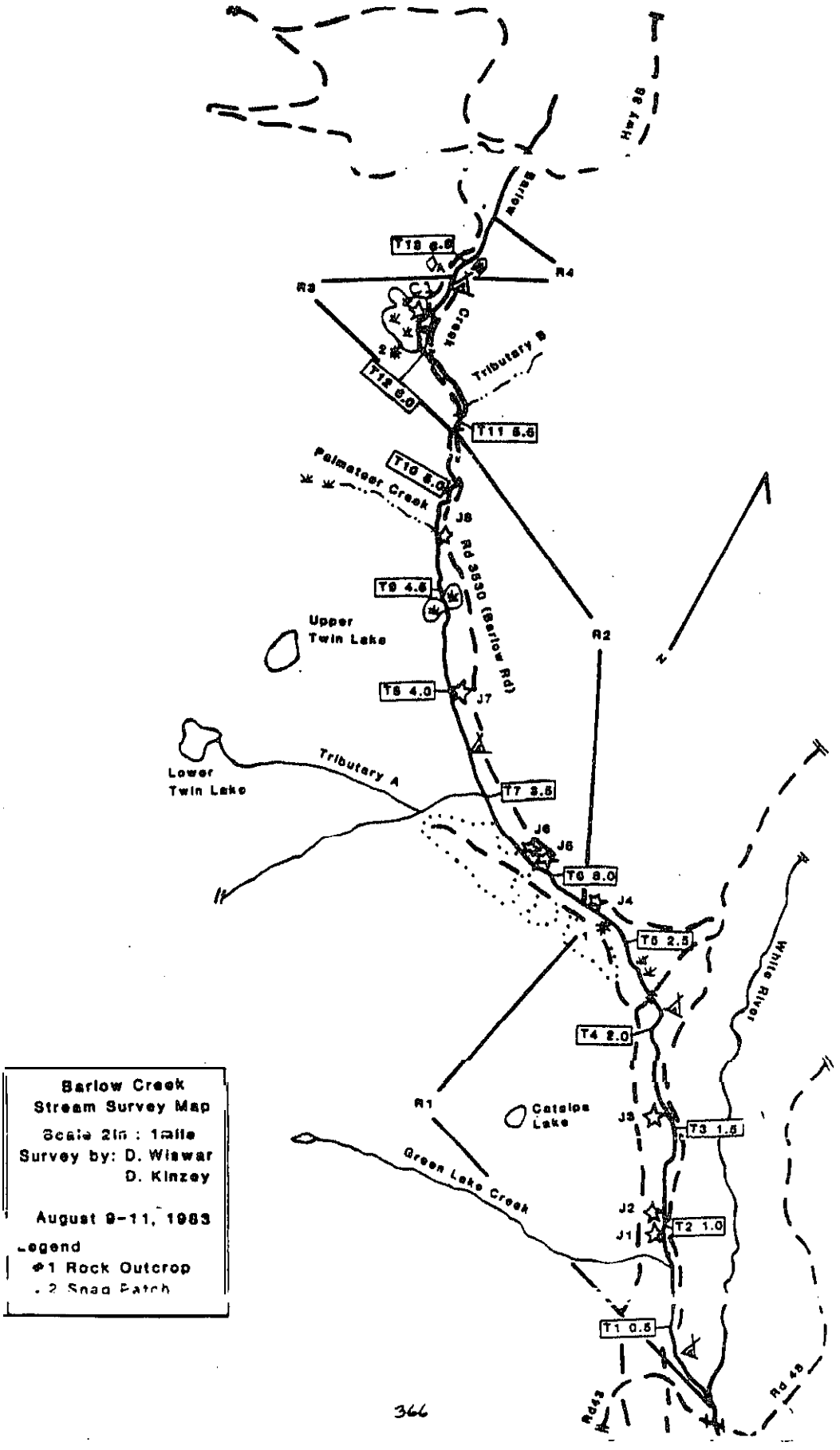
Four Forest Service campgrounds are located alonq Barlow Creek. Loss of riparian vegetation and high levels of bank instability in these areas appear to be a direct result of the heavy localized recreational use. Rehabilitation efforts in these areas should likely he a hiqh priority for maintaining the existing high quality fish habitat. This site is at RM 1.9.



Stream Order 3rd

BARLOW CREEK

Scale 1 in : 1 mi


Barlow Creek
Stream Survey Map
Scale 2in : 1mile
Survey by: D. Wiswar
D. Kinzey
August 9-11, 1983
Legend
#1 Rock Outcrop
#2 Snag Patch
Hwy 35
Barlow
R4
R3
T13 6.5
Creek
Tributary B
T12 6.0
T11 5.5
T10 5.0
Palmateer Creek
J8
Rd 3530 (Barlow Rd)
T9 4.5
Upper
Twin Lake
R2
T8 4.0
J7
Lower
Twin Lake
Tributary A
T7 3.5
J6
J5
T6 3.0
J4
T5 2.5
White River
T4 2.0
R1
Catalpa
Lake
J3
T3 1.5
Green Lake Creek
J2
J1
T2 1.0
T1 0.5
Rd 43
Rd 45

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 1.0	TRANSECT I and RIVERMILE
OBSTRUCTION	BARRIER
J1,2,3,	JAN and #
)1,2,3	FALLS, HEIGHT, and I
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
S-47	ROAD AND ID NUMBER
	EARTHFLOW

BUCK CREEK
BEAR SPRINGS RANGER DISTRICT

Surveyors: Jeff Uebel. Tom Cain

County: wasco

Date Surveved: **August** 16, 1983

Mouth Location: **T4S, R10E,** Sec. 19

Tributarv To: Wnite River

Watershed Area: 3.0 so. mi.
1938 acres

Drainage: Deschutes

Stream **Length:** 2.0 miles

TRI Compartment: Bonnev, 2201

Distance Surveved: 7.0 mires

Game Fish: **Rainbow** & Brook Trout

Ava. Low Flow Width: 4 ft.

Potential Anadromous Species: Coho
Steelhead

Stream Order: 11

Average Fish Habitat Condition Rating: a.9 (Fair)

Average Riparian Condition Rating: 5.3 (Moderate)

BUCK CREEK
Survey Summarv

A. Stream Survey

Buck Creek is a minor second order trihutarv to White River, providinq 1.5 cfs (low flow) at their confluence (RM 36.0 of White River). The entire drainage area (1938 acres) lies on National Forest System Land. Access is good with road crossinqs at RM 0.3 (Spur 071), RM 0.7 IS-481, 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 hrook trout were observed between the mouth and RM 1.5.

B. Watershed Characteristics and Geomorpholoqy

The vallev configuration is tvoically a narrow, flat bottom "V" with a floodplain width ranginq hetween 30-50 feet. An exceotion 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 generallv gentle to moderatelv steep with an atypical section (RM 0.5-1.2) havina steeo sideslopes. Tributaries are small first and second order streams, flowinq less than 1 cfs during low flow. Groundwater is aoparentlv supplementinq flows in the vicinity of RM 1.0. Flows in this area are noticeablv increased without a significant addition from surface sources. Water temperatures observed In this area were quite low (49°F), which likelv indicates groundwater recharqe. The surface flow reqime appears to be moderatelv flashv.

C. Reach Descriptions

Two reaches were identified. These are primarilv distinquished by pool to riffle ratio, streamflow discharqe, and qradient. Reach I (RM 0.0 - 1.0) is riffle dominated (60%) and lower qradient (5%) than Reach II (RM 1.0 - 2.0) which is pool dominated (60%) with a hiqher averaqe Qradient (10%). 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 ratinq is ooor to fair (HCR = 4.9). Low numbers of rainbow and brook trout were observed from the mouth to RM 1.5. Approximatelv one mile of potential anadromous fish habitat exists on the mainstem including potential coho habitat in the lower 0.7 miles and winter steelhead hahitat to RM 1.0. Low flow rearinq habitat is poor with 70% of the pools less than 17 inches deeo. 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 slightlv larqer and deeper (50% are I 2.5 ft. deep) in Peach I than the small, shallow pools of Reach II. Spawninq hahitat is good in Reach I which contains 75% (180 sq. yds.) of the total stream qravels counted. Seventy w-cent of these ace of a size class suitable for anadromous utilization.

E. Riparian Areas

The overall rloarian condition rating is 5.3 (moderate). Negative factors influencinq this score are found primarllv in Reach Il. including the predominantly dense coniferous overstory, limited floodplain width, and lack of special hahitat units. Positive factors fprimarilv in Reach 11 include the presence of cottonwood In the overstory. an increased floodplain width, all five habitat units, and two special habitats, Including a lar e wetland located between the mouth and RM 0.1. An active timber sale 3408 Tie) lies within the dralnage and 65% of the surveyed area (RM 0.0-0.7 and 1.1-1.7) is within the sale boundary.

F. Rehahilitation and Enhancement

Rehab/enhancement possihilities include pool development throughout the stream, passage enhancement at a debris iam (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 bottomm "V" with gentle sldeslopes.

2. The gradient averages 5%.

3. The riffle bottom composition is predominsntlv small boulder/rubble (65%).

4. Riffles dominate the stream area (60%).

5. Shading is high (85%).

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% with a range of 6 - 14%.

3. The bottom composition is similar to Reach I.

4. Pool area increases to 60%.

5. Shading decreases sliahtlv (75%).

Tributary A:

Tributary A is a major tributarv 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 hiahwater width of five feet and a gradient of 7%. Marginal trout hahitat is present for approximately the lower 0.2 miles.

Tributary B:

Trlb B contributes approximately 30% (0.3 cfs) of the flow in Suck Creek at their confluence (RM 1.01. The gradient is high (30%) and no fish habitat appears to be present.

BUCK CREEK
Fish Habitat Summarv

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 hiqh and is provided by LWO, the boulder/rubble substrate, and water turbulence.

3. Spawning habitat is good with 70% of the 180 sq. vds. of gravel In a size class suitahle for anadromous utilization. Fiftv percent of the gravels are rated qood qualitv.

4. A trash rack associated with culvert C3 (RM 0.71 forms a partial passage barrier due to a steeo chute of boulders at its hase.

5. Potential-anadromous habitat appears to end at RM 1.0.

Reach II; RM 1.0 - 2.0:

1. The hahltat condition rating decreases to 4.0 (poor).

2. Pool rearing habitat is poor. Pools are tvpicallv smaller (1 sq. yd.) and shallower (less than 12") than the previous reach. Effective cover decreases and is primarilv 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% less than 1" in diameter). Fiftv percent are rated as good quality.

4. The upper limit of resident trout hahitat appears to end at approximatelv RM 1.5.

Tributary A:

Trib A has approximately 0.2 miles of marqinal resident trout hahitat. Low summer flows and poor pool development appear to limit fish production.

BUCK CREEK
Riparian Hahftat Summary

Reach I; RM 0.0 - 1.0:

1. The riparian condition rating is 6.2 (high).
2. The floodplain width averaqes 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 larqe and small wetlands, particularly RM 0.0-0.1, and a small talus slope (RM 1.0).

Reach II; RM 1.0 - 7.0:

1. The riparian condition ratino decreases to 4.3 (moderate).
2. The average floodolain width decreases to 35 feet.
3. All five hahitat units are present. Large saw timber is reduced in some areas due to past fires and recent logging.
4. The coniferous overstorv is structurally similar to Reach I. No deciduous species are included in the overstorv.
5. No special habitat units were observed.

BUCK CREEK
Rehabilitation and Enhancement Summarv

Pool Rearinq Habitat Enhancement: RM 0.0-1.5.

Pool rearing habitat is generallv poor in terms of quantity and qualitv (depth, area) throughout the stream. Enlarging existing pools and creating additional pools could increase fish production. Access Is good to manv sites in both reaches, and project implementation could utilize either heavy equipment or hand tools.

Passaqe Enhancement: RM 0.6 and 0.7.

A small debris jam acts as a oartial barrier at RM 0.6. Partial removal could enhance passage. A trash rack at RM 0.7 also appears to be a partial passaqe barrier to potential anadromous fish miqration. Boulders either used durinq construction of the trash rack or trapped from bedload movement have formed a small boulder catatract at the hase of the rack. Passage could be enhanced bv 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 he accompllshed with hand tools.

Two culverts, Cl (RM 1.9) and C2 (RM 1.6) are above the apoarent limit of resident and potential andromous fish habitat so no modifications are needed.

At the time of the survev, 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 reoortedly been installed at this site. An inspection for fish passage prohlems and soil Instahilitv should likelv he made.

Riparian Enhancement: RM 0.5-2.0.

A dense coniferous overstorv apparentlv reduces riparian diversitv as evidenced bv the lack of deciduous species in the riparian overstorv (RM 0.5-2.0). Planting deciduous species in the riparlan area of recentlv harvested clearcuts could increase the riparian diversitv.

The large wetland at RM 0.0-0.1 is hecomino dominated by densely stocked "tag" alder. Small patch hurns to create grass/sedge openinos could improve structural hahitat diversity In the wetland.

Stream Monitorinq Opportunities:

Four units In an active timber sale (Tie 408 - Units 1, 2, 8, and 10) provide opportunities to assess and monitor anv changes In stream temperature and sedlment loading associated with the removal of the overstorv In the riparian zone. The opportunity also exists in these areas to establish deciduous species In the overstorv bv plantino cottonwood and alder on disturbed riparian sites.

TABLE I - HABITAT DATA SUMMARY

REACH (R.M.)	STREAM		POOLS						RIFFLES (%)					
	HCR	S	P:R	G	d	A	EC	BR	1'+	6-12"	I-6"	.1-1"	SD	D
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 qradient (%)
d: Average maximum depth (L ≤ 12", M = 12 - 29", H ≥ 30")
A: Average pool area fsq. yards)
EC: Effective cover (L ≤ 40%. M = 40-60%, H ≥ 60%)
BR: Bedrock
SD: Sand
0: Average depth finches1
*: Present, but less than 5%

TABLE II - FISH SPECIES OBSERVED AND RELATIVE ABUNDANCE1100 FT.

Species	REACH I	REACH II	TRIBUTARIES A
Rainbow trout - a	L	L	L
Brook trout - a	L	-	

LEGEND: L = Low (0-5); M = Moderate (6-50); H = High (50+)
a = adult, 1 = juvenile

* = hahitat suitable; presence reported hut not observed.
( )= habitat suitable; mav not be present

TABLE III - SPAWNING GRAVEL (SQUARE-YARDS)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0 - 1.0)	180	90	90
II (1.0 - 2.0)	57	27	30
TOTAL	237	117	120

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
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 hahitat.

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

*Refer to special case form for barrier characteristics.

TABLE V - ANADRDMDUS HABITAT SUMMARY

REACH (RM)	MILES Avail.	MILES Pot.	P:R	REARING Area	REARING Depth	SPAWNING 1"-3"	SPAWNING 3"-6"	Comments
I (0.0 - 1.01	0.6	0.4	4:6	3	1	82	41	Potential anadromous habitat ends at RM 1.0.
II (1.0 - 2.01	--	--	6:4	1	1	73	3	
Total	0.6	0.4				105	44	

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 lenqth : riffle length.
Area: Average pool area (sq. vds.).
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.)	SP. GRAVELS Total (%)	SP. GRAVELS HO (%)	POOL Total (%)	POOL HO (%)	LWD CHARACTERISTICS OR	#	L	Dia	Source
I (0.0 - 1.0)	65	85	60	90	Pet-o.	S-M	l-2	1-2	M
II (1.0 - 2.0)	70	95	60	N/A	Perp.	S-M	1-2	l-2	M

LEGEND: Total: % of total habitat area dependant on LWD
HO: % of high quality habitat area dependent on LWD
OR: angle of orientation to flow: pero = 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 w	SUMMER d	SUMMER v	SUMMER D	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
I (0.0 - 1.0)	6	.25	1	1.5	10	1	100'
II (1.0 - 2.01	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

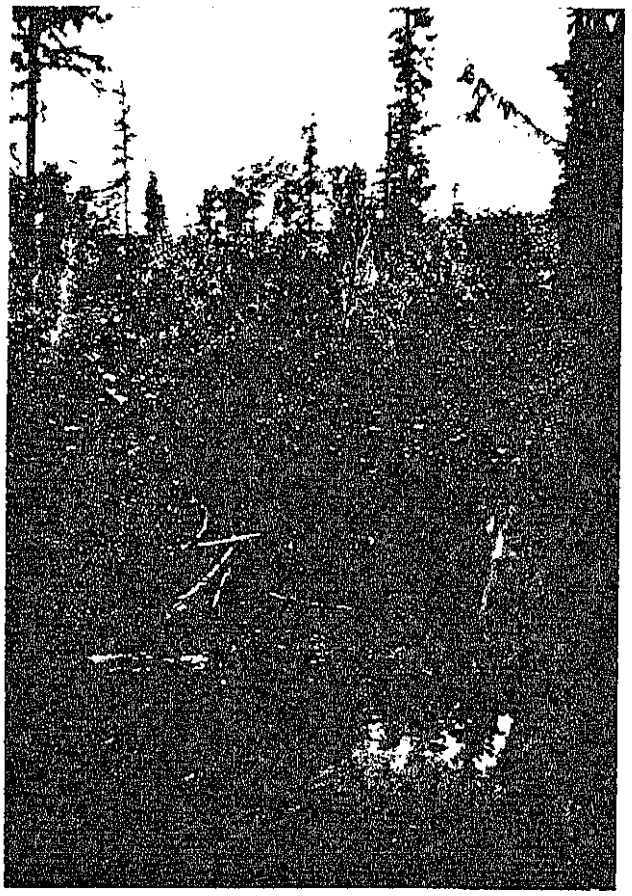
-TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP.0 F A/W A/W	TIME
1 (0.0 - 1.0)	8/16/83	1.5	85	S	71/53 - 72/53	1550-1745
II 11.0 -2.0)	8/16/83	0.4	75	S	66/49 - 71/53	1215-1400

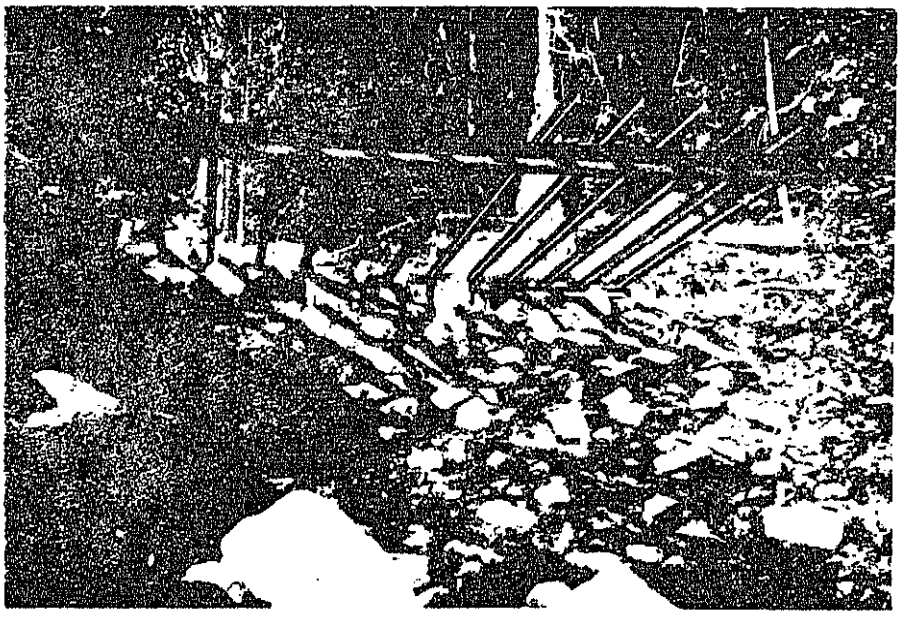
TABLE I - RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY F.P. (ft.7	VEGETATION H.U.	Overstory Con.	Dec.	AOUATIC Streamclass	Wetland%	Size	Special Habitat
1 (0.0-1.0)	6.2	100	5	5	I	II	10	s-t	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.: Hahitat Units H ≥ 4; M 7-3; L ≤ 1
Con: # Conifer Species
Dec: # Deciduous Species
Wetland: % stream lenath with adiacent wetlands; H >50%; M 25-50%; L <25%
Size: Size of Wetlands
S = Small (less than 1 acre)
L = Large (greater than 1 acre)



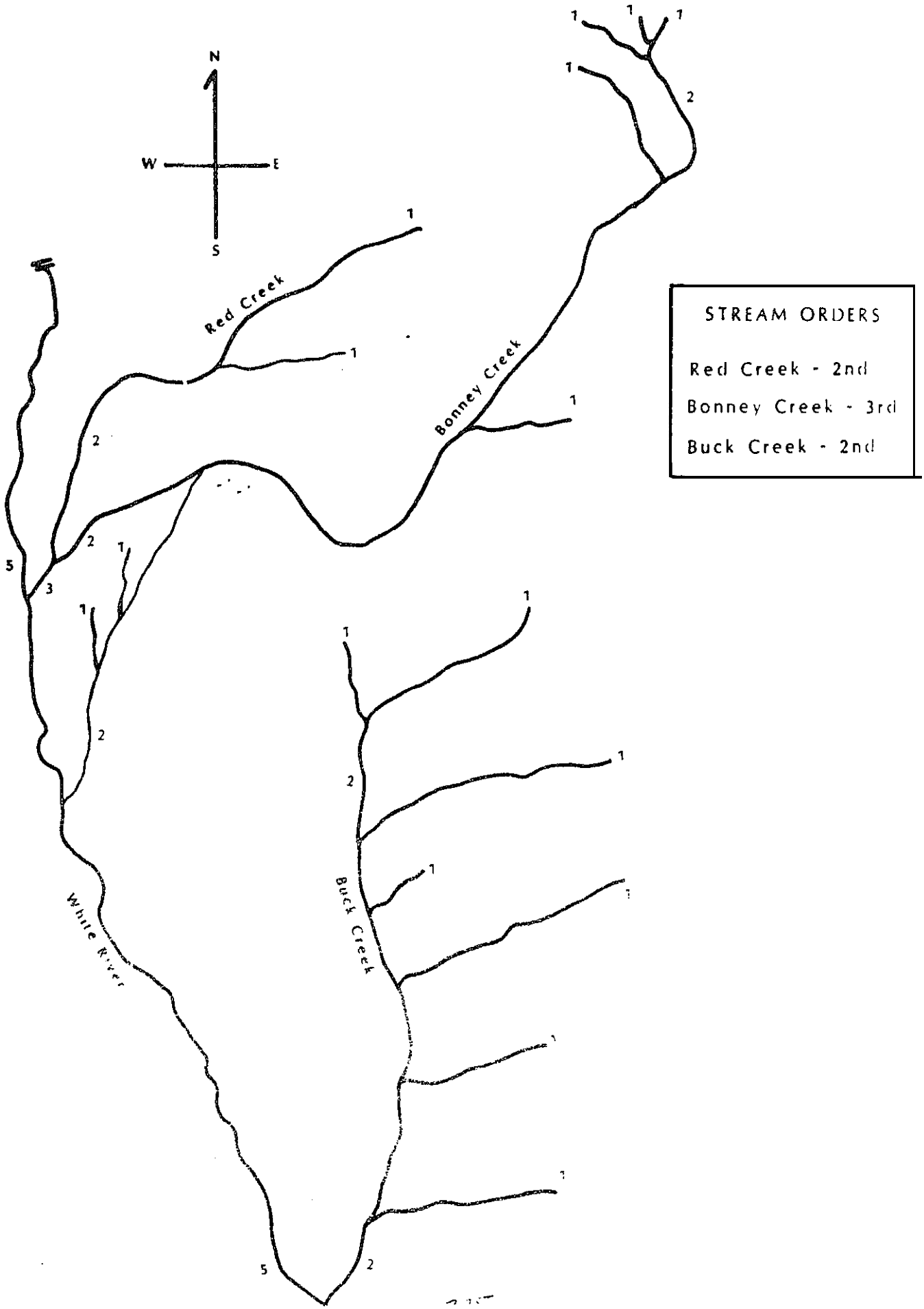
This large wetland (RM 0.0-0.1) occurs where Buck Creek enters the broad White River floodplain. High quality wildlife and fish habitat are found within this wetland. Wetland development is low on the rest of Buck Creek and the overall riparian qualltv is moderate (RCR=5.3).

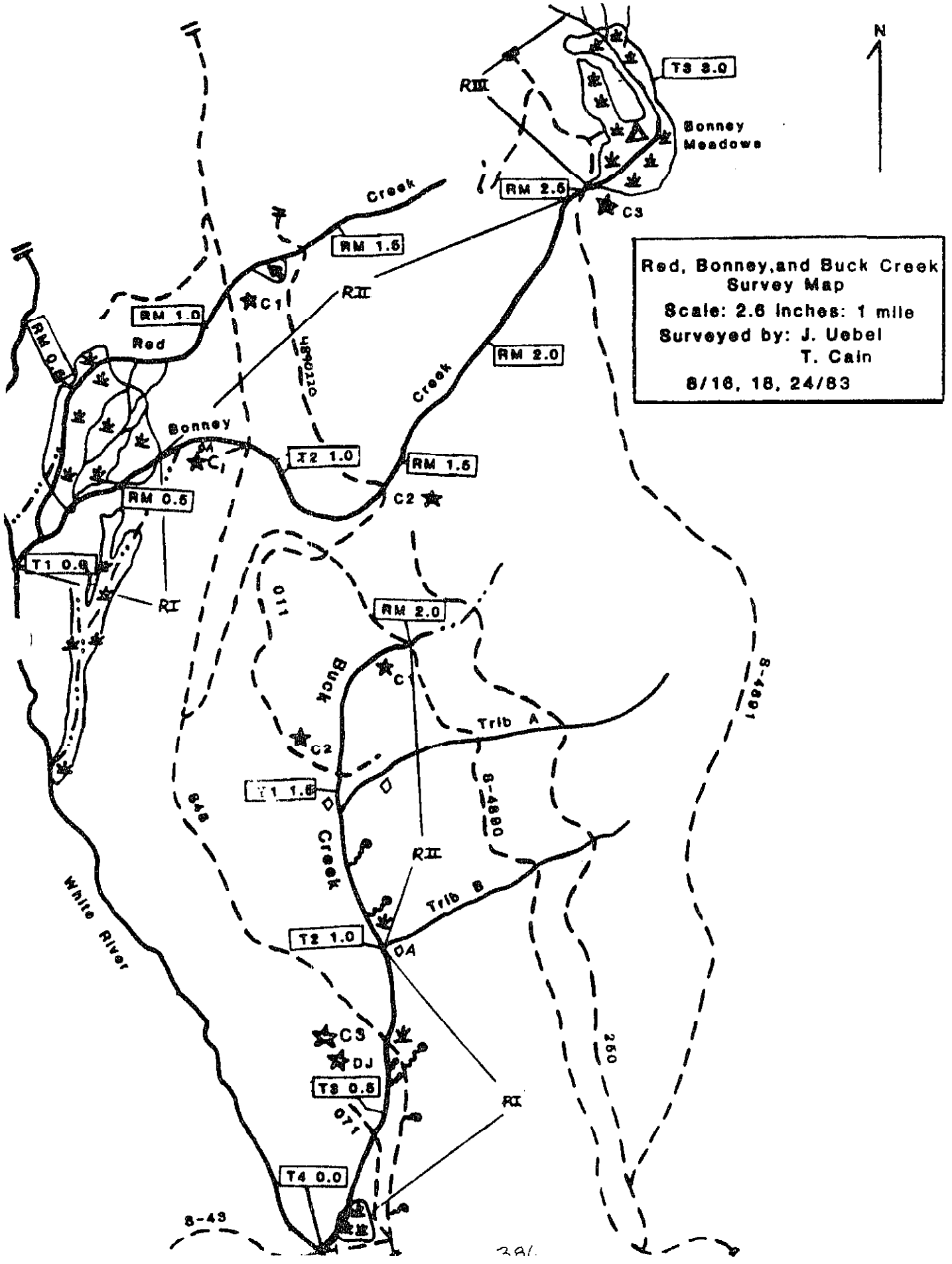


Passage Is generally good throughout the potential anadromous habitat (RM 0.0-1.0). This trash rack (RM 0.7), which has created a boulder chute, and a debris jam (RM 0.6) could act as partial passage barriers. Minor modifications could enhance passage at both sites.

Large woody debris (LWD) plays an important role In habitat development throughout Reach I. Ninety percent of the high quality pools observed and 65% (100 sq.yds.) of the high quality gravels counted in this reach are associated with LWD. Although no hlqh 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 from RM 0.5 to 2.0. An active timber sale (408 Ile, 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.


N
W
E
S
Red Creek
Bonney Creek
Buck Creek
White River
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
N
T3 3.0
Bonney
Meadows
RIII
RM 2.5
C3
Creek
RM 1.5
RII
C1
RM 1.0
Red
RM 0.5
Creek
RM 2.0
Bonney
DA
C1
T2 1.0
RM 1.5
C2
RM 0.5
T1 0.0
RI
RM 2.0
Buck
C1
Trib A
C2
T1 1.5
Creek
RII
Trib B
T2 1.0
DA
White River
C3
DJ
T3 0.5
RI
T4 0.0
8-43
8-4991
8-4990
250
648

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

^{R}I,II,III REACH # and SECTION

T_1 1.0 TRANSECT # and RIVERMILE

OBSTRUCTION BARRIER

J1,2,3, JAM and #

)1,2,3 FALLS, HEIGHT. and I

C1,2,3 CULVERT and I

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 anddromous fish habitat)

BANK EROSION (EXTENSIVE/SEVERE)

1,2,3, :MISCELLANEOUS

WETLAND HABITAT

ROAD AND ID NUMBER

EARTHFLOW

BONNEY/RED CREEKS
BEAR SPRINGS RANGER OISTRICT

Surveyors: Jeff Uebel, Tom Cain

Dates Surveyed: August 16, 18, and 24, 1983

Tributary to: White River

Drainage: Decchutes

TRI Compartments: Bonney 2200
Iron 2202

Game Fish: Rainbow trout
Brook trout

County: Wasco

Mouth Location:
Bonney - T.4S., R.9E., Sec. 1
Red - T.4S., R.9E., Sec. 1

Watershed Area:
Bonney - 1458 acres, 2.3 sq. mi.
Red - 426 acres, 0.7 sq. mi.

Stream Length:
Bonney - 3.5 miles
Red - 1.5 miles

Distance Surveyed:
Bonney 3.3 - miles
Red - 1.3 miles

Low Flow Width:
Bonney - 3 feet
Red - 2 feet

Stream Order:
Bonnev - III
Red - II

Potential Anadromous Species: Winter Steelhead
Coho Salmon

Average Fish Habitat Condition Rating: Bonnev - 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% (1.5 cfs) of low flows at their confluence (RM 39.5 of the White Rlver). The stream has apparently undergone channel realignment recently, likely due to winter flood conditions and flow diversion hy 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 heavilv braided, and most of the flow (0.5 cfs) is contributed to Bonnev Creek in a large wetland complex at their confluence (RM 0.2 of Bonnev 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 lle 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.

8. Watershed and Geomorphic Characteristics

Red and Bonney Creeks are small second and third order drainages issuing from narrow valleys with very high gradients (15%+) and steep, heavilv forested sideslopes (70%+). Both flow out about 0.8 miles onto the broad valley floor of the White River, with heavily braided channels and high wetland development. Thev differ in their headwater characteristics: Red Creek heads in a small, steep (70%+) springs/wet area on the west slope of Bonnev 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 flashv in the mid and lower reaches.

C. Reach Description

Three reaches were delineated on Bonney Creek based on changes in gradient, valley configuration, and rinarian and channel characteristics. Reach I, RM 0.0-0.5, Is very low gradient (1-2%), 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 to very high gradient (10-20%) increasing moving upstream, and the stream is entrenched in a single channel in a narrow, heavilv-forested valley with steep sideslopes and narrow floodplain (50 feet wide). Reach III, RM 2.5-3.5, lies entirely within Bonnev Meadows; it is a large, open, wet sedge/rush meadow, with a low stream gradient (2%).

Red Creek has two general reach areas, very slmilar 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 Bonnev 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 habltat from RM 0.0-0.8 appears potentially suitahle for winter steelhead and coho salmon utilization. Fish habitat quality was rated fair overall (5.9). Rearlng habitat Is highly variable over the stream length. Pools and riffles in the wetland Reaches 1 and III are well balanced (5:5). The high gradient In Reach II creates a continuous stepped cascading stream profile, with pools comprising only 30% of the stream area. Spawning habitat Is limited overall and Datch.v in distribution. Over 50% of the 255 square yards observed were rated marginal due to their placement In the channel. About 85 sq. yards of falr to excellent qualitv gravels are potentlally suitable for and availahle 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 qualitv 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, heaver, 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 Bonnev 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 relativelv low and this is, therefore, likely a low priority project. Pool size and depth in the Bonneg Meadows area may limit large trout production. Increaslng 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.?-0.6.

21 Stream gradient averages 2%.

3) Substrate composition varies from the small boulder/rubble of RM 0.0-0.2 to the muc/silt/woody debris substrate of the wetland area RM 0.2-0.6.

4) Pools dominate the stream area (60%), particularly in the wetland section.

5) Stream shading-is high (95%).

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 flood plain development (50 feet) and moderate to steep sideslopes (40-70%).

2) Stream gradient is high (10%+).

3) Substrate is predominant [illegible] ulder (70%).

4) Pool area decreases, and cascades and riffles dominate the stream area (70%).

5) Stream shading remains high (90%).

Reach III; RM 2.5-3.5:

1) Valley configuration broad[illegible]s to the very wide, flat-bottom headwater basin (1200 feet wide) of Bonney Meadows.

2) Stream gradient lowers to [illegible].

3) Substrate becomes grave' dominated (70%).

4) Pools and riffles are e[illegible] balanced ([illegible]).

5) Stream shading becomes [illegible] the open meadow [illegible].

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%+) 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%. RM 0.6-1.0, gradient varies between 5 and 15%. Above RM 1.0. gradient increases from 15 to 20%+.

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%) and shallow riffle below that point.

5) Stream shading was high throughout (95%+).

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% 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 hraiding. RM 0.0-0.2 has exceptionally high qualitv pool habitat for a small stream (2 cfs). Both pool and spawning gravel qualitv appear to be highly dependent on LWD.

3) Spawning habitat is patchv 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% of the 50 sq. yards available are of a size class suitable for anadromous fish and 50% 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 15.4 HCR).

2) Pool rearing habitat conditions are similar to RM 0.0-0.2 in Reach I. Stream gradient is increased (10% 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 hahitat 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% of the gravels are of a size class suitable for anadromous fish, and SO% 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 present above RM 0.[illegible]. A series of small debris jams combined with [illegible] gradient (15%+) block upstream fish passage above RM 0.7. The culvert [illegible] (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 [illegible]-out present. The reach lies entirely within the Bonney Meadows area.

2) Rearing habltat 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% 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 ioss of pool depth and cover have occurred due to high recreational and livestock use (RF! 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 0.7-0.6. Snags are abundant in this area, and vegetational types range from pond plants, through small wet and dry meadow areas, to shrub/willow/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 coniferous (four species) and scattered cottonwood are present.

5) Limited small wetland development is present. No other special habitats were observed.

Reach III; RM 2.5-3.5 (Bonney Meadows):

1) Riparian conditions are high quality

2) True floodplain development is low due to the small size and very well-regulated flows of Bonnev 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 domlnated 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 Bonnev Meadows.

6) Road 4891 and the Bonnev 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 burn 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 heavv canopv (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 sharplv entrenched in a narrow V-notch valley with very steep sideslooes (70%+). Floodplain development is minimal (25 feet). Riparian hahitat development is limited bv heavv 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; RN 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 ravelling 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 sour 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 hraided out into ephemeral channels, and fish habitat is virtually non-existent. Reducing the braiding and forming a single channel where possible would likelv 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 hahitat. With this improvement work, both areas could be potentially utilized by anadromous fish. Almost 150 sq. yards of fair to qood 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 - Bonnev Creek RM 0.5-2.0; Red Creek RM 0.6-1.0:

Canopy closure is near 100% and the riparian understorv 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; plantinq cottonwood and/or alder could be coupled with canopy opening to increase hahitat 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, althouqh 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"	l-6"	.1-1"	SD	I
I (0.0-0.6)	6.8	95	6:4	2	L-M	4	t!	0	50	40	10	0	0	4
II (0.6-2.5)	5.4	90	3:7	10	i-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 qradient (%)
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 ANT, RELATIVE ABUNDANCE/100 FT.

Species	REACH I	JI	III	TRIBUTARIES Red Creek
Trout - j	H	M	M	
Rb - a	M	L	I)	
Bk - a	L	[illegible]	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)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0-0.6)	45	20	25
II (0.6-2.5)	130	60	70
III (2.5-3.0)	80	40	40
TOTAL	255	120	135

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
0.3	Debris jam	None	P	None
0.8	Debris jam/ qradient	None	N	None
0.9	Culvert	[illegible]	N	None
1.3	Culvert		N	None
2.6	Culvert	[illegible]	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

REACH (RM)	Miles Avail.	Pot.	P:R	Rearing Area	Depth	Spawning 1"-3"	3"-6"	Comments
I (0.0-0.6)	0.6	-	[illegible]	4	1	20	0	Small Creek (1-2 cfs)
II (0.6-2.5)	0.1	0	[illegible]	4	1	40	25	Small Creek (1-2 cfs)
III (2.5-3.0)	0	0				-	-	
TOTAL	0.7	0.0				60	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.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HO (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
I (0.0-0.6)	70	90	70	90	Var	S/M	2+	l-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 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

	SUMMER			BANKFULL		
Reach (R.M.)	w	d	U	W	D	Floodplain Width (Ft.)
I (0.0-0.6)	4	0.[illegible]	1.3	8	1	8-500
II (0.6-2.5)	3	0.[illegible]	1	8	1.5	50
III (2.5-3.0)	1	0.[illegible]	0.4	1.5	0.5	500+

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

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP.0 F	TIME
I (0.0-0.6)	8/18/83	1.3	95	E-W	66/50	1100
11 (0.6-2.5)	8/24/83	1.0	90	E-W	68/50	1445
III (2.5-3.0)	8/24/83	4	30	N-S	56/57	1700

TABLE IX - RIPARiAN HABITAT SUMMARY

REACH RM	RHR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstorv con.	Dec.	AOUATIC Strermclass	Wetland%	Size	Special Habitat
							50		
I (0.0-0.6)	8.6	300	5	6	2	,	10	S+L	2
II (0.6-2.5)	4.9	50	4	4	1	II		S	1
III (2.5-3.5)	7.5	500	3	3	0	II	100	L	2
Red Creek									
70.0-1.0)	8.6	300	5	6	2	II	60	L	1
(1.0-1.5)	3.8	25	3	4	0	I.	10	S	1

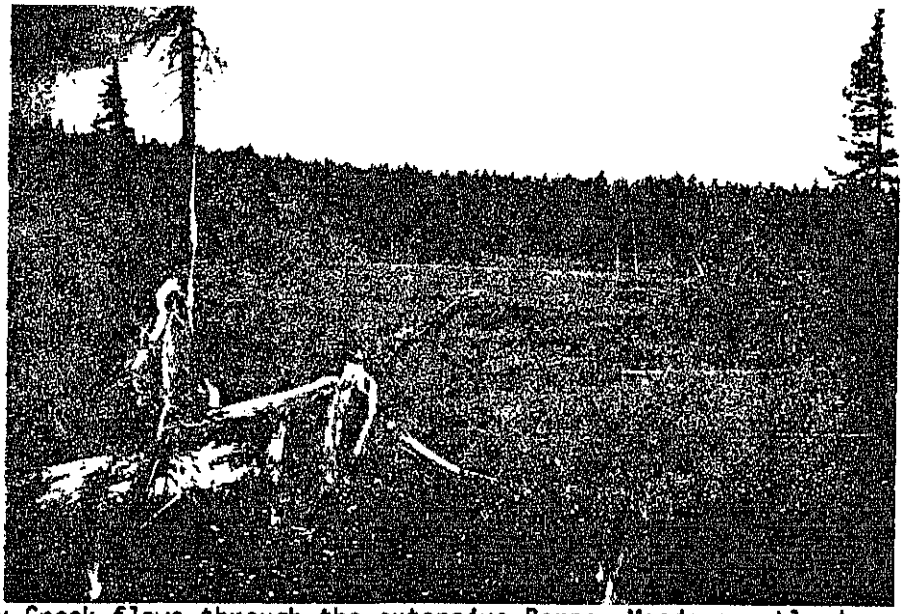
LEGEND:
- RCR: Riparian Condition Rating
- F.P.: Floodplain d ith, in feet
- H.U.: # Habitat Units (H ≥ 4; M = 2-3 ≤ 1)
- Con : # Conifer Species
- Dec: # Deciduous Species
- Wetland: % stream length with adjacent wet lands: H >50%; M = 25-50%; L <25%
- Size: Size of wet ds
  - s = Small less than 1 acre
  - L = Large greater than I ac

Reach I (RM 0.0 - 0.6) of Bonney Creek is quite diverse in fish habitat and tiparian conditions. This view (RM 0.1) shows the hiqh qualitv fish habitat and moderate qualitv riparian development present RM 0.0-0.2. The following two photos illustrate the changes in habitat moving upstream through the reach. Large woodv debris is a very important element of channel structure throughout the stream, with 70% of spawning and rearing hahitat development dependent on incorporated LWD.

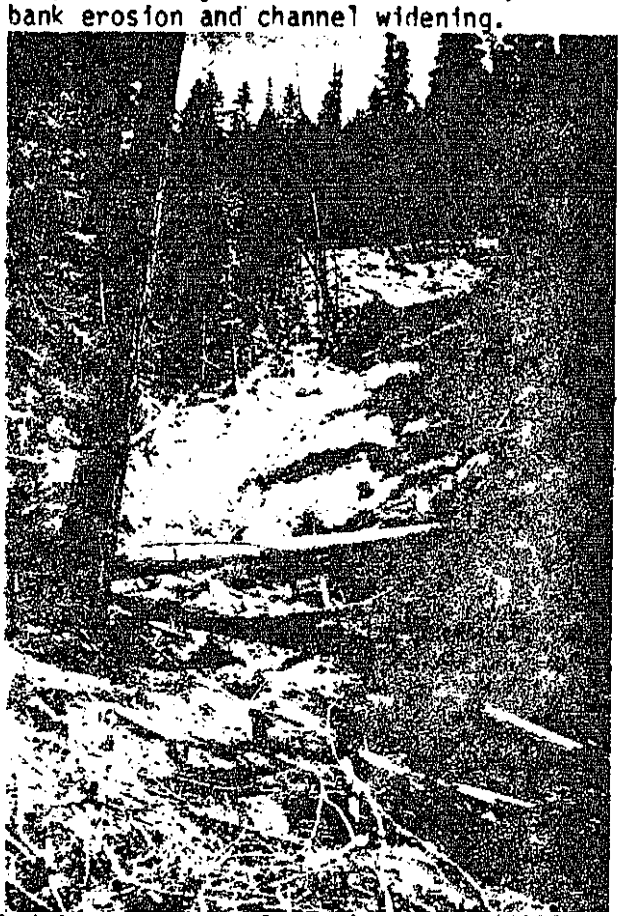
A large wetland complex (100 acres) is located at the Red Creek confluence (RM 0.2 Bonney Creek). Excellent wildlife hahitat development is found throughout Reaches I and III of Bonney Creek In the high quality wetlands present. Channel braiding is abundant in this wetland (RM 0.2 - 0.6), and salmonid 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 - 0.9 has resulted in the development of a large sediment plain RM 0.5 - 0.6. Potential anadromous spawning habitat conditions are very mod in this area, with over 125 square yards of gravels available.

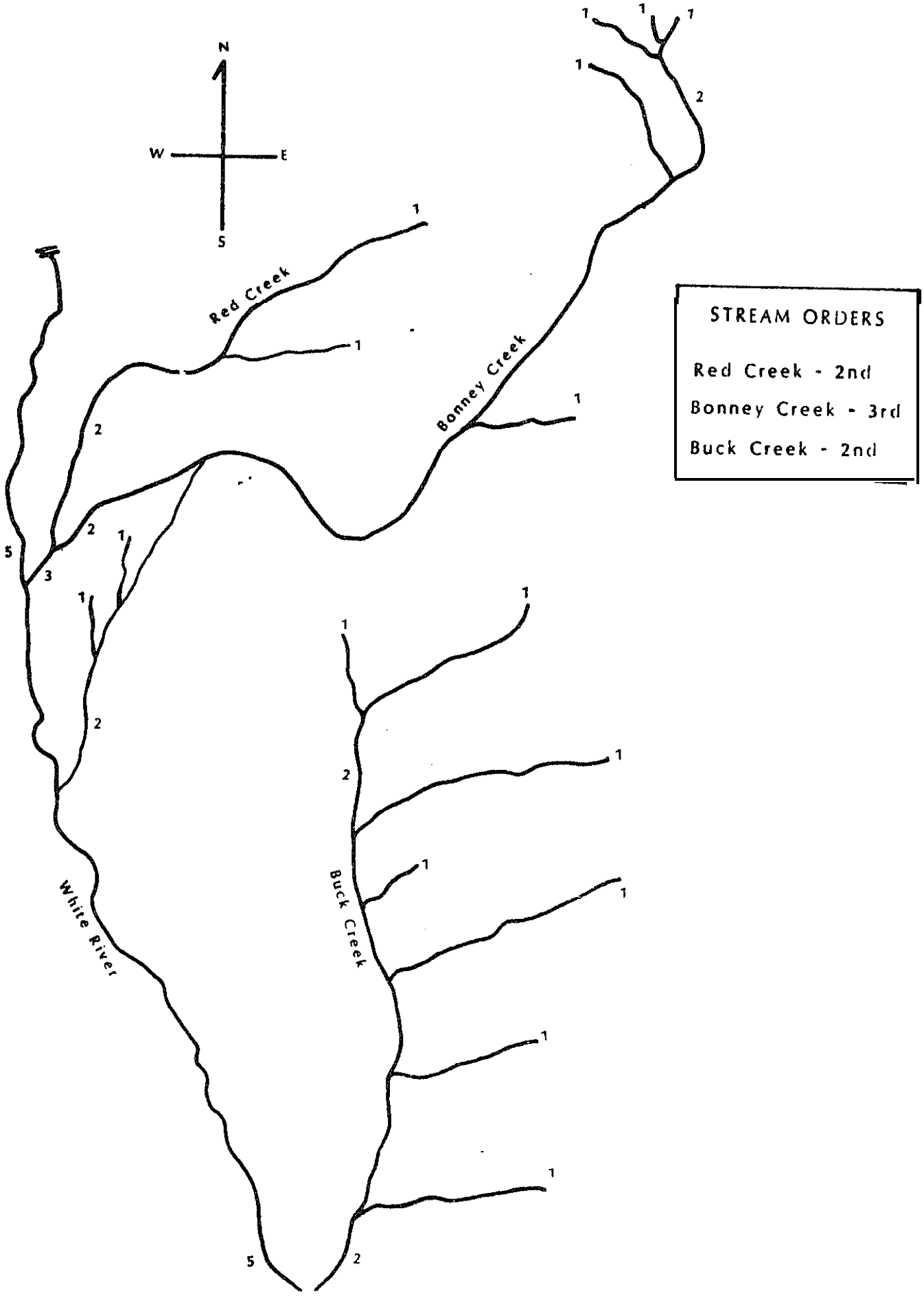
Reach II (RM 0.6-2.5) composes over half of the length of Bonney Creek. This view (RM 0.7) is near the limit of potential anadromous fish habitat, where continuous high gradient cascades (15-20%) present impassable migration barriers. Resident trout habitat quality is fair in this reach and good in Reaches 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 undergrowth development typical of Reach II and Red Creek.

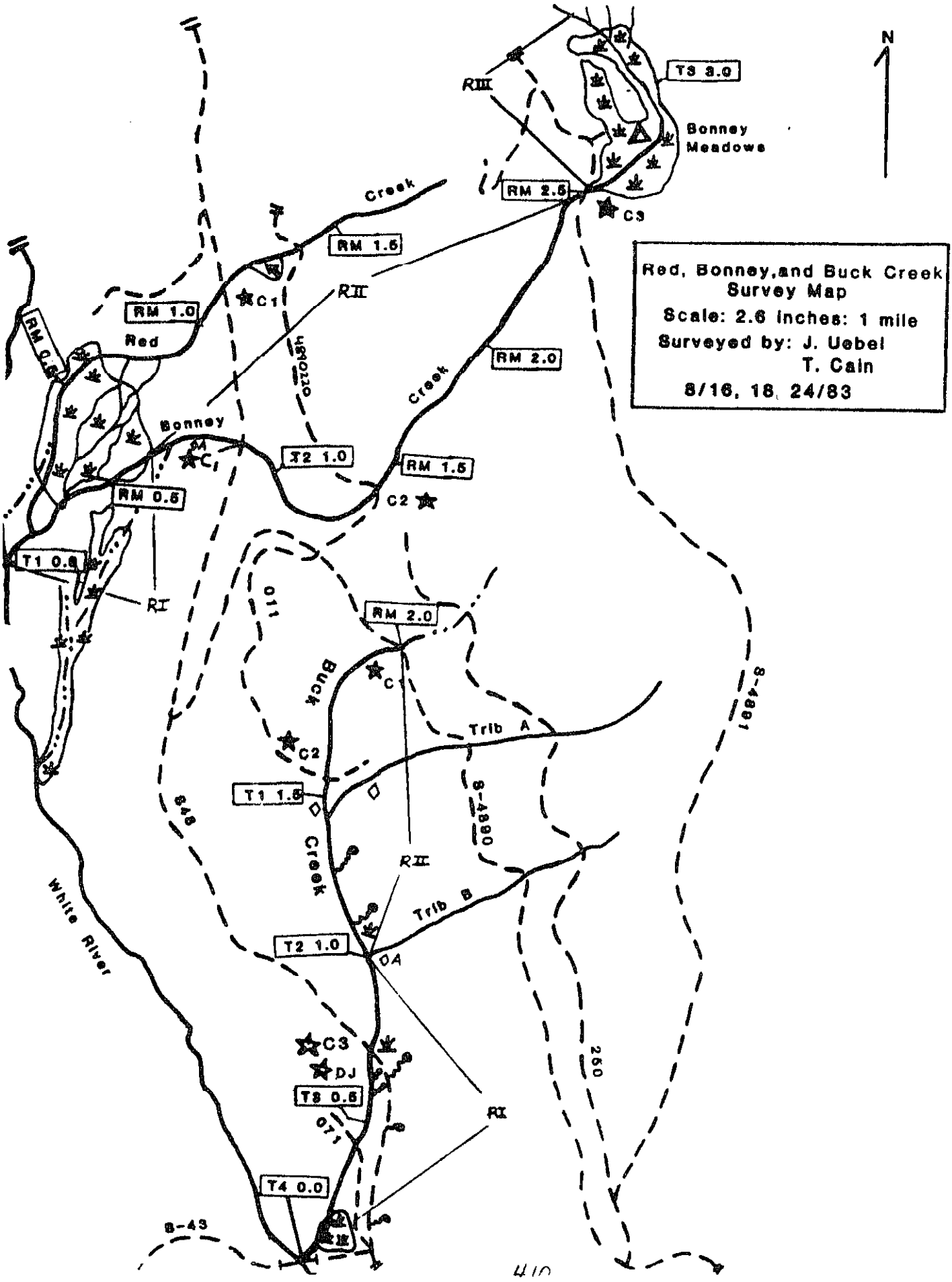


Bonney Creek flows through the extensive Bonney Meadows wetland area (125 acres) in Reach III (RM 2.5 - 3.3). The channel is very narrow and sharply entrenched (2-3 ft. deep) in much of this reach, as can be noted in this typical view at RM 2.7 (center and right middleground). Trout habitat is good quality 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.


N
W
E
S
Red Creek
Bonney Creek
Buck Creek
White River
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
N
Bonney Meadows
TS 3.0
RIII
RM 2.5
C3
Creek
RM 1.5
RII
C1
RM 1.0
Red
RM 0.5
RM 2.0
Creek
Bonney
DA
C1
T2 1.0
RM 1.5
C2
RM 0.5
T1 0.8
RI
011
RM 2.0
Buck
C
Trib A
C2
T1 1.5
848
Creek
RII
Trib B
White River
T2 1.0
DA
C3
DJ
TS 0.5
071
RI
T4 0.0
B-43
250
S-4881
S-4880

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BDUNDARY
$R_{I,II,III}$	REACH I and SECTION
T_1 1.0	TRANSECT I end RIVERMILE
OBSTRUCTION	BARRIER
J1,2,3,	JAM and #
F( )1,2,3	FALLS, HEIGHT, and I
C1,2,3	CULVERT and #
B1,2,3	CHUTE and I
	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
S-47	ROAD AND ID NUMBER
	EARTHFLOW

IRON CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

Dates Surveyed: July 7-B and 11-12, 1983

Trlbutary to: White River

Drainage: Deschutes

TRI Compartments: Iron 2202

Gamefish: Rainbow trout

Potential Anadromous Species:
Steelhead trout
Coho salmon
Chinook salmon

County? Hood River

Mouth Location:
T. 3 S., R. 9 E.. Sec. 36

Watershed Area: 5200 acres
8.1 sq. miles

Stream Length: 4.3 miles

Distance Surveyed:
4.3 miles mainstem
0.8 miles Caro Creek
0.4 miles South Fork Iron Creek
0.1 miles North Fork Iron Creek
1.5 miles Upper Tributary Creek

Low Flow Width (Avg.): 14 ft.

Stream Order: IV

Average Fish Habitat Condition Ratinq: 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% of the flow (30 cfs) to the White River at their confluence (RM 2.7. of Iron Cr.) 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.

8. 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.1 and many small sedge meadows above RM 3.0.

C. Geomorphology

The floodplain width over the entire mainstem is greater than 200 feet. Sideslope gradients are SO-70% on the east side and less than 20% 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%.

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 woudv debris (LWD).

E. Fisheries

The overal ratinq of the fisheries hahitat is fair with a Habitat Condition Ratinq (HCR) of 5.6. Rainbow trout were observed in Reach II! (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 ratio (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. Hiqh 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%) were rated marginal due to extremely high sand/sediment loading and usually occurred in small beds (< I yard). The Tower 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 I I . 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 trihutaries along the western floodplain from the mouth to RM 3.7. The source may be from the sedge meadows in this area.

The macroinvertebrates populations normally identified with the stream substrate material appear to he sparse in these areas. Fish production in these areas may also 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%).
3. Substrate is predominantly boulders and rubble (55%).
4. Riffles dominate the stream area (P:R i 2:8).
5. Stream shading is low (20%).
6. Channel and bank stability is very low. The stream has numerous, low flow braids and high flow side channels.

Reach II; RM 2.7 - 3.4:

1. Valley configuration and floodplain width are the same as Reach I.
2. Average gradient increases to 4.5%.
3. Substrate is boulder dominated (55%).
4. Percentage of pool surface area increases (P:R = 4:6).
5. Shading increases to 60%.
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%).
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%).
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% to 8%). Overall gradient increases (> 10%) again at RM 0.4 as the stream becomes a series of chutes and falls (12+ feet high).

3. Substrate changes from hoylder and rubble dominated to rubble and bedrock at RM 0.4.

4. Stream shading is high throughout (90%).

5. Pool area changes from 40% of the stream surface area below RM 0.4 to less than 10% above. A corresponding decrease in pool quality is also evident.

Upper Tributary C.:

Upper Tributary C was surveyed from Oregon State Highwav 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 (RM 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%).

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%).

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 R. M. 0.1 valley configuration is V-notched and floodplain width is narrow (< 30 ft.).

2. Stream gradient also changes quickly from a low (3%) to a high, stepped gradient (> 11%).

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%).

South Fork Iron Creek; RM 0.0 - 0.3:

1. Valley configuration is wide, U-shaped, with gentle slde slopes I 30% gradient).

2. Gradient is high (9%).

3. Substrate is rubble, gravel. and sand mlxture.

4. Riffles dominate the stream area (P:R q .1:9).

5. Stream shading Is high (90%).

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 = 4.61.

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; RN 0.0 - 2.7:

1. The fish habitat is rated fair (HCR = 5.11.

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 hiqh 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:

1. Fish habitat quality is rated good (HCR = 6.31, an increase from Reach I.

2. The major single factor contributing to the higher HCR is a qreater abundance of pools (P:R = 4:6). Pools, however, are still small (averaging 1 square yard). High quality pools are largely boulder dependent (80%).

3. Only two square yards of marginal quality spawning qravels 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% of high quality pools were 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 = 5.01. 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 vards 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 sedqe meadow (RM 0.1 - 0.5) before re-establishing a channel and flowinq into Iron Creek.

North Fork Iron Creek; RM 0.0 - 0.1:

1. Fish habitat rates fair (HCR = 5.51.

2. The pool-to-riffle ratio is approximately 5:5. Pools are 2 to 3 square yards with shallow (< 12 inches) to moderate depths (12-29 inches) and good effective cover. LWD and boulders are important in pool formation.

3. Forty percent 130 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% 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% 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-diverslty, 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 I.5 and 2.3.

5. Special hahitat 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% of the reach length.

3. An average of three habitat units per transect were observed, with grass-forb. shrub-seedling-sapling, and small sawtimber predominatino.

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 thirty feet in height were observed.

5. One special hahitat 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 = 6.71.

2. The floodplain width continues to be very wide (200+ feet), forming a flat bottom V-shaped valley. Small wetlands are present along 35% 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 overstorv is composed of spruce, lodgepole, Douglas-fir. and nohle fir.

5.

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, shruh-seedling-sapling, poles, and small sawtimber.

4. The coniferous overstorv 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% of the tributary length.

3. Three habitat units were observed, shrub-seedling-sapling, poles, and small sawtimber.

4. The coniferous overstory is composed orimarily of lodgepole pine, with small amounts of mountain hemlock and white pins.

North Fork Iron Creek; RM 0.0 - 0.1:

1. The riparian habitat rates moderate (RCR = 4.71.

2. The floodplain width is wide (120 feet), forminq a flat-bottom V-shaped valley. Small wetlands are present alonq 10% of the tributary length.

3. Four habitat units were observed, grass-forb, shrub-seedling-sapling. small sawtimber, and large sawtimber.

.4 The coniferous over-story 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% 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 Rearinq 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 andesitel is porous. Interstitial spaces are heavily filled with sand.

Introduced gravels would probably be subject to the same processes which have impai,·ed 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.

Rlparian 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 (RN 0.3) and South Fork Iron Creek (RM 0.3) are impassable, but stream gradients of 9% to 11% 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"	l-6"	l-l"	SD	D
1 (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
Tributaries														
Carp Creek (0.0-0.4)	5.0	90	4:6	4	L	1-2	M	-	-	-	-		-	-
(0.4-0.8			1:9	10+	L	1	L	-	-	-	-		-	-
Upper Trib.C.	2.8	20	2:B	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 (%)
- d: Average maximum depth (L ≤ 12", M = 12 - 29", H ≥ 30")
- A: Average pool area (sq. yards)
- EC: Effective cover (L ≤ 40%, M q 40-60%, H ≥ 60%)
- BR: Bedrock
- SD: Sand
- D: Average depth (inches)
- l: Present, but less than 5%

IRON CREEK

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

	R E A C H			TRIBUTARIES			
Species	I	II	III	Carp Ck.	Up.Trib.C.	NF Iron Ck.	SF Iron Ck.
Rainbow trout	*	0	L	L		( )	( )

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

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

TABLE III - SPAWNING GRAVEL (SQUARE YARDS)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0-2.7)	24	0	24
II (2.7-3.9)	2	0	2
III (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	76	25	51

IRON CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM	(R.M.)	TYPE	I D	PASSABLE	RECONMENOATIONS
Carp Creek	0.25	Logjam	J_1	N	None
Carp Creek	0.3	Culvert	C_1	N	None, 300 ft. long, limited habitat above.
Carp Creek	0.31	Bedrock chute	B_1	N	None
Carp Creek	0.32	Falls	F_1	P	None
Carp Creek	0.4	Falls	F2	N	None, 20 ft. high.
Carp Creek	0.45	Falls	F3	N	None
NF Iron Cr.	3.1	Culvert	C_1	F	None
Upper Trlb C		Culvert	C_1	N	None

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

*Trout migratlon barrier only; anadromous fish could pass obstacle.

TABLE V - ANADROMOUS HABITAT SUMMARY

Reach (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Size	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
				1	2			
I (0.0-2.7)	2.7	0.0	2:B	1	2	14	5	Cemented, sandy
II (2.7-3.9)						2		& in small pockets
III (3.9-4.3)	1.24	0.0	4:6	6	2	0	i	less than 1 sq. vd.
				1	1	4		
Carp Trib. C.	0.0	0.0	2:8	1	1	0	i	
	0.1	0.0		2				
NF Iron Cr.	0.3	0.0	1:9	1	1	0	i	
Total	5.0	0.5				36	13	

LEGEND: Avail.: Miles of hdhitat 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" sire classes.

IRON CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	SP. GRAVELS Total (%)	SP. GRAVELS HQ (%)	POOL Total (%)	POOL HQ (%)	LWD CHARACTERISTICS OR	#	L	Dia	Source
1 (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	1-2	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 = % of total habitat area dependant on LWD
HO = % of high quality habitat area dependent on LWD
OR = angle of orientation to flow: Pero = 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

Reach (R.N.)	SUMMER w	d	v	4	BANKFULL W		Floodplaln Width (Ft.)
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
CarpCr.	5	0.5	1.5	4	6	1	50
Up. Trlh. C.	5	0.5	2	5	5	0.5	200+

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

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/H_2O TEMP. ^oF A/W	A / W	TIME
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

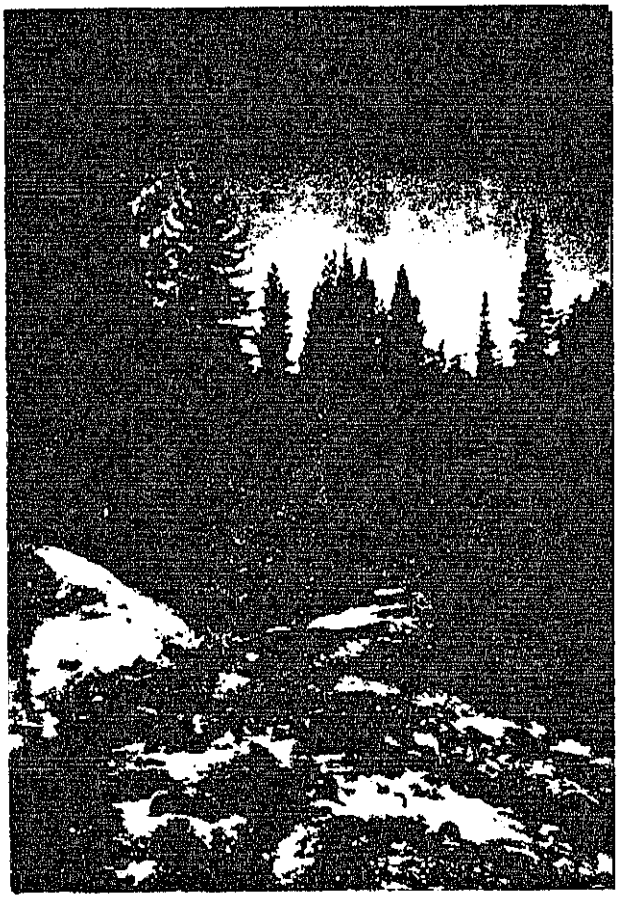
IRON CREEK

TABLE IX - RIPARIAN HABITAT-SUMMARY

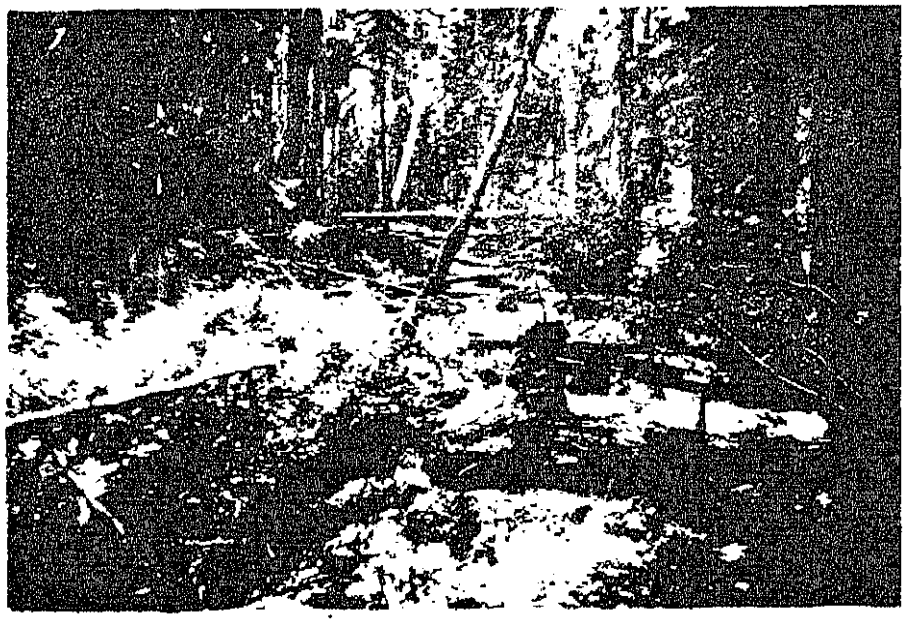
REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstory Con.	Dec.	Stream-class	Wetland %	AQUATIC Size	Sp. Habitat units
I (0.0-2.7)	7.5	200+	i	4	2	II	L	S	2
II (2.7-3.9)	7.5	200+	4	4	0	II	L	L	1
III (3.9-4.3)	7.2	200+	4	4	0	II	M	S	1
Carp Creek (0.0-0.8)	6.0	70	4	4	0	II	-	-	0
Upper Trib. C (0.0-1.5)	6.5	Z00+	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	11	L	S	1

LEGEND: RCR: Riparian Condition Rating
F.P.: Floodplain
H.U.: I Habitat Units: H ≥ 4; M=2-3; L ≤ 1
con: I 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)

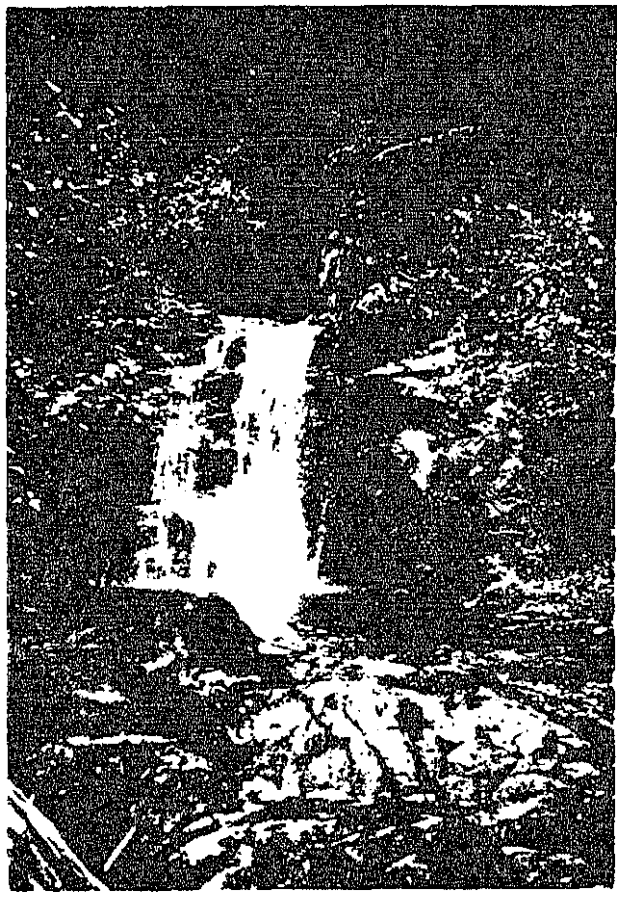
Vlew of a typical section In Reach I (R.M. 1.71. The flow regime In this reach is very flashy. At RM 2.7 a new channel of White Rlver has captured the estahlished Iron Creek channel. Channel and flow characteristics in Reach I are therefore a blend of White River and Iron Creek. Channel and bank stability are low. Fish habltat Is fair, wfth fast flowing riffles and runs dominating the stream surface area. Pool size is small (1 sa. 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 attrfbuted to an increase in boulder structure. Rearing habitat is fair. Pools are small (avg. = 1 so. yd.) with shallow to moderate depths and high effective cover (view at R.M. 7.61.

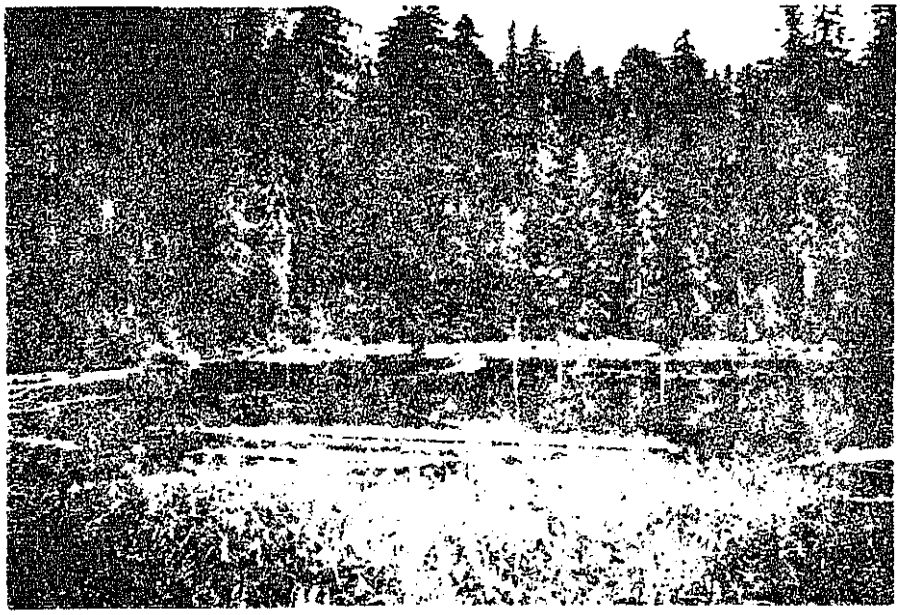


Large woody debris is the dominant structural element of the stream channel in Reach III (photo at R.M. 4.2). Average pool size Increases to six square vards wfth manv hfgh quality pools present. The Iron Creek flow reqime is more regulated In this upper section.



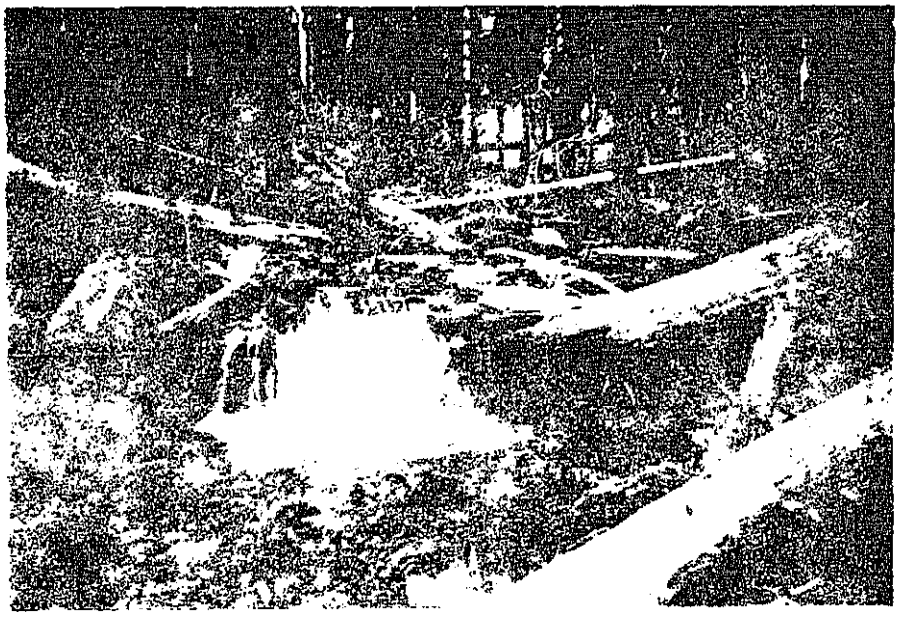
Carp Creek is a major trlbutarv to Iron Creek at R.M. 1.7. A series of water falls greater than 17 feet high are present on Carp Creek above RM 0.4 (shown). They present a total barrier to fish migration. NO anadromous fish habltat appears to exist above the falls.

Two large sedge meadows et RR 1.5 and 3.4 (shown) between the Iron Creek and White River floodplains add diversitv to riparian habitat in Reaches I and II. Big game utilization of these areas appears heavy.

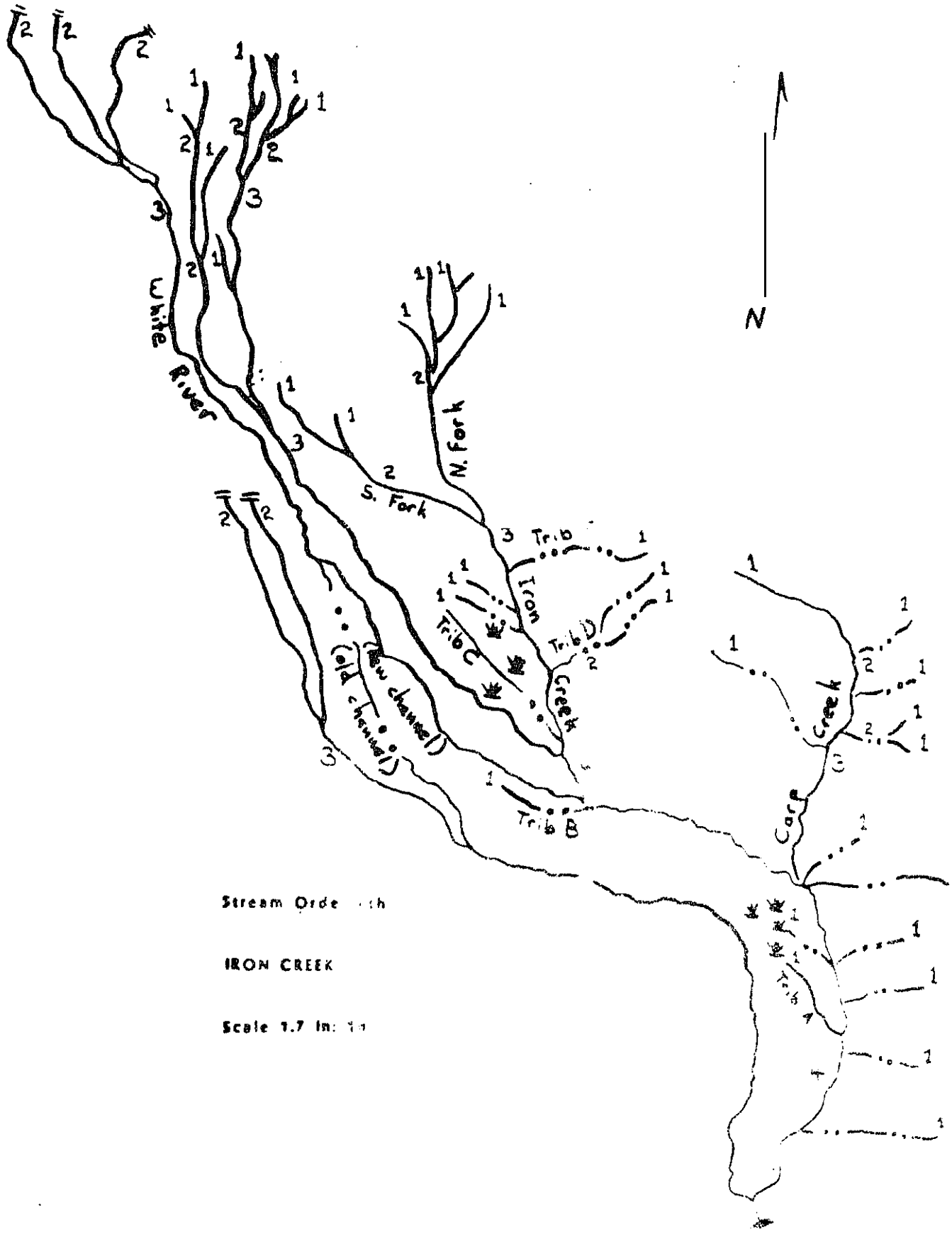


A small pond on the east side 0f the floodplain at RM 0.2 covers about an acre. Riparian wildlife habitat in this area is exceptionallv diverse both in terms of vegetative structure and number of species. A great blue heron and female mallard were using the pond at the time of the survey. Deer and elk sign were common also.

Upper Tributary C flows within the White River - Iron Creek floodplain. Riffles dominate the stream area (P:R = 2:8). Pools are small I 1 sq. yd.) 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.



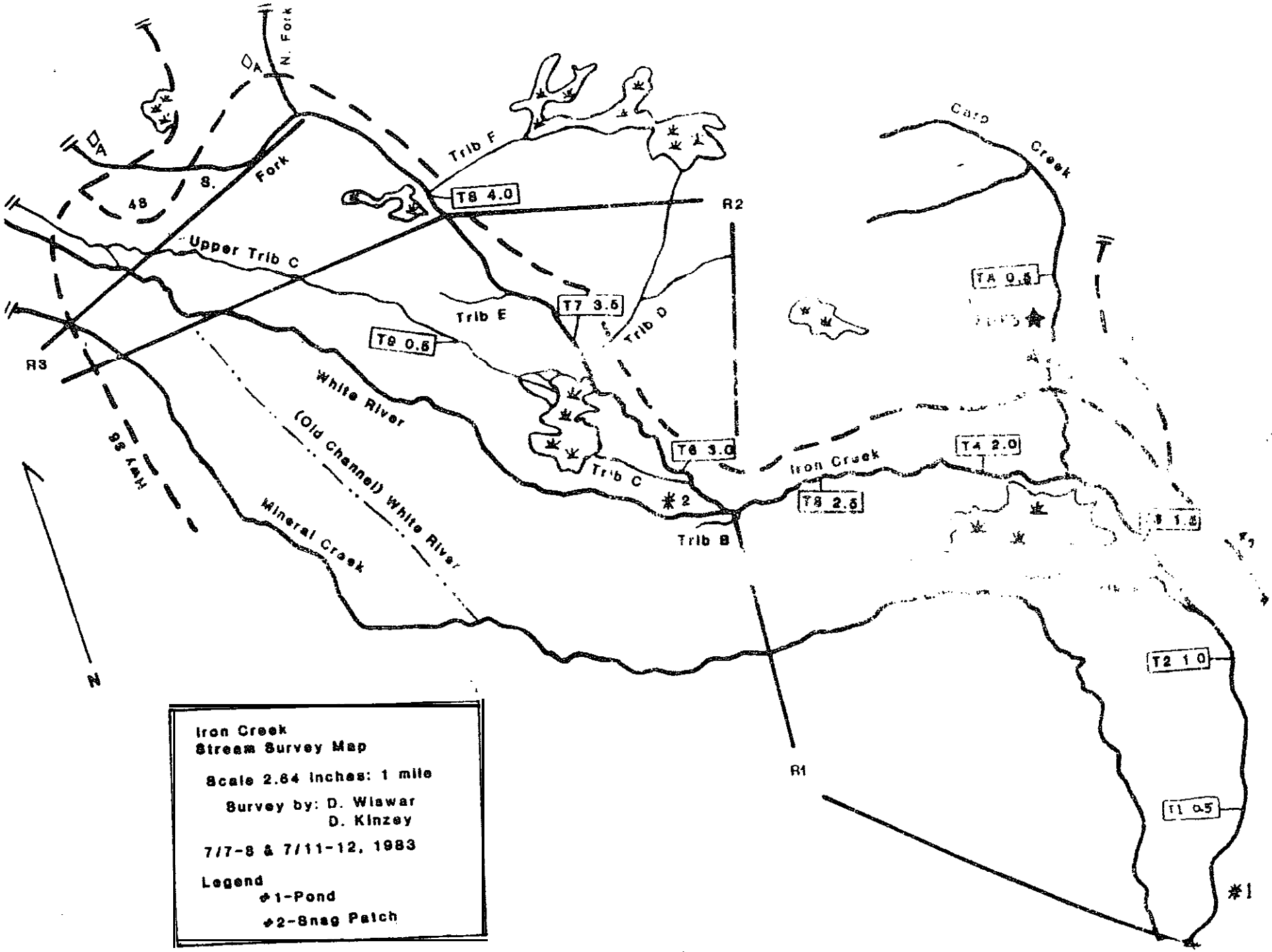
North Fork Iron Creek has an overall 11% gradient; large woody debris (LWD) and boulders create a stair-step profile. Pools are 2-3 square yards in area with shallow to moderate depths. This view is at R.M. 0.1.



Stream Orde ·:h

IRON CREEK

Scale 1.7 in: 1 ·



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
$R_{I,II,III}$	REACH # and SECTION
T_1 1.0	TRANSECT I and RIVERMILE
OBSTRUCTION	BARRIER
J1,2,3,	JAM and #
F( )1,2,3	FALLS, HEIGHT, end #
C1,2,3	CULVERT and I
B1,2,3	CHUTE and I
	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 (E-TENSIVE/SEVERE)
	1,2,3, :MISCELLANEOUS
	WETLAND HABITAT
	ROAD AND IDENTIFIER
	EARTHFLOW

FROG CREEK
BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

County: Wasco

Mouth Location:
T5S.,R10E, Sec. 8

Dates Surveyed: July 20-21 and 26-28, 1983

Tributary to: Clear Creek

Drainage: Deschutes

Watershed Area:
8,107 Acres
12.7 Sq. Mi.

TRI Compartments:
Frog 2205
Bearpaw 2105
Camas 2103

Stream Length: 8.5 Miles

Distance Surveyed:
Mainstem; 8.5 Miles
Tributary A; 0.2 Miles
Tributary B; 0.8 Miles

Game Fish: Rainbow trout
Brook trout

Low Flow Width (Avg): 6 Feet

Potential Anadromous Species:
Coho Salmon
Steelhead Trout

Stream Order: III

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%) to moderate (50%) 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% 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% suitable for utilization by trout species and 35% potentially suitable for anadromous salmonids. Spawning gravel concentration is highest in Reach I (45%), where gravel beds range from one 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 (4-5), 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%).

3. Substrate is primarily sand and gravel (75%).

4. Pools dominate the stream area (P:R = 7:3).

5. Stream shading is high (90%).

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%).

3. Substrate size decreases and is heavily dominated by the gravel-sand size classes (95%).

4. Pool-to-riffle ratio decreases slightly (P:R = 6:4).

5. Stream shading continues to be high (90%).

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%).

3. Substrate size classes continue to decrease. Nearly 100% are below 6" in diameter.

4. Pool-to-riffle ratio shows a slight increase (P:R = 7:3).

5. Stream shading continues to be high (90%).

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%).

3. The dominant substrate size class is gravel (40%).

4. Pool-to-riffle ratio remains 7:3.

5. Stream shading decreases to 75%.

Tributary A; RM 0.0 - 0.2:

1. Valley configuration is narrow (floodplain 60 feet) with gentle (less than 30%) sideslopes.

2. Gradient is low (2%).

3. Substrate is rubble dominated (80%).

4. Pools cover half the stream area (P:R = 5:5).

5. Stream shading is 100%.

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%).

3. Substrates are gravel dominated (70%).

4. Pools dominate the stream area (P:R = 6:4).

5. Stream shading is high (80%).

FROG 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% (298 square yards) of the total gravels are in the 0.5 to 1.0 inch size class, with the remaining 40% (198 yards) in the 1.5 to 3 inch size class. LWD influences retention of 80% of the total gravels and 90% 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 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% gradient. Velocity at the time surveyed (low-flow) was 5 feet/second.

Reach II; RM 1.7 - 4.6:

1. The fish habitat quality decreases 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% are in the 0.5 to 1 inch size class. Ninety percent are dependent on LWD. The substate in this reach is predominantly gravel (75%); 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 40 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% 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" deep) during summer flows. No jump pool is provided for the 3 foot 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" deep) with high effective cover.

3. Eighty-seven yards of spawning gravels were counted. Approximately 95% 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% 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% 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% 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 1.7 - 4.6:

1. The riparian habitat decreases to moderate quality (RCR = 5.8).

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 than for Reach I (poles).

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% 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%; 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 (RM 0.0-1.7) is limited. Increasing stream flow 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 generation 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.

Species	REACH I	II	III	IV	Tributary A	TRIBUTARY B
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)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
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
TOTAL	1076	631	445

FROG CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM	(R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS
Frog Creek	0.8	Culvert	C_1	P	Velocity barrier (length 40 ft., 4.5% gradient, low flow velocity 5 ft./sec.), baffle.
Frog Creek	3.55	Culvert	C_2*	P	Partial high flow barrier, (length 90 ft., 1.5% gradient, low flow velocity 2 ft./sec.), baffle.
Frog Creek	4.6	Diversion Structure	D_1	N	Improve jump pool.
Frog Creek	6.8	Culvert	C_3	F	Create jump pool
Tributary B	0.2B	Log ford	L_1	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 Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
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	4	0	
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.)	SP. GRAVELS Total (%)	SP. GRAVELS HQ (%)	POOL Total (%)	POOL HQ* (%)	LWD CHARACTERISTICS OR	#	L	Dia	Source
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

Reach (R.M.)	SUMMER w	SUMMER d	SUMMER v	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
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

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/H_2O TEMP. °F A/W	A/W	TIME
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

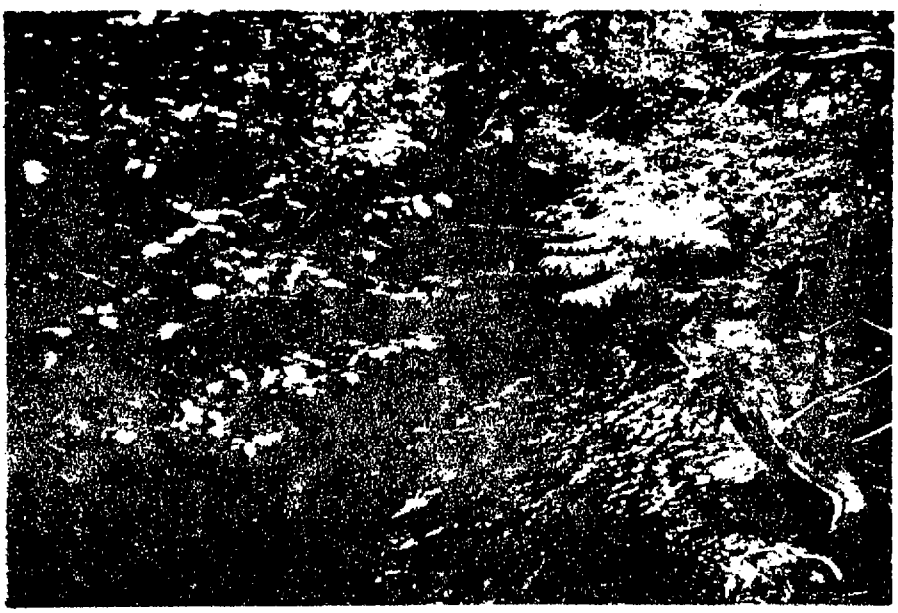
REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstory Con.	Overstory Dec.	AQUATIC Stream-class	Wetland %	Size	Special Habitat
I (0.0-1.7)	6.7	120	5	4	0	2	M	S	1
II (1.7-4.6)	5.8	125	4	3	0	2	L	S	1
III (4.6-6.7)	5.2	140	4	3	0	2	--	--	0
IV (6.7-7.8)	6.2	140	5	4	0	2	M	L	2
Tributary A. (0.0-0.2)	3.2	60	2	2	0	3	--	--	0
Tributary 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 ≥ 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)

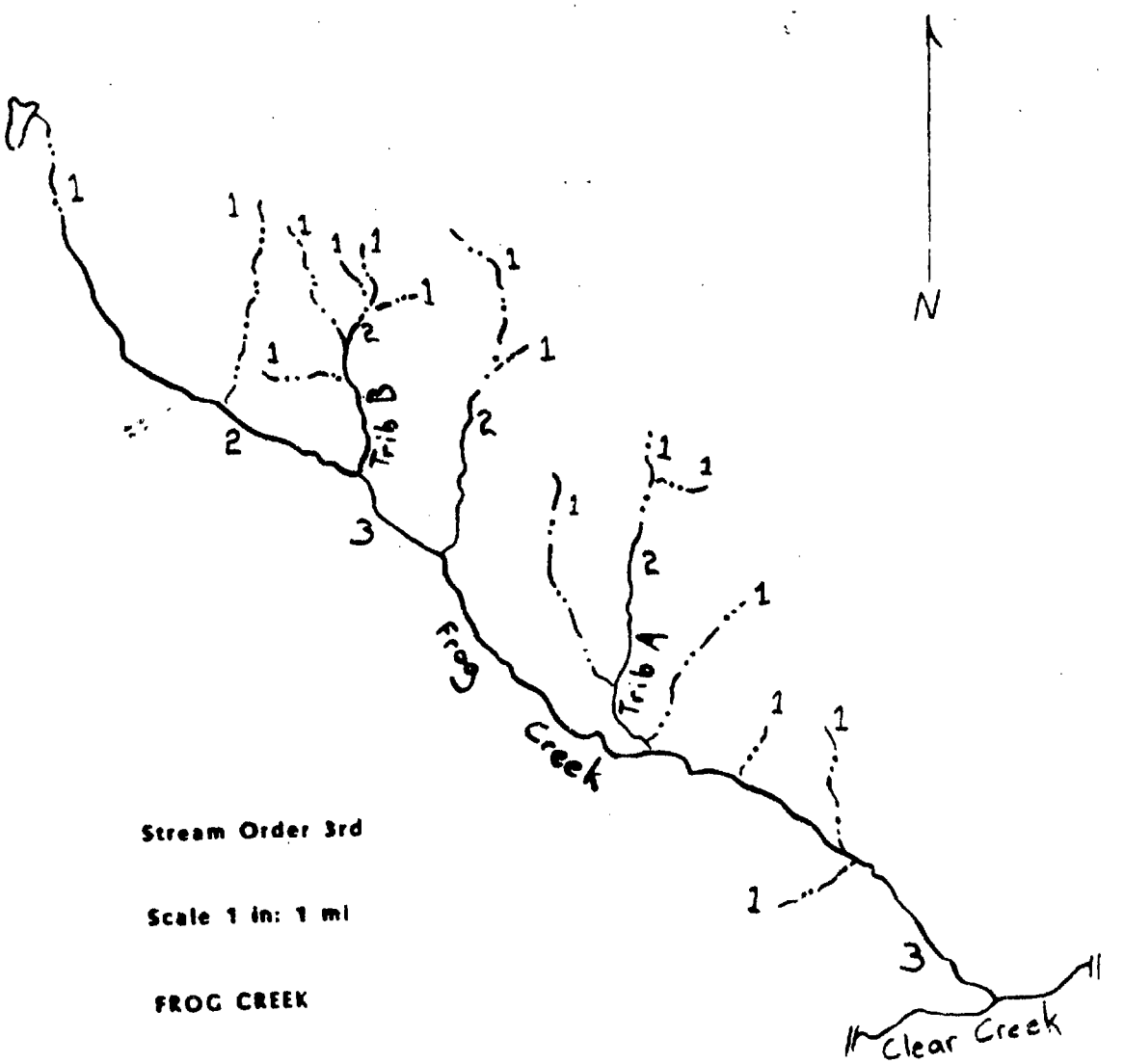
True riparian vegetation is dominated by dense tag alder and Pacific yew along much of the stream in Reach III (above the ditch diversion at RM 4.6). Channel structure is provided by moss covered hummocks of decaying logs, often supporting new growth. Channel braiding is very common.

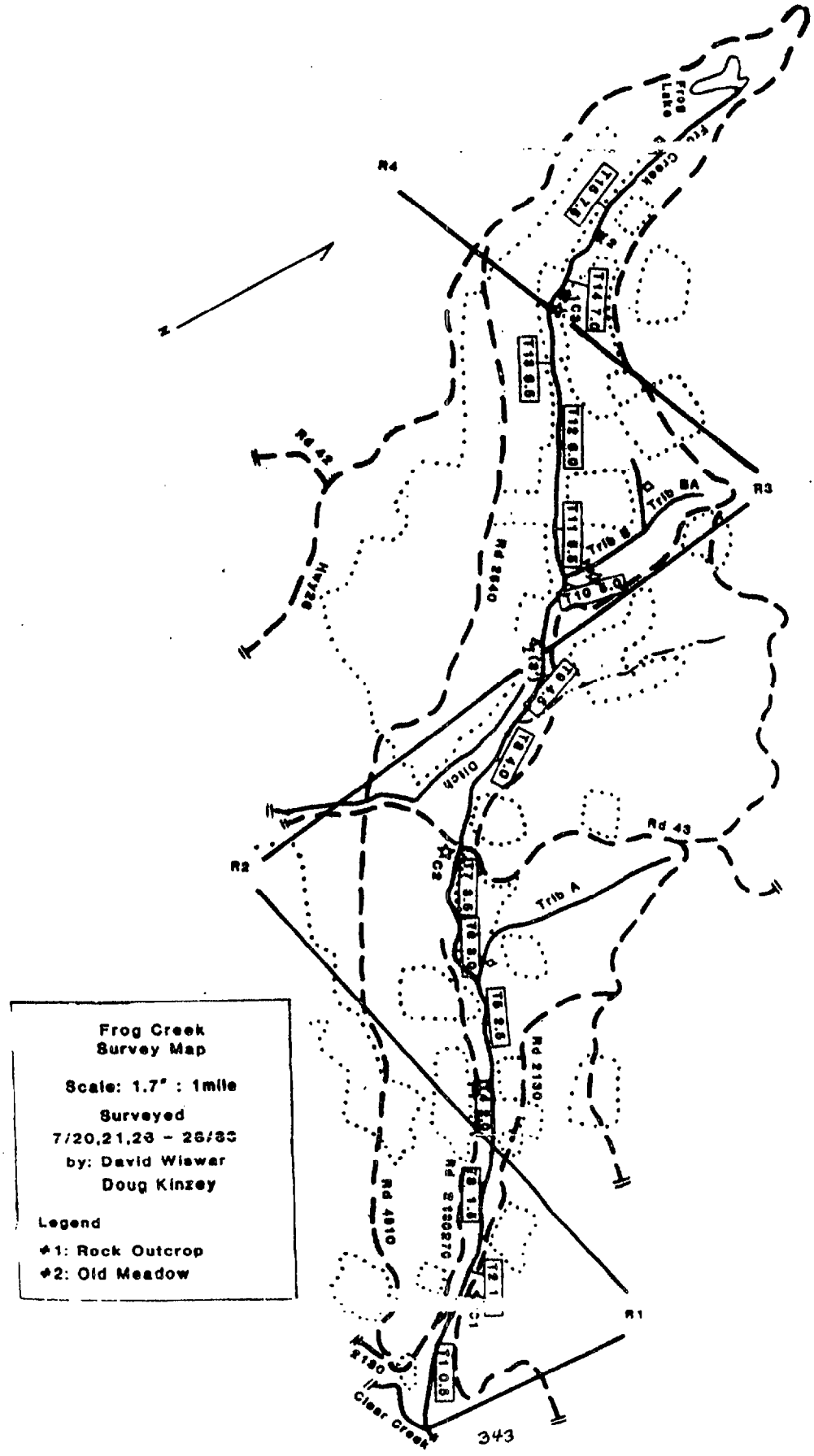
The influence of LWD continues to be high in Reach IV (photo at R.M. 7.3) although channel braiding is reduced. Average pools are one square yard in area with shallow depths and high effective cover.

Typical view of Frog Creek in Reach I (R.M. 0.5). 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.


N
Trib B
Trib A
Frog Creek
Clear Creek
Stream Order 3rd
Scale 1 in: 1 mi
FROG CREEK


Frog Creek
Survey Map
Scale: 1.7" : 1mile
Surveyed
7/20,21,26 - 26/30
by: David Wiswar
Doug Kinzey
Legend
#1: Rock Outcrop
#2: Old Meadow
R1
R2
R3
R4
Rd 43
Rd 2840
Rd 2150
Rd 4910
Trib A
Trib B
Trib BA
Ditch
Clear Creek
Frog Lake
343

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 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
5-47	ROAD AND ID NUMBER
	EARTHFLOW

BARLOW CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

Dates Surveyed: August 9-11, 1983

Tributary to: White River

Drainage: Deschutes

TRI Compartments:
Bonney 2201
Grindstone 2203
Bird 2204

Gamefish: Rainbow trout
Brook trout

Potential Anadromous Species:
Coho Salmon
Steelhead trout
Chinook Salmon

County: Hood River
Wasco

Mouth Location:
T.4S, R.9E., Sec. 24

Watershed Acres: 6,692 acres
10.5 sq. mi.

Stream Length: 7.1 miles

Distance Surveyed:
Mainstem: 6.8 miles

Low Flow Width (Avg.) 10 feet

Stream Order: III

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% (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 month. 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%). Valley walls are moderately steep to steep (60-90%). Stream gradient is low throughout the stream's length (2-4%), 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% (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. Reach Descriptions

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% 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%) 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% 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%) 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.

BARLOW CREEK

Reach Summary

Reach I; RM 0.0 - 2.7:

1. The floodplain width is greater than 200 feet in a very wide (200+ ft.) glacial, U-shaped valley. (Barlow Creek flows in the White River floodplain).

2. Stream gradient is low (2%).

3. Channel substrate is comprised of gravel and rubble.

4. Pools dominate the stream area (P:R = 7:3).

5. Stream shading is moderate (60%).

Reach II; RM 2.7 - 5.4:

1. The valley shape changes to a very wide, flat-bottom V-configuration. Floodplain widths range from 80 to greater than 200 feet.

2. Stream gradient remains low (3%).

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%).

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%).

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%).

Reach IV; RM 6.4 - 6.8:

1. Valley configuration is V-notched with steep (> 70%) sideslopes. Floodplain width averages 25 feet.

2. Gradient is stepped and highly influenced by LWD; the gradient ranges from 7-17%.

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%).

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%) would preclude the introduction of any anadromous species. It is a major water source for Barlow Creek, providing approximately 40% 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% 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 included 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% (343 sq.yd.) are good quality. Approximately 50% of the total are in the 1.5-3 inch size class and 45% in the 3-6 inch size class. Spawning beds of 5+square yards are common. LWD influenced formation of 60% of all the beds and 70% 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% of the pool formation; however, ninety 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 = 7.5). Rainbow and brook trout were observed in moderate numbers.

2. Spawning gravels total 175 square yards with most (80%) 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% of the beds and 80% 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% 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%). 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% 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 bush 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.

Species	REACH I	II	III	IV
Trout fry	H	H	M	( )
Trout - j	M	M	L	( )
Trout - a	M	M	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)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
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)	18	9	9
TOTAL	893	484	409

BARLOW CREEK

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
0.95	Logjam	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 Avail.	Miles Pot.	P:R	Rearing Area	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
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	
III(5.4-6.4)	1.0	0.0	7:3	6	1.0	11	1	
IV (6.4-6.8)	0.4	0.0	6:4	1	0.5	4	0	
Total	6.8	0.0				421	317	

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 [illegible] ved in the 1"-3" and 3"-[illegible] size classes

BARLOW CREEK

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HO (%)	Total (%)	HO (%)	OR	#	L	Dia	Source
I (0.0-2.7)	60	70	30	90	Perp	S+M	1-2	1-2	M
II (2.7-5.4)	75	80	50	70	Perp	S+M	1-2	1-2	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: % of total habitat area dependant on LWD
- HO: % 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

	SUMMER				BANKFULL		
Reach (R.M.)	w	d	v	Q	W	D	Floodplain Width (Ft.)
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	?	1.5	6	1	30

* Data compiled from transect measurements.

LEGEND:
- W,w: Stream width (ft)
- D,d: Stream depth (ft)
- v: Velocity (feet/second)
- Q: Average reach flow [illegible] feet/second

BARLOW CREEK

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

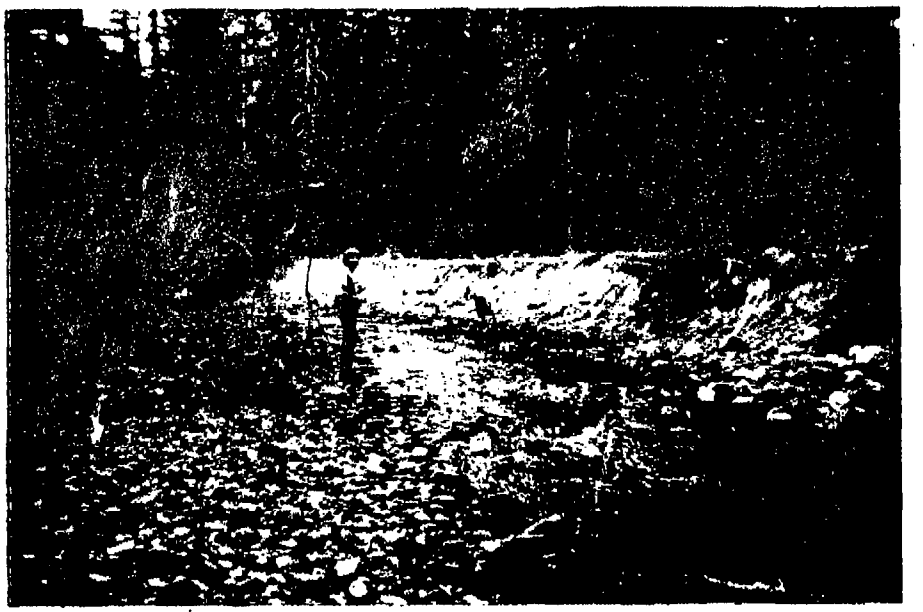
REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/WATER TEMP.° F A/W A/W	TIME
I (0.0-2.7)	8/9-10/83	12-7	60	SE	61/54-78/59	1400-1900
II (2.7-5.4)	8/10-11/83	10-4	70	SE	56/50-62/54	1220-1820
III (5.4-6.4)	8/11/83	4	40	SE	54-57/50	1420-1530
IV (6.4-6.8)	8/11/83	1.5	100	SE	54/45	1800

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstory Con.	Dec.	AQUATIC Streamclass	Wetland%	Size	Special Habitat
I (0.0.-2.7)	7.1	200	5	5	1	II	L	L	1
II (2.7-5.4)	7.6	150	5	3	1	II	M	L, S	2
III (5.4-6.4)	8.2	130	3	2	1	II	H	L, S	3
IV (6.4-6.8)	3.8	30	4	4	1	II	-	-	0

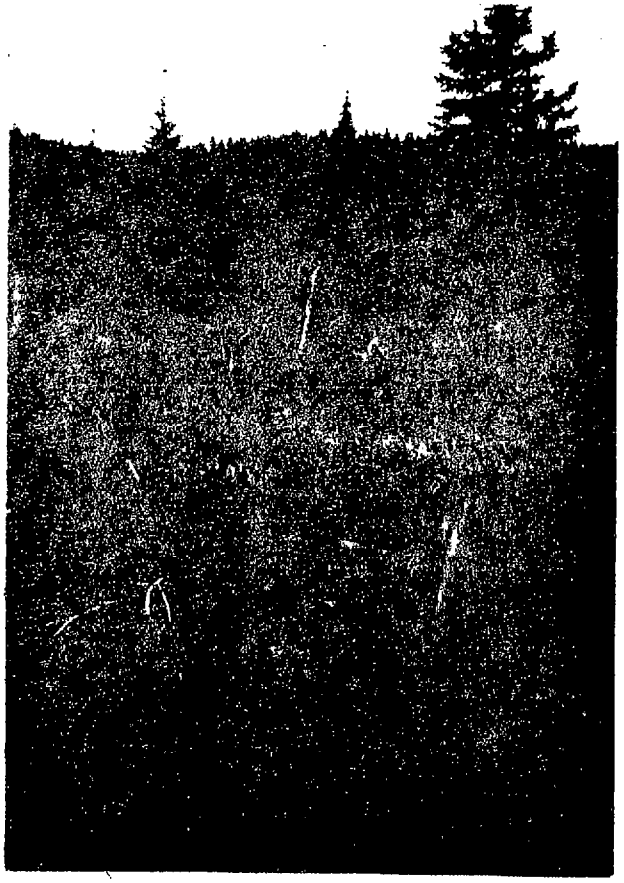
LEGEND:

- RCR: Riparian Condition Rating
- F.P.: Floodplain
- H.U.: # Habitat Units: H $\geq$ 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)



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:R=4:6). Small boulders are the predominant channel structural componant 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.

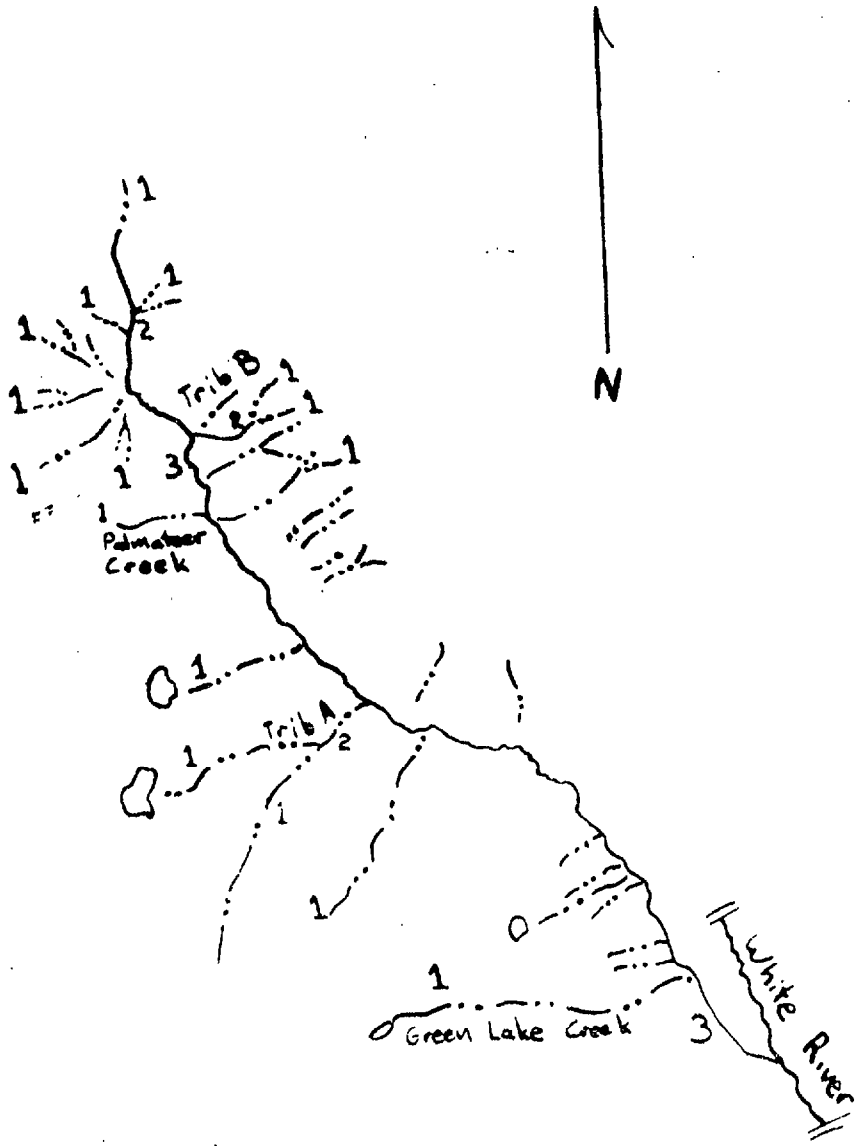


At RM 6.0 Barlow Creek braids out into a large sedge meadow. Numerous beaver channels are present. The Old Barlow Road parallels the east side of the area, and Devil's Half Acre Campground is also adjacent. Although riparian habitat is very high quality, wildlife utilization (especially big game) may 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 depths.

Palmateer Creek provides about 40% (3 cfs) of the flow at its confluence with Barlow Creek (R.M. 4.8). 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.

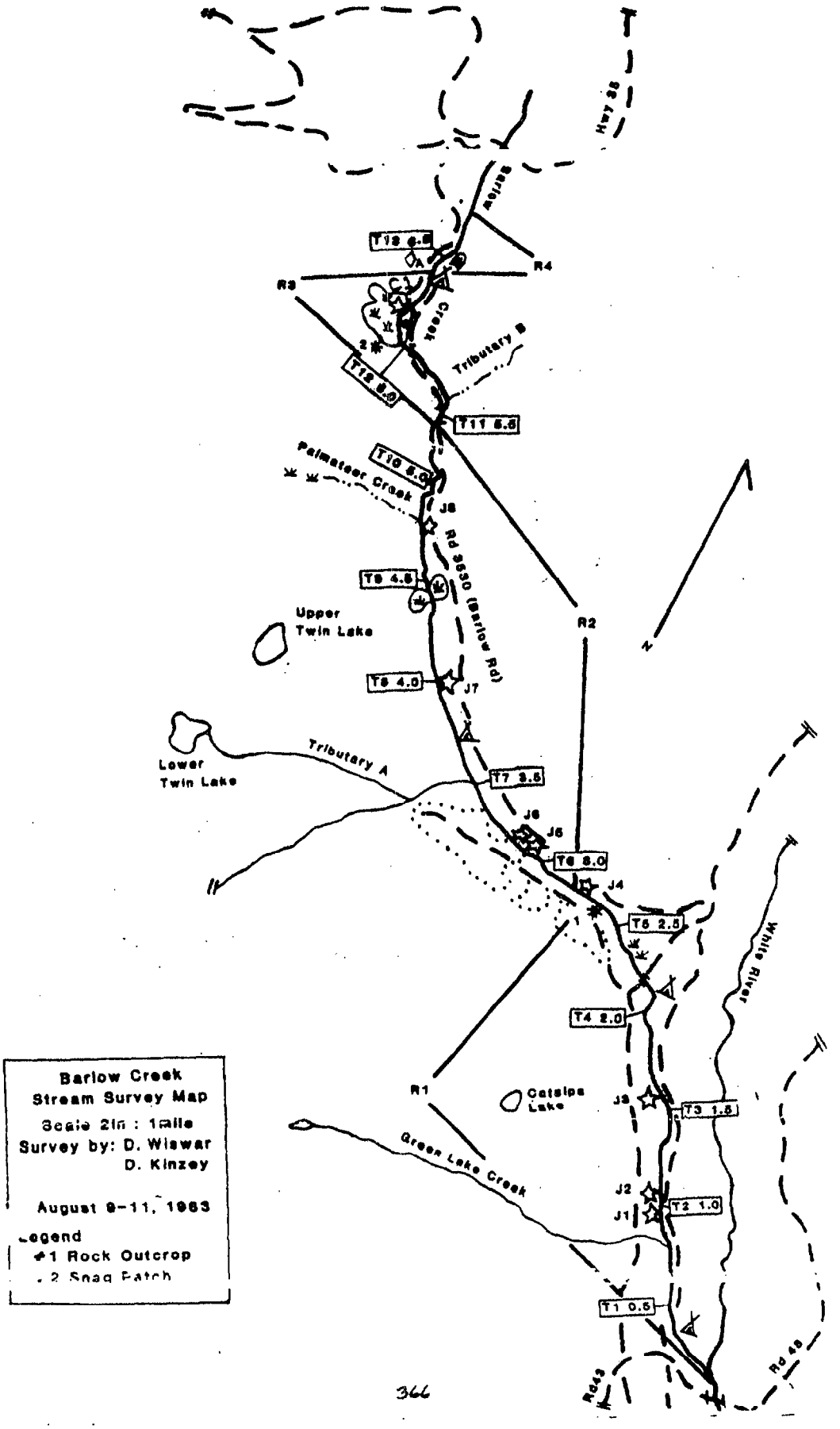
Four Forest Service campgrounds are located along Barlow Creek. Loss of riparian vegetation and high levels of bank instability in these areas appear to be a direct result of the heavy localized recreational use. Rehabilitation efforts in these areas should likely be a high priority for maintaining the existing high quality fish habitat. This site is at RM 1.9.



Stream Order 3rd

BARLOW CREEK

Scale 1 in : 1 mi


Barlow Creek
Stream Survey Map
Scale 2in : 1mile
Survey by: D. Wiswar
D. Kinzey
August 9-11, 1983
Legend
#1 Rock Outcrop
#2 Snag Patch
Hwy 35
Barlow
Creek
Tributary B
Palmateer Creek
Rd 3650 (Barlow Rd)
Upper
Twin Lake
Lower
Twin Lake
Tributary A
Catalpa
Lake
Green Lake Creek
White River
Rd 43
Rd 45
R1
R2
R3
R4
T13 6.5
T12 6.0
T11 5.5
T10 5.0
T9 4.5
T8 4.0
T7 3.5
T6 3.0
T5 2.5
T4 2.0
T3 1.5
T2 1.0
T1 0.5
J1
J2
J3
J4
J5
J6
J7
J8

- STREAM SURVEY MAP SYMBOLS -

CLEAR CUT BOUNDARY

$R_{I,II,III}$ REACH # and SECTION

T_1 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

S-47 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.
1938 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 (1938 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%) and lower gradient (5%) than Reach II (RM 1.0 - 2.0) which is pool dominated (60%) with a higher average gradient (10%). 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% 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% 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% (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% 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 bottomm "V" with gentle sideslopes.

2. The gradient averages 5%.

3. The riffle bottom composition is predominantly small boulder/rubble (65%).

4. Riffles dominate the stream area (60%).

5. Shading is high (85%).

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% with a range of 6 - 14%.

3. The bottom composition is similar to Reach I.

4. Pool area increases to 60%.

5. Shading decreases slightly (75%).

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%. Marginal trout habitat is present for approximately the lower 0.2 miles.

Tributary B:

Trib B contributes approximately 30% (0.3 cfs) of the flow in Buck Creek at their confluence (RM 1.0). The gradient is high (30%) 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% 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% 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 - 1.0:

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 andromous 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

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 (0.0-1.0)	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 $\geq$ 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	REACH I	REACH II	TRIBUTARIES A
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)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0 - 1.0)	180	90	90
II (1.0 - 2.0)	57	27	30
TOTAL	237	117	120

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
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 Avail.	MILES Pot.	P:R	REARING Area	REARING Depth	SPAWNING 1"-3"	SPAWNING 3"-6"	Comments
I (0.0 - 1.0)	0.6	0.4	4:6	3	1	82	41	Potential anadromous habitat ends at RM 1.0.
II (1.0 - 2.0)	--	--	6:4	1	1	23	3	
Total	0.6	0.4				105	44	

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.

TABLE VI - LWD HABITAT QUALITY INFLUENCE

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	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	N/A	Perp.	S-M	1-2	1-2	M

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.)	SUMMER w	SUMMER d	SUMMER v	SUMMER Q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
I (0.0 - 1.0)	6	.25	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

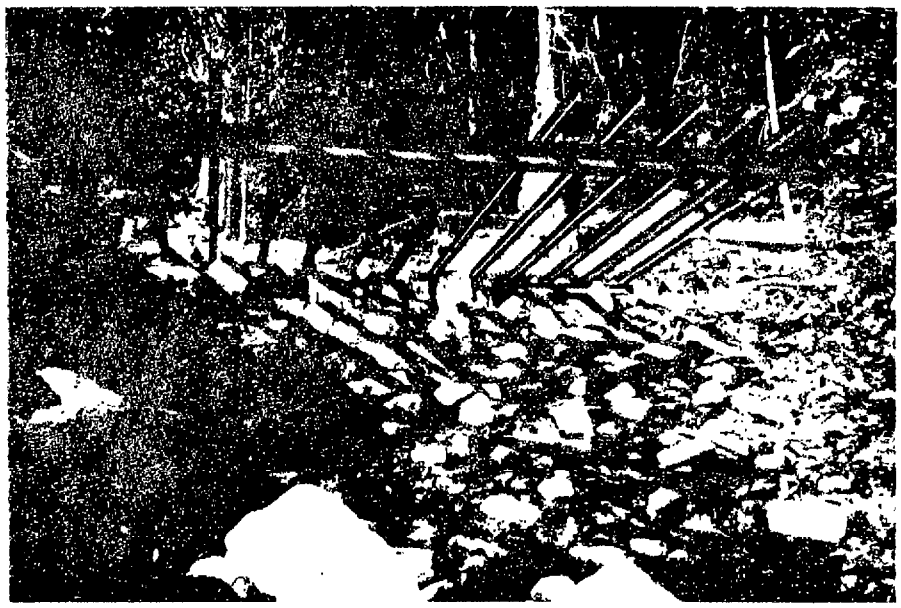
REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP. ^{o} F A/W	A/W	TIME
I (0.0 - 1.0)	8/16/83	1.5	85	S	71/53 -	72/53	1550-1745
II (1.0 -2.0)	8/16/83	0.4	75	S	66/49 -	71/53	1215-1400

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstory Con.	Overstory Dec.	AQUATIC Streamclass	Wetland%	Size	Special Habitat
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
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)

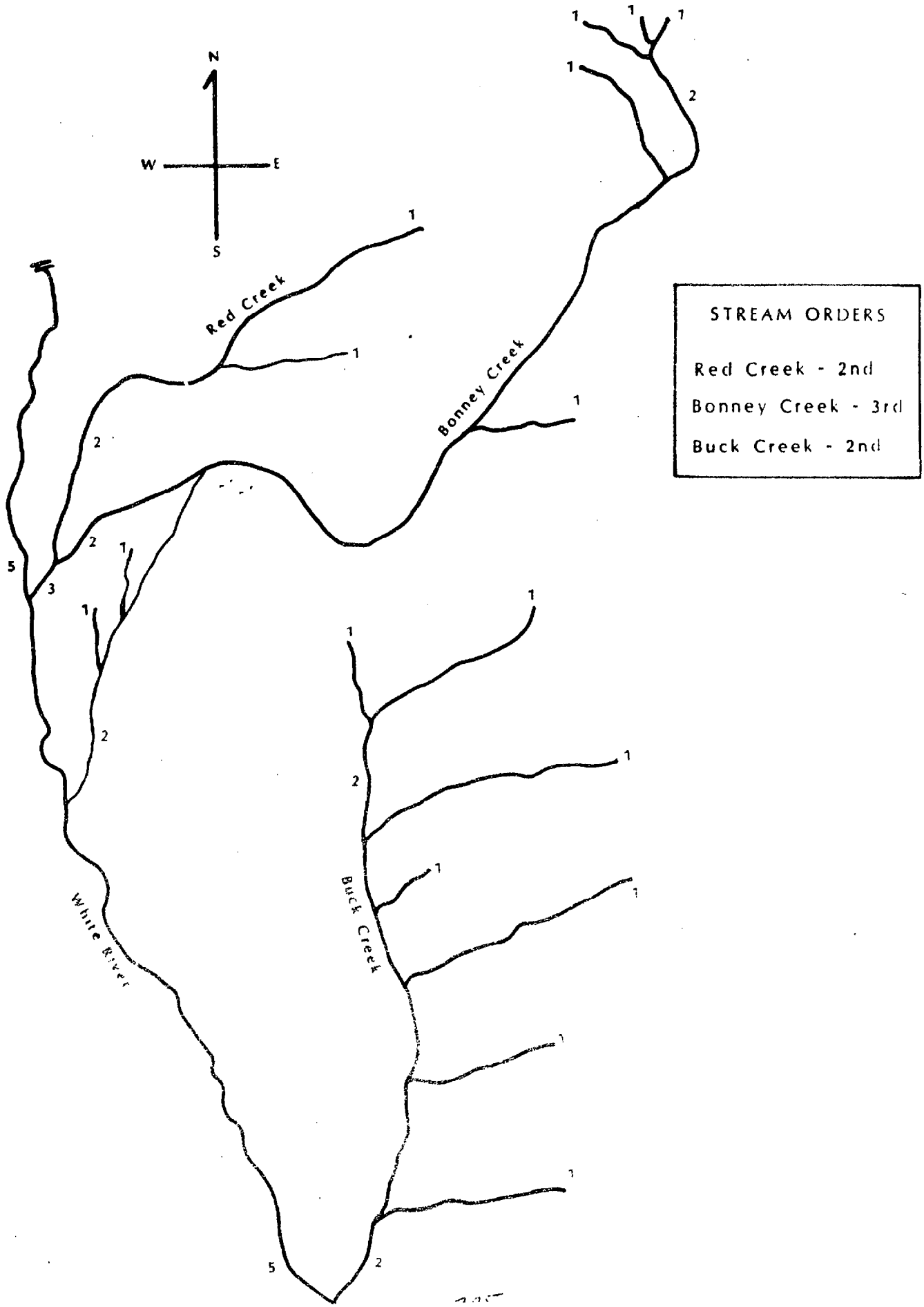
This large wetland (RM 0.0-0.1) occurs where Buck Creek enters the broad White River floodplain. High quality wildlife and fish habitat are found within this wetland. Wetland development is low on the rest of Buck Creek and the overall riparian quality is moderate (RCR=5.3).

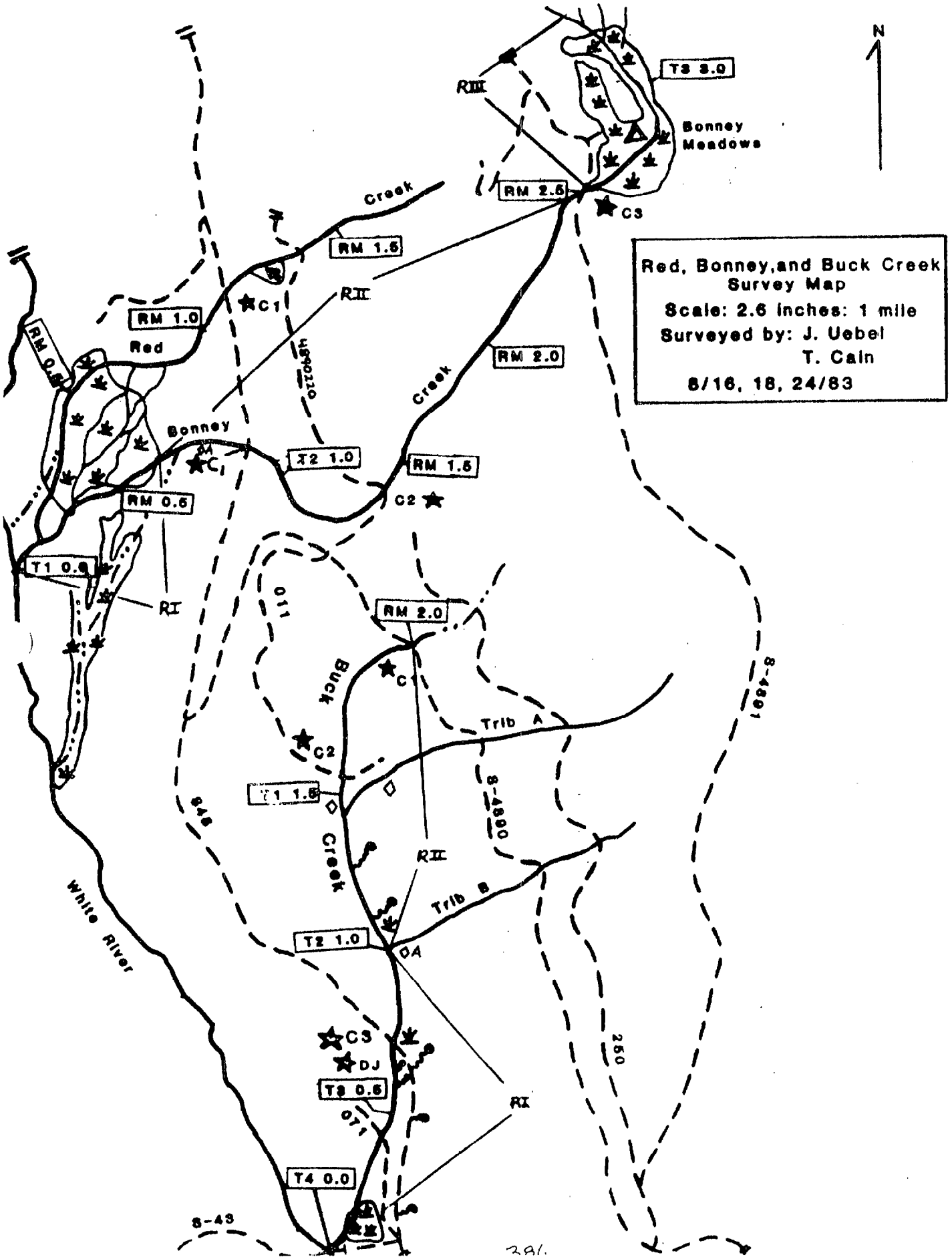


Passage is generally good throughout the potential anadromous habitat (RM 0.0-1.0). This trash rack (RM 0.7), which has created a boulder chute, and a debris jam (RM 0.6) could act as partial passage barriers. Minor modifications could enhance passage at both sites.

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 from RM 0.5 to 2.0. An active timber sale (408 Ile, 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.


N
W
E
S
Red Creek
Bonney Creek
Buck Creek
White River
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
N
T3 3.0
Bonney
Meadows
RIII
RM 2.5
C3
Creek
RM 1.5
RII
C1
RM 1.0
Red
RM 0.5
Creek
RM 2.0
Bonney
C1
T2 1.0
RM 1.5
C2
RM 0.5
T1 0.5
RI
RM 2.0
Buck
C1
Trib A
C2
T1 1.5
Creek
RII
Trib B
T2 1.0
A
White River
C3
DJ
T3 0.5
RI
T4 0.0
8-43
8-4891
8-4890
250
945
110
011

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 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
S-47	ROAD AND ID NUMBER
	EARTHFLOW

BONNEY/RED CREEKS
BEAR SPRINGS RANGER DISTRICT

Surveyors: Jeff Uebel, Tom Cain

Dates Surveyed: August 16, 18, and 24, 1983

Tributary to: White River

Drainage: Deschutes

TRI Compartments: Bonney 2200
Iron 2202

Game Fish: Rainbow trout
Brook trout

County: Wasco

Mouth Location:
Bonney - T.4S., R.9E., Sec. 1
Red - T.4S., R.9E., Sec. 1

Watershed Area:
Bonney - 1458 acres, 2.3 sq. mi.
Red - 426 acres, 0.7 sq. mi.

Stream Length:
Bonney - 3.5 miles
Red - 1.5 miles

Distance Surveyed:
Bonney 3.3 - miles
Red - 1.3 miles

Low Flow Width:
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% (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%+) and steep, heavily forested sideslopes (70%+). 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%+) 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%), 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%) 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%).

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 II creates a continuous stepped cascading stream profile, with pools comprising only 30% of the stream area. Spawning habitat is limited overall and patchy in distribution. Over 50% 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%.

3) Substrate composition varies from the small boulder/rubble of RM 0.0-0.2 to the muc/silt/woody debris substrate of the wetland area RM 0.2-0.6.

4) Pools dominate the stream area (60%), particularly in the wetland section.

5) Stream shading is high (95%).

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 flood plain development (50 feet) and moderate to steep sideslopes (40-70%).

2) Stream gradient is high (10%+).

3) Substrate is predominantly boulder (70%).

4) Pool area decreases, and cascades and riffles dominate the stream area (70%).

5) Stream shading remains high (90%).

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%.

3) Substrate becomes gravel dominated (70%).

4) Pools and riffles are even balanced (P:R=F.4).

5) Stream shading becomes low in the open meadow (3%).

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%+) 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%. RM 0.6-1.0, gradient varies between 5 and 15%. Above RM 1.0, gradient increases from 15 to 20%+.

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%) and shallow riffle below that point.

5) Stream shading was high throughout (95%+).

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% 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% of the 50 sq. yards available are of a size class suitable for anadromous fish and 50% 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% 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% of the gravels are of a size class suitable for anadromous fish, and 50% 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%+) block upstream fish passage above RM 0.7. The culvert at (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% 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 coniferous (four species) and scattered cottonwood are present.

5) Limited small wetland development is present [illegible] 8. No other special habitats were observed.

Reach III; RM 2.5-3.5 (Bonney Meadows):

1) Riparian conditions are [illegible] high quality [illegible]

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 burn 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%+). 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 ravelling 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% 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%

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

Species	REACH I	REACH II	REACH III	TRIBUTARIES Red Creek
Trout - j	H	M	M	-
Rb - a	M	L	( )	-
Bk - 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

TABLE III - SPAWNING GRAVEL (SQUARE-YARDS)

Reach (R.M.)	Spawning Gravel (Sq. Yds.) Total	Good	Marginal
I (0.0-0.6)	45	20	25
II (0.6-2.5)	130	60	70
III (2.5-3.0)	80	40	40
TOTAL	255	120	135

TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM (R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS*
0.3	Debris jam	None	P	None
0.8	Debris jam/ gradient	None	N	None
0.9	Culvert	C1	N	None
1.3	Culvert	[illegible]	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.

TABLE V - ANADROMOUS HABITAT SUMMARY

REACH (RM)	Miles Avail.	Pot.	P:R	Rearing Area	Depth	Spawning 1"-3"	3"-6"	Comments
I (0.0-0.6)	0.6	-	4.5	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

	SP. GRAVELS		POOL		LWD CHARACTERISTICS				
Reach (R.M.)	Total (%)	HQ (%)	Total (%)	HQ (%)	OR	#	L	Dia	Source
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 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

	SUMMER				BANKFULL		
Reach (R.M.)	w	d	v	Q	W	D	Floodplain Width (Ft.)
I (0.0-0.6)	4	0.[illegible]	[illegible]	1.3	8	1	8-500
II (0.6-2.5)	3	0.3	[illegible]	1	8	1.5	50
III (2.5-3.0)	1	0.2	[illegible]	0.4	1.5	0.5	500+

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

TABLE VIII - TEMPERATURE AND SHADE RELATIONSHIP

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ORIENTATION	AIR/WATER TEMP.° F	TIME
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

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM	RHR	VALLEY	VEGETATION			AQUATIC			
		F.P. (ft.)	H.U.	Overstory Con.	Overstory 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
Red Creek									
(0.0-1.0)	8.6	300	5	6	2	II	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 ≥ 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)

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.

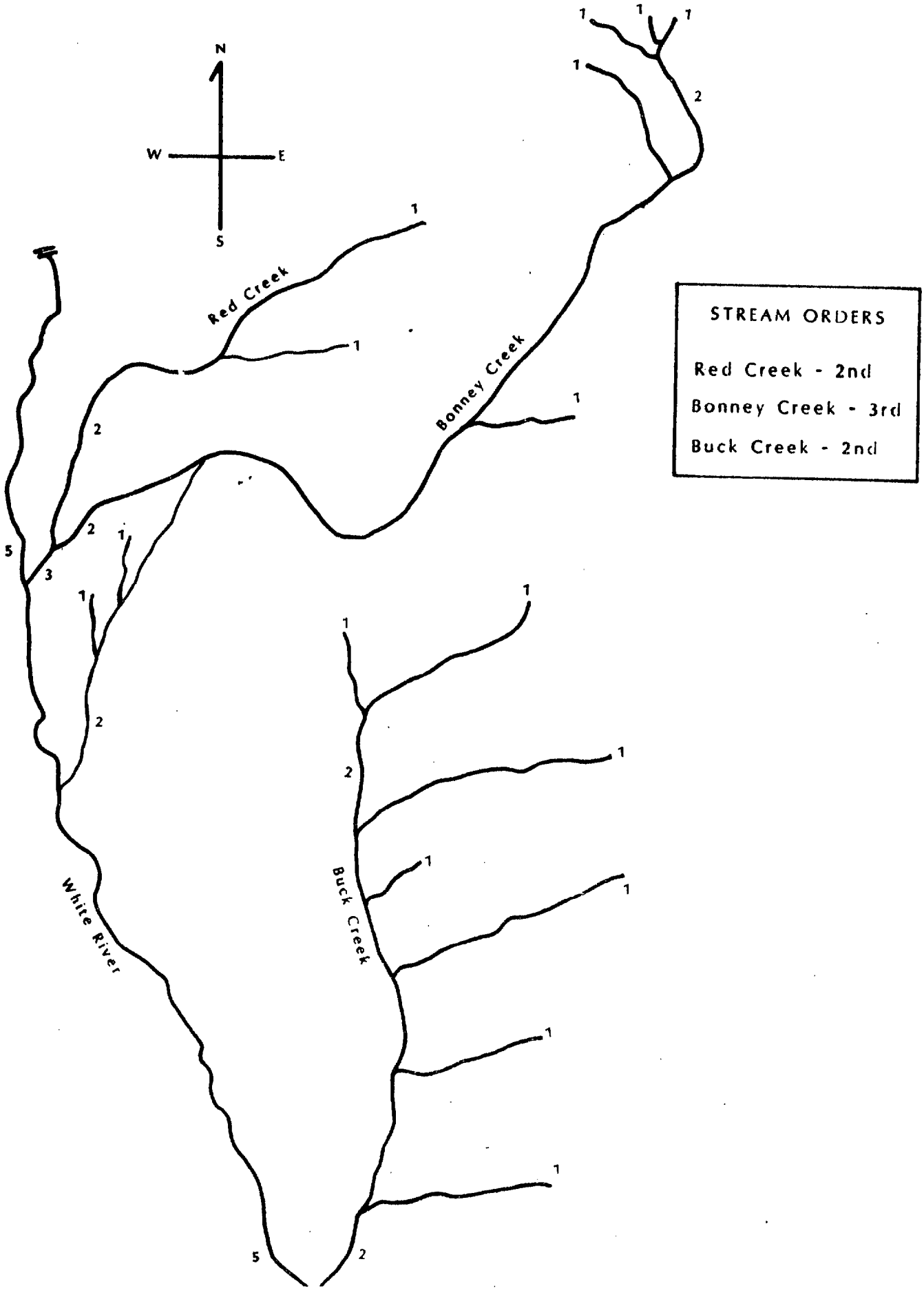
A large wetland complex (100 acres) is located at the Red Creek confluence (RM 0.2 Bonney Creek). Excellent wildlife habitat development is found throughout Reaches I and III of Bonney Creek in the high quality wetlands present. Channel braiding is abundant in this wetland (RM 0.2 - 0.6), and salmonid rearing habitat conditions are excellent.

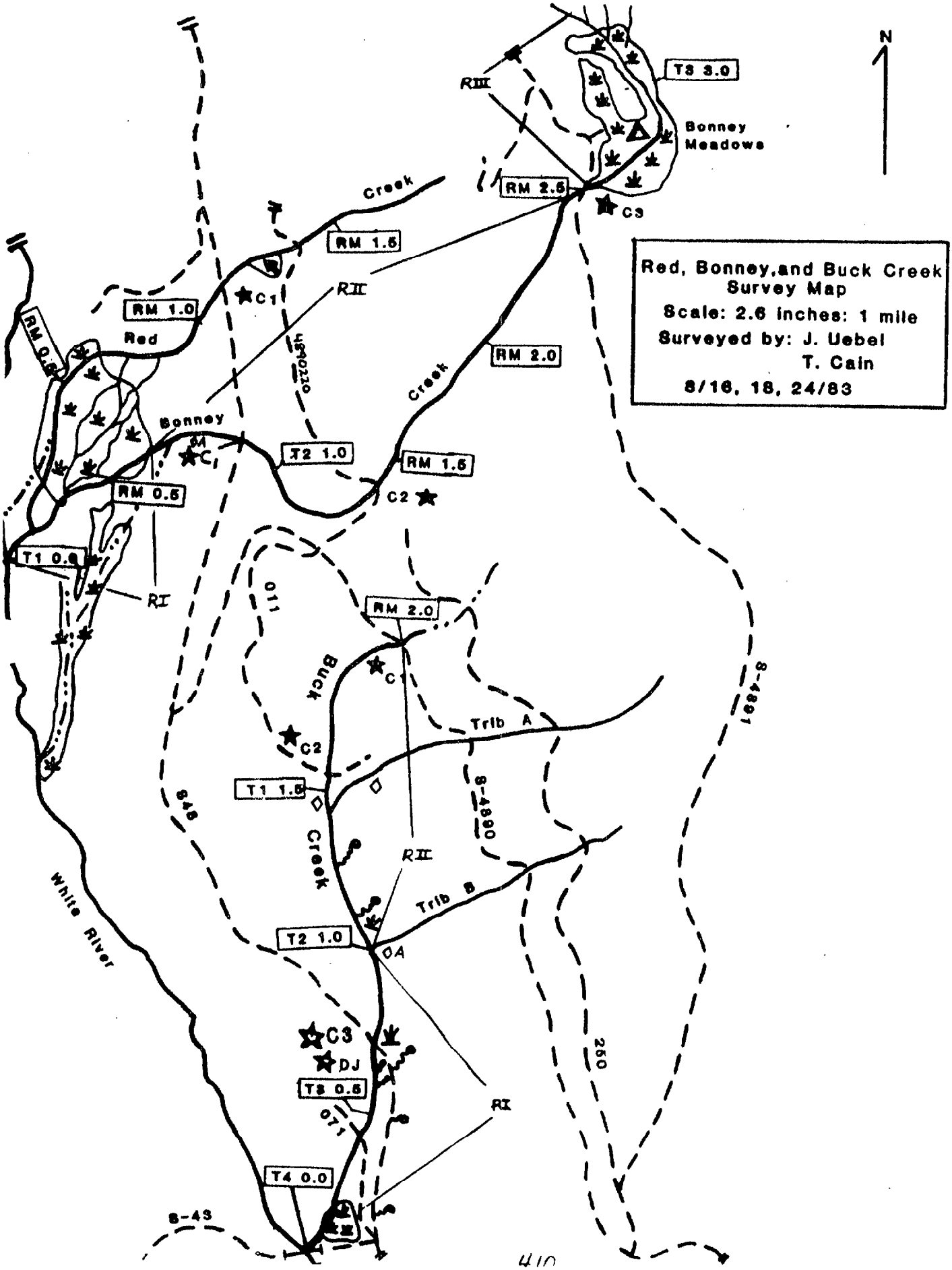
This view at RM 0.6 is near the upper end of the large wetland in Reach I of Bonney Creek. Channel downgrading and bank erosion following the establishment of a new channel at RM 0.7 - 0.8 has resulted in the development of a large sediment plain RM 0.5 - 0.6. Potential anadromous spawning habitat conditions 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.


N
W
E
S
Red Creek
Bonney Creek
Buck Creek
White River
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
N
T3 3.0
Bonney
Meadows
RIII
RM 2.5
C3
Creek
RM 1.5
RII
C1
RM 1.0
Red
RM 0.5
RM 2.0
Creek
Bonney
T2 1.0
RM 1.5
C2
RM 0.5
T1 0.0
RI
RM 2.0
Buck
C1
Trib A
C2
T1 1.5
Creek
RII
Trib B
T2 1.0
DA
White River
C3
DJ
T3 0.5
RI
T4 0.0
S-43
260
S-4891
S-4890
648
011
410

- STREAM SURVEY MAP SYMBOLS -

	CLEAR CUT BOUNDARY
$R_{I,II,III}$	REACH # and SECTION
T_1 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
S-47	ROAD AND ID NUMBER
	EARTHFLOW

IRON CREEK

BEAR SPRINGS RANGER DISTRICT

Surveyors: David Wiswar
Doug Kinzey

Dates Surveyed: July 7-8 and 11-12, 1983

Tributary to: White River

Drainage: Deschutes

TRI Compartments: Iron 2202

Gamefish: Rainbow trout

Potential Anadromous Species:
Steelhead trout
Coho salmon
Chinook salmon

County: Hood River

Mouth Location:
T. 3 S., R. 9 E., Sec. 36

Watershed Area: 5200 acres
8.1 sq. miles

Stream Length: 4.3 miles

Distance Surveyed:
4.3 miles mainstem
0.8 miles Carp Creek
0.4 miles South Fork Iron Creek
0.1 miles North Fork 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% of the flow (30 cfs) to the White River at their confluence (RM 2.7. of Iron Cr.) 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. Geomorphology

The floodplain width over the entire mainstem is greater than 200 feet. Sideslope gradients are 60-70% on the east side and less than 20% 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%.

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 overal 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 ratio (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%) 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.

The macroinvertebrates populations normally identified with the stream substrate material appear to be sparse in these areas. Fish production in these areas may also 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%).
3. Substrate is predominantly boulders and rubble (55%).
4. Riffles dominate the stream area (P:R = 2:8).
5. Stream shading is low (20%).
6. Channel and bank stability is 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%.
3. Substrate is boulder dominated (55%).
4. Percentage of pool surface area increases (P:R = 4:6).
5. Shading increases to 60%.
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%).
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%).
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% to 8%). Overall gradient increases (> 10%) 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%).

5. Pool area changes from 40% of the stream surface area below RM 0.4 to less than 10% 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 (RM 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%).

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%).

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 R. M. 0.1 valley configuration is V-notched and floodplain width is narrow (< 30 ft.).

2. Stream gradient also changes quickly from a low (3%) to a high, stepped gradient (> 11%).

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%).

South Fork Iron Creek; RM 0.0 - 0.3:

1. Valley configuration is wide, U-shaped, with gentle side slopes (30% gradient).

2. Gradient is high (9%).

3. Substrate is rubble, gravel, and sand mixture.

4. Riffles dominate the stream area (P:R = 1:9).

5. Stream shading is high (90%).

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. Electro-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:

1. 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%).

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% of high quality pools were 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 depths (12-29 inches) 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% 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.

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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% 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% 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 thirty 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% 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.

5.

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% 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% 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% 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.

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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% to 11% make areas upstream apparently unsuitable as anadromous fish habitat. The culvert on North Fork Iron Creek appears passable.

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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
Tributaries														
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 (%)
- 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%

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

	REACH			TRIBUTARIES			
Species	I	II	III	Carp Ck.	Up.Trib.C.	NF Iron Ck.	SF Iron Ck.
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)

	Spawning Gravel (Sq. Yds.)		
Reach (R.M.)	Total	Good	Marginal
I (0.0-2.7)	24	0	24
II (2.7-3.9)	2	0	2
III (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	76	25	51

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TABLE IV - FISH MIGRATION OBSTRUCTIONS

STREAM	(R.M.)	TYPE	ID #	PASSABLE	RECOMMENDATIONS
Carp Creek	0.25	Logjam	J_1	N	None
Carp Creek	0.3	Culvert	C_1	N	None, 300 ft. long, limited habitat above.
Carp Creek	0.31	Bedrock chute	B_1	N	None
Carp Creek	0.32	Falls	F_1	P	None
Carp Creek	0.4	Falls	F_2	N	None, 20 ft. high.
Carp Creek	0.45	Falls	F_3	N	None
NF Iron Cr.	0.1	Culvert	C_1	F	None
Upper Trib C		Culvert	C_1	N	None

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

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

TABLE V - ANADROMOUS HABITAT SUMMARY

Reach (RM)	Miles Avail.	Miles Pot.	P:R	Rearing Size	Rearing Depth	Spawning 1"-3"	Spawning 3"-6"	Comments
I (0.0-2.7)	2.7	0.0	2:8	1	2	14	5	Cemented, sandy
II (2.7-3.9)	1.2	0.0	4:6	1	2	2	0	& in small pockets
III (3.9-4.3)	0.4	0.0	4:6	6	2	0	0	less than 1 sq. yd.
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	13	

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.

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TABLE VI - LWD HABITAT QUALITY INFLUENCE

Reach (R.M.)	SP. GRAVELS Total (%)	SP. GRAVELS HQ (%)	POOL Total (%)	POOL HQ (%)	LWD CHARACTERISTICS OR	#	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	1-2	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 = % 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

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

Reach (R.M.)	SUMMER w	SUMMER d	SUMMER v	SUMMER q	BANKFULL W	BANKFULL D	Floodplain Width (Ft.)
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

REACH (R.M.)	DATE	FLOW (cfs)	% SHADE	ASPECT	AIR/H_2O TEMP. ^{0} F A/W	A/W	TIME
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

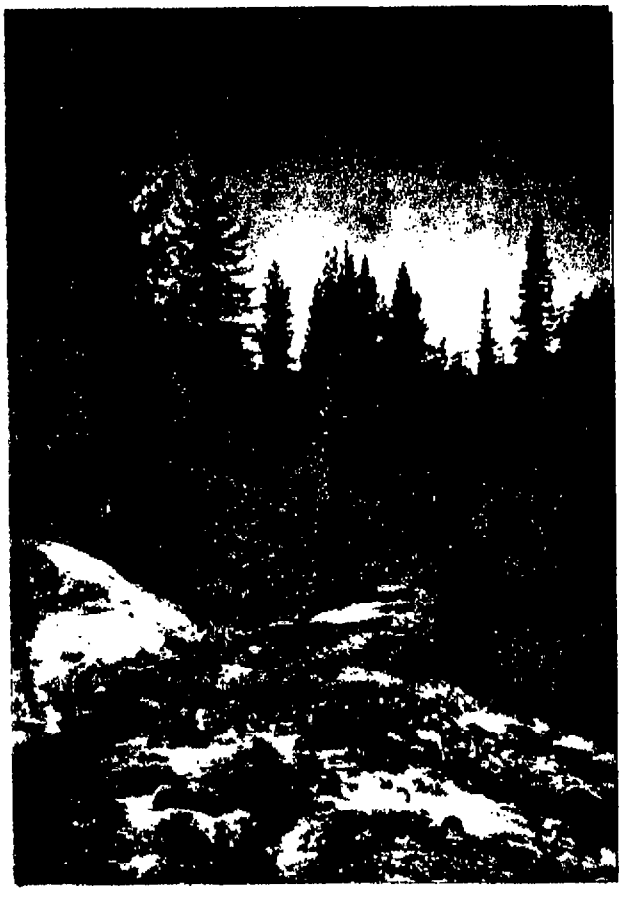
IRON CREEK

TABLE IX - RIPARIAN HABITAT SUMMARY

REACH RM	RCR	VALLEY F.P. (ft.)	VEGETATION H.U.	Overstory Con.	Overstory Dec.	AQUATIC Stream-class	Wetland %	Size	Sp. Habitat Units
I (0.0-2.7)	7.5	200+	5	4	2	II	L	S	2
II (2.7-3.9)	7.5	200+	4	4	0	II	L	L	1
III (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 ≥ 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)

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).

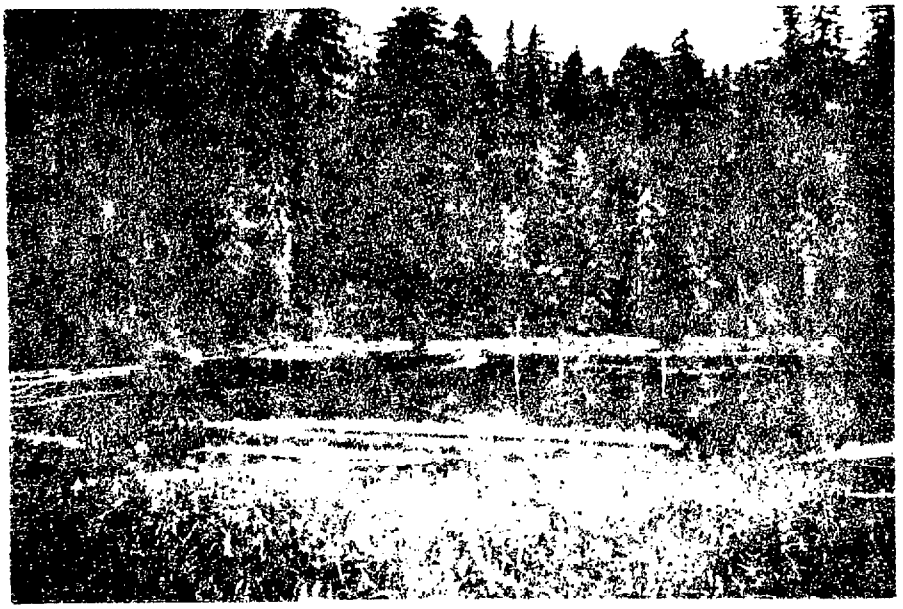


Bank and channel stability increase in Reach II due to decreased flow and increased bank vegetation. Pool surface area increases (P:R = 4:6) and is attributed to an increase in boulder structure. Rearing habitat is fair. Pools are small (avg. = 1 sq. yd.) with shallow to moderate depths and high effective 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 yards 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 water falls 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.

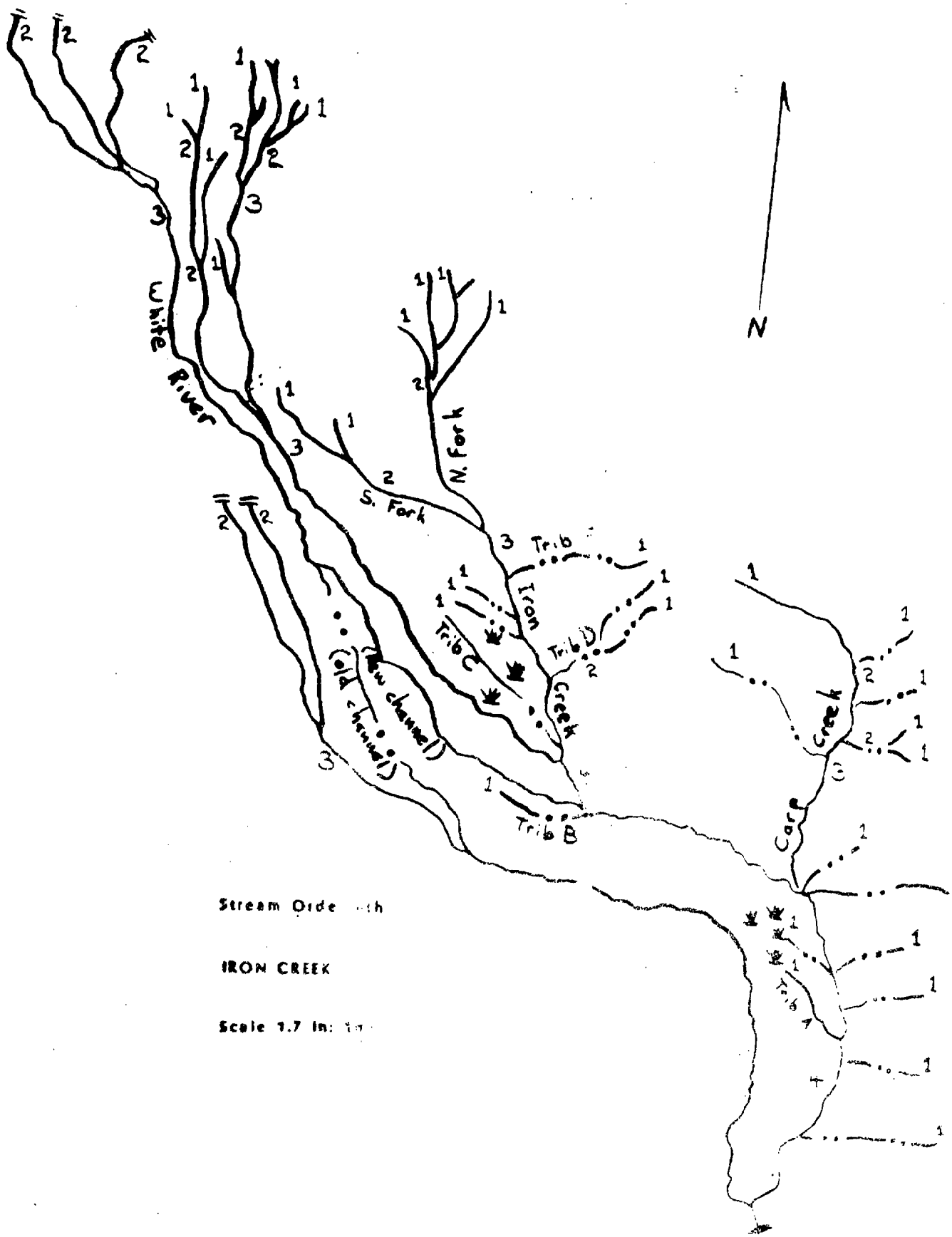
Two large sedge meadows at RM 1.5 and 3.4 (shown) between the Iron Creek and White River floodplains add diversity to riparian habitat in Reaches I and II. Big game utilization of these areas appears heavy.



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 mallard 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 = 2:8). Pools are small (1 sq. yd.) 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.

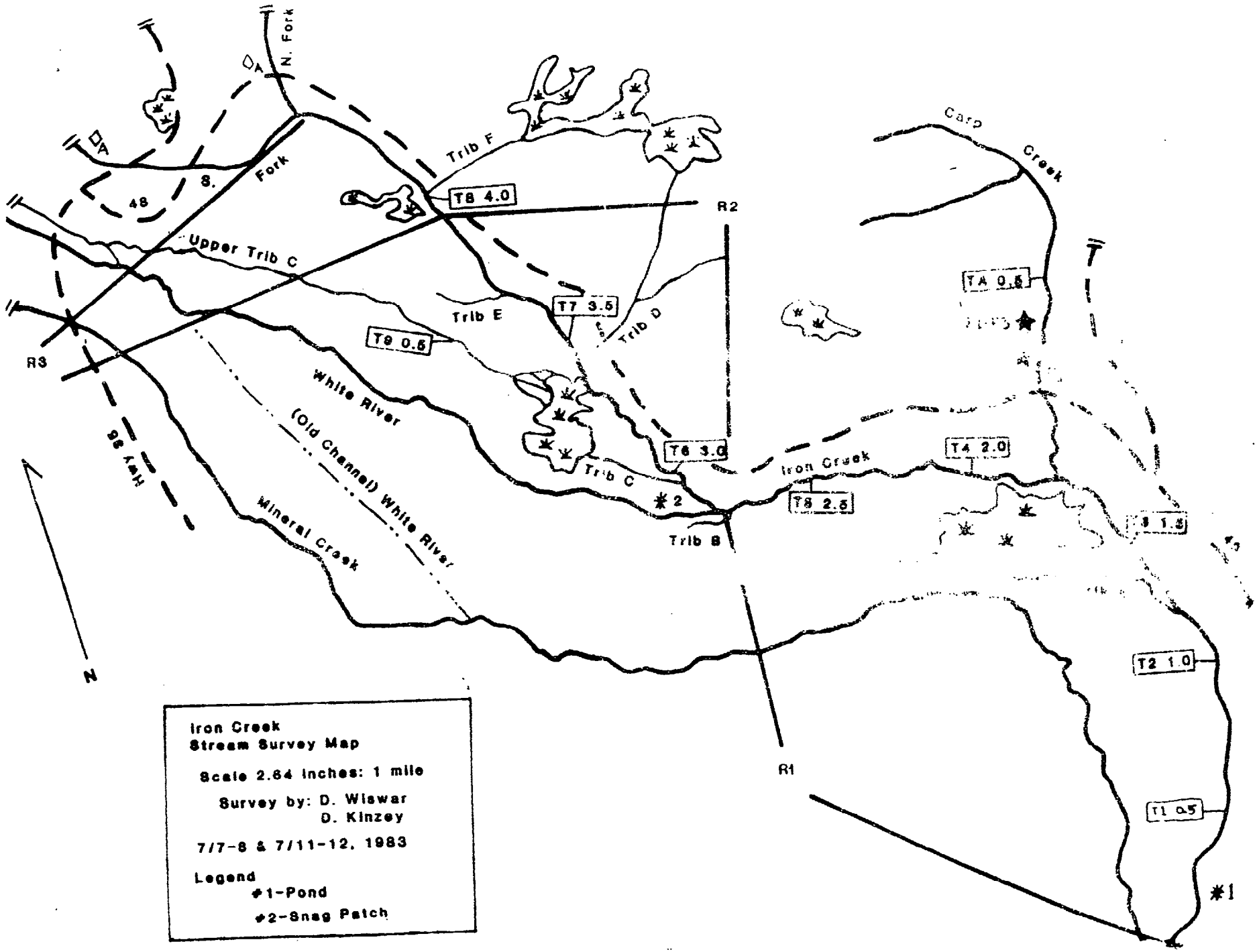
North Fork Iron Creek has an overall 11% gradient; large woody debris (LWD) and boulders create a stair-step profile. Pools are 2-3 square yards in area with shallow to moderate depths. This view is at R.M. 0.1.



Stream Order

IRON CREEK

Scale 1.7 in: 1 mi


N. Fork
S. Fork
48
Trib F
T8 4.0
R2
Carp Creek
Upper Trib C
Trib E
T7 3.5
Trib D
T9 0.5
R3
White River
(Old Channel) White River
Mineral Creek
Hwy 96
T6 3.0
Trib C
#2
Trib B
Iron Creek
T4 2.0
T5 2.5
T3 1.5
T2 1.0
T1 0.5
R1
#1
N
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
$R_{I,II,III}$	REACH # and SECTION
T_1 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
S-47	ROAD AND ID NUMBER
	EARTHFLOW