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WATER TYPING CONSOLIDATION FOR LAST FISH/ LAST HABITAT DATA IN NINE WESTERN WASHINGTON BASINS EXECUTIVE SUMMARY

By
Mary Lou White

TIMBER/FISH & WILDLIFE

Watertyping Consolidation for Last Fish/Last Habitat Data in Eight Western Washington Basins

EXECUTIVE SUMMARY

Contract # PSC00-135

By: **Mary Lou White**
Field Biologist / Project Manager
Washington Trout

Acknowledgements

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Executive Summary: Watertyping Consolidation for Last Fish/Last Habitat Data in Eight Western Washington Basins

Introduction

Washington Trout has been collecting watertyping data throughout Washington since before and after the Washington Department of Natural Resources' (DNR) emergency watertype rule in 1996. Washington Trout crews have conducted watertyping surveys in streams as far north as the Nooksack River basin and as far south as the Columbia River, collecting a large store of data. However, these data had not been collated into a database, nor had data collected prior to the 1996 emergency ruling been distinguished from data collected after the emergency ruling, which had revised physical default parameters for fish-bearing streams.

In the spring of 2000, Washington Trout was awarded a contract with DNR to determine the compatibility between Washington Trout watertyping protocols and the Forest Practice Board's Last Fish/Last Habitat (LF/LH) protocol, and to review and collate Washington Trout watertyping data points for integration into the DNR LF/LH watertyping model. The LF/LH model is currently being tested and refined for use in delineating type S, F, and N waters.

Washington Trout has collected the bulk of its watertyping data under various grants and for private landowners. Surveys were generally conducted for fish presence rather than location of "Last Fish" or "Last Habitat." Determining "Last Fish" location was generally not required, and not always documented.

The results reported in this executive summary refer to data points that can be *considered* for the LF/LH model. Survey data collected by Washington Trout on fish-bearing waters in which the last fish and/or the last habitat location was not clear or not documented were not included in the database referenced in this executive summary. Survey data collected on type 4 and type 5 (non-fish bearing) waters were also not included in the database or this executive summary. All of the raw data for all of Washington Trout's watertyping surveys have been separately submitted to DNR under our watertyping-consolidation agreement.

Again, it should be emphasized: *In their watertyping surveys, Washington Trout crews were not necessarily surveying for the "Last Fish" or the "Last Habitat," as defined by the Forest Practice Board protocol, though in some instances crews did document the last fish or last habitat sighted. The points submitted in the database referred to in this executive summary are not intended to represent LF/LH points; they are submitted for LF/LH consideration only. All submitted data should be carefully scrutinized for model suitability and to determine if they meet DNR criteria.*

Protocol Compatibility

Washington Trout protocols differ from the Forest Practice Board (FPB) protocol in the following ways:

1) Although Washington Trout crews typically utilize electroshockers in determining fish presence, visual determinations for presence are also made without using the electroshockers. Under the Washington Trout protocol (WT Last-Salmonid protocol[1]), last-fish-found points are documented without electroshocker follow-up to prove absence above those points; these points would not meet the necessary requirement for a FPB "Last Fish" determination.
2) While Washington Trout crews routinely surveyed upstream of the last-fish-found to the nearest barrier, the WT Last-Salmonid protocol (prior to 2000) did not require methodically shocking a minimum of 12 pools or ¼ mile upstream of the break, inconsistent with the FPB protocol.

Washington Trout was informed that although the watertyping data collected under the WT Last-Salmonid protocol does not follow the FPB protocol to the word, Washington Trout data should nevertheless be submitted for consideration. The Washington Trout dataset should be compared with datasets following the FPB protocol to determine if they are statistically different.

Last Fish/Last Habitat Data

A total of 691 data points were identified, 312 (45%) under Pre-emergency-ruling protocol and 379 (55%) under WT Last-Salmonid protocol. Of the data points identified, 206 (30%) were Last-Salmonid points, and 485 (70%) were "last habitat" points. Of the total 691combined points, 339 (49%) were collected during the March 1 – July 15 window.

Of the 206 Last-Salmonid data points identified, the species identified were as follows: 149 cutthroat trout (*Oncorhynchus clarki*); 26 rainbow trout (*O. mykiss*); nine coho salmon (*O. kisutch*); six brook trout (*Salvelinus fontinalis*); one native char (*Salvelinus malma/S. confluentus*); one chinook salmon (*O. tshawytscha*); 14 unidentified salmonids. The single chinook was located at a culvert barrier.

Site Locations

Watertyping surveys conducted by Washington Trout crews encompassed watersheds or tributaries of the following eight basins: Nooksack (Hutchinson Cr. tributaries); Stillaguamish (Deer Cr. tributaries), Nisqually (Mashel tributaries), Puyallup (South Prairie and White River tributaries); Snoqualmie; Puget Sound; Chehalis (Black River);

[1] Within this summary and the accompanying data-set, the designation, *WT Last-Salmonid protocol* refers to watertyping data collected by Washington Trout crews under the Washington Trout protocol for identifying fish presence. The designation *Last Salmonid protocol* was applied to WT data collated in the data set for simplification and clarification purposes, per Arleta Agun, Washington Department of Natural Resources.

A list of all watersheds and tributaries submitted in the watertyping dataset along with associated basins are listed by year surveyed in Table 1.

Methodology

Last-Salmonid - upper extent of fish observed or electroshocked – and Last-Habitat points were determined utilizing surveyor summaries and/or base-map documentation. Data point reference numbers beginning at 1000 were assigned to each Last-Salmonid or Last-Habitat point and placed on the watertyping field forms. The field-form data along with the corresponding Last-Salmonid or Last-Habitat data point reference number was then entered into a Microsoft Access database designed to consolidate the fields required for the LF/LH model with the existing Washington Trout watertyping survey fields. Six data points were reevaluated and determined to be questionable during the error checking process. These points have been tagged with a (++) in the comments section of the survey form.

Limitations of the Data

The data entered into the Washington Trout watertyping consolidation database were not collected exclusively for the purpose of collecting LF/LH data, and should be used cautiously with respect to the LF/LH model. This is especially true with regard to surveys conducted in 1996 and the first 8 months of 1997. Washington Trout watertyping surveys through March of 1997 followed the pre-emergency ruling DNR fish-presence protocol with the exception that DNR verbally requested gradient breaks be made at 16% sometime in 1996. Both the pre-emergency-rule and WT Last-Salmonid protocols were utilized during the emergency-ruling training period between March and August of 1997. After August 1997 the WT Last-Salmonid protocol was utilized continuously by all Washington Trout crews. **Points identified prior to August 1997 should not be considered for model use unless thoroughly examined for LF/LH-model suitability.**

As stated previously, last-fish-found points are documented on Washington Trout survey forms proving fish-presence without electroshocker follow-up to prove fish-absence above those points. Per communications to Washington Trout, these points have been included in the submitted database, but while these data may be useful in proofing the model, they do not meet the necessary requirement for a FPB Last-Fish point. **These submitted data-points are not intended to represent Last-Fish Points as defined in the FPB protocol and are not recommended for use in the LF/LH model.**

Additionally, while culverts that crews identified as passage barriers have been noted on the watertyping survey forms, culverts that allow some fish life-stages or species to pass, but that may be partial impediments, were not noted on the forms. However, these culverts could influence fish distribution patterns and subsequently bias the data. Similarly, because culvert assessments were conducted after watertyping in some drainages, culverts that were later identified as barriers may not have been noted on the survey forms. Likewise, some culvert barriers may have been entered with the Last-Habitat data, but missed while entering the Last-Salmonid data.

We recommend that a query for all culvert barriers on Last-Salmonid and Last-Habitat points be conducted prior to determining the number of culvert barriers. While this would not totally eliminate the problem, it could reduce the probability of error.

Figure 1 Watersheds and tributaries with associated basins by year surveyed.

1996	Basin	1997	Basin	1998	Basin	1999	Basin	2000	Basin
Unnamed tribs	*	Beaver Creek	*	Unnamed Tribs	*	Unnamed Tribs	*	Harris Creek	Snoqualmie
Brockway Creek	Columbia (Wind River)	Martha Creek	*	Patterson Creek	Snoqualmie	Ames Creek	Snoqualmie		
Olallie Creek	Columbia (Wind River)	Unnamed Tribs	*	Snoqualmie	Snoqualmie	Harris Creek	Snoqualmie		
Beaver Creek	Nisqually (Mashel Tribs)	Mill Creek	Black River	Stossel Creek	Snoqualmie	North Fork Creek	Snoqualmie		
Little Mashel River	Nisqually (Mashel Tribs)	Mima Creek	Black River	Tokul Creek	Snoqualmie	Patterson Creek	Snoqualmie		
Midway Creek	Nisqually (Mashel Tribs)	Waddell Creek	Black River	Deer Creek	Stillaguamish (Deer Cr.)	Snoqualmie	Snoqualmie		
North Stream	Nisqually (Mashel Tribs)	Black River	Chehalis	Little Deer Creek	Stillaguamish (Deer Cr.)	Stossel Creek	Snoqualmie		
Busy Wild Creek	Nisqually (Mashel Tribs)	Archer Creek	Columbia	Stillaguamish (Deer Cr.)	Stillaguamish (Deer Cr.)	Tokul Creek	Snoqualmie		
Hutchinson Creek	Nooksack (Hutchinson Cr. Tribs.)	Campen Creek	Columbia			Hanstead Creek	Snoqualmie?		
SF Nooksack (Hutchinson Cr.)	Nooksack (Hutchinson Cr. Tribs.)	Gee Creek	Columbia			Deer Creek	Stillaguamish (Deer Cr.)		
Brickoven Creek	Puyallup (So. Prairie Tribs.)	Gibbons Creek	Columbia			Higgins	Stillaguamish (Deer Cr.)		
Page Creek	Puyallup (So. Prairie Tribs.)	Good Bear Creek	Columbia			Little Deer Creek	Stillaguamish (Deer Cr.)		
South Prairie	Puyallup (So. Prairie Tribs.)	Hardy Creek	Columbia			N.F. Stillaguamish (Deer Cr.)	Stillaguamish (Deer Cr.)		
Wilkeson Creek	Puyallup (So. Prairie Tribs.)	Planting Creek	Columbia						
Cherry Creek	Snoqualmie	Poacher Spring	Columbia						
Griffen Creek	Snoqualmie	Trout Creek	Columbia (Trib to Wind River)						
Harris Creek	Snoqualmie	Bedrock Creek	Columbia - Wind River - (Trout Creek)						
Mud Creek	Snoqualmie	Compass Creek	Columbia - Wind River - (Trout Creek)						
North Fork Creek	Snoqualmie	Crater Creek	Columbia - Wind River - (Trout Creek)						
Raging River	Snoqualmie	Ditch Creek	Columbia - Wind River - (Trout Creek)						
S.F. Tolt	Snoqualmie	Dry Mouth Creek	Columbia - Wind River - (Trout Creek)						
Skunk Creek	Snoqualmie	East Trout Creek	Columbia - Wind River - (Trout Creek)						
Snoqualmie	Snoqualmie	Layout Creek	Columbia - Wind River - (Trout Creek)						
Tokul Creek	Snoqualmie	Pass Creek	Columbia - Wind River - (Trout Creek)						
Tolt Reservoir	Snoqualmie	Deschutes River	Deschutes						
Tolt River	Snoqualmie	Fall Creek	Deschutes						
Kennedy Creek	South Puget Sound	Huckleberry Creek	Deschutes						
Deer Creek	Stillaguamish (Deer Cr.)	Hull Creek	Deschutes						
N.F. Stillaguamish (Deer Cr.)	Stillaguamish (Deer Cr.)	Johnson Creek	Deschutes						
		Mitchell Creek	Deschutes						
		Mulqueen Creek	Deschutes						
		Pipeline Creek	Deschutes						
		Rachel Lake	Deschutes						
		Thurston Creek	Deschutes						
		Beaver Creek	Nisqually (Mashel Tribs)						
		Gale Creek	Pullyallup						
		Pond Creek	Pullyallup						
		South Prairie	Pullyallup						
		Wilkeson Creek	Pullyallup						
		Ames Creek	Snoqualmie						
		Cherry Creek	Snoqualmie						
		Lake Margret	Snoqualmie						
		NF Tolt	Snoqualmie						
		North Fork Creek	Snoqualmie						
		Phelps Creek	Snoqualmie						
		S.F. Tolt	Snoqualmie						
		Snoqualmie	Snoqualmie						
		Titicad Creek	Snoqualmie						
		Tokul Creek	Snoqualmie						
		Tolt Reservoir	Snoqualmie						
		Tolt River	Snoqualmie						
		Little Patterson Cr.	Snoqualmie ?						
		Canyon Creek	White River						
		East Twin Creek	White River						
		Old Pond Creek	White River						
		New Pond Creek	White River ?						
		Tate Creek	White River ?						

* - Basin was not listed on field survey forms

Appendix

Appendix A	1996 Pre-Emergency Ruling Protocal Quality Assurance Forms,
Appendix A - 1	- Employee resumes for water typing crew working in 1996
Appendix A - 2	- Graph for flows in 1996.
Appendix A – 3	- Basins decriptions for watersheds water typed in 1996.
Appendix B	- 1997 Pre-Emergency Ruling Protocal Quality Assurance Forms,
Appendix B - 1	- Employee resumes for water typing crew working in 1997.
Appendix B - 2	- Graph for flows in 1997.
Appendix B - 3	- Basins decriptions for watersheds water typed in 1997.
Appendix BB	- 1997 Last Salmonid Protocal Quality Assurance Forms
Appendix BB - 1	- Employee resumes for water typing crew working in 1997
Appendix BB- 2	- Graph for flows in 1997.
Appendix BB - 3	- Basins decriptions for watersheds water typed in 1997.
Appendix C	- 1998 Last Salmonid Protocal Quality Assurance Forms
Appendix C - 1	- Employee bios for water typing crew working in 1998.
Appendix C - 2	- Graph for flows in 1998.
Appendix C - 3	- Basins decriptions for watersheds water typed in 1998.
Appendix D	- 1999 Last Salmonid Protocal Quality Assurance Forms
Appendix D - 1	- Employee bios for water typing crew working in 1999.
Appendix D - 2	- Graph for flows in 1999.
Appendix D - 3	- Basins decriptions for watersheds water typed in 1999.

Appendix A

Quality Assurance Information Report Form

Please see cover letter for instructions. Answer as many of these questions as you can. This is not a test, and not all questions need to be answered affirmatively or in a certain way for a dataset to be included in the model. The Water Type Committee will review the information on a dataset-by-dataset basis.

A) Who collected the data?

1) Agency or company. Include address:

Washington Trout
PO Box 402
Duvall, Washington 98019

2) Principal investigator. Name, professional address, and short paragraph of qualifications and background.

Steve Conroy - Please see A-1 in Appendix A

3) Field survey crews. Names, short paragraph of qualifications and training in last fish or last habitat field methodologies. Attach additional pages if necessary.
Please see A-1 in Appendix A

B) When and Where was the data collected?

1) Year in which the data was collected. Please use one year per dataset.

1996 - Pre-Emergencey Ruling Protocal

2) Months in which the data were collected.
April, May, June, July, August, September, November, December

i) Was the data collected in the sampling protocol window (March 15 through July 15)?

62% - 44 Last Salmonid, and 87 Last Habitat data points were collected within the March 15 - July 15 window.

ii) How would you characterize stream flow during the sampling period? (I.e., Higher than average flow conditions, Average, lower than average or mixed)

Higher than average. Please see A-2 in Appendix A

3) What basins is the data from? (Use names, and WRIA codes).

Nooksack (Hutchinson Cr.) - 01
Stillaguamish (Deer Cr.) - 05
Snoqualmie - 07
Puyallup (So. Prairie) - 10
Nisqually (Mashel) - 11
Deschutes - 13

4) Describe the sampling area (basins, watersheds, ownerships, tribal U&As) in as much detail as possible.

See A-3 in Appendix A

C) Sampling Objectives and Design.

1) Was this data collection effort exclusively for the purpose of collecting last fish or last habitat data? No.

If YES, what was the sampling design?

i) Complete sampling of watersheds, or basins?

ii) Complete or partial ownership sampling? ....

iii) Random sampling? .....

iv) Other? (Explain with attachment)................

2) Was this data collection effort part of a last fish assessment associated with an FPA or prospective timber harvest site? No, although water typing was done in collaboration with the timber industry on streams in So. Prairie. Additionally, some streams were typed by request from Weyerhauser for validation.

If YES:
i) Did sampling extend beyond the boundary of the harvest site as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

ii) Did sampling consistently extend beyond the ownership boundary as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

If you answer 'no' to either question above, do not submit dataset.

3) Was sampling incidental to other research or assessment objectives? Yes

If YES:
i) Were there aspects of the sampling design that would be considered non-random or potentially biased for the purposes of last fish or last habitat determination? Please specify at end of questionaire. Yes, Type 3/4 breaks were targeted in some basins. In addition, the pre-emergency protocal could be biased against Last Habitat Locations as gradient breaks were set at 12%.

ii) Did sampling target a specific species, elevation, ownership, etc.?
Sampling did not target specific ownership, however, wateryping locations were occasionally governed by grants.

D) What Field Methodology was Used?

1) Which field sampling protocol was used?
Forest Practice Board Manual Protocal (Pre-emergency ruling) was utilized with the following modifications: 1) streams were not methodically surveyed beyound the break for a minimum of 12 pools or ¼ mile 2) Although Washington Trout crews typically utilize electroshockers in determining fish presence, visual determination of presence are also made without using electroshockers.
In addition, a 16% gradient break was utilized under verbal request from the Department of Natural Resources after fish were found consistently beyond a 12% gradient break.

2) What field equipment was used to validate fish present or absence? Electroshocker? Snorkeling? Night-time snorkeling? Other?

Electroshocker, Visual identification, or visual, followed by Electroshocking in the absence of visual confirmation.

3) Was sampling for fish systematically carried a full 0.25 miles above the last fish or last habitat?
No

If you answer 'no', do not submit dataset.

4) How was the last fish or last habitat location marked in the field, i.e., monumented

for future reference? Describe the appearance of the monuments, and where they were place. Last fish points were not routinely marked; when points were marked they were marked with flagging, noting last fish. Occasionally, date, organization, and surveyors names were also noted on last fish flagging. Break points were marked with an Aluminum tag and flagging placed on a tree on both sides of the stream, Water Type Breaks, Date, Organization, and Surveyors names were noted on the flagging, only watertype breaks were noted on the tags.

5) Were channels subjected to mass wasting in the past decade excluded from sampling or identified in the field data? If they were identified, how were they identified?

Channels subjected to mass wasting were not excluded from the sampling, however, Mass wasting is addressed in the field form and Last Fish/Last Habitat points within these drainages could be easily eliminated. It is possible that some drainages whose geomorphology has been changed over time may have been missed during the survey process.

6) In situations where surface flows ended, did samplers make a determination as to whether there was a break in channel gradient or other feature (headwater lake or wetland) that would cause surface flow to re-emerge up-stream?

Yes

7) In situations where last fish was determined to be below a culvert, how was this information recorded?

Culvert barriers were noted on the field form and in the database.

Where these situations discarded from the dataset?

No

Were these situations uniquely coded so that these data points could be easily pulled out of the dataset? Although these situations are not uniquely coded, this data can easily be pulled out of the dataset.

Was the last habitat protocol applied above the culvert? Yes

:) **Validation of Field Data.**

1) Has the any of the data in this dataset been subjected to replicate sampling or verification, either within the same year or in a different year? If the replicate sample is in a different dataset, describe the location of this dataset. (Replicate sampling is not a requirement for dataset consideration.)

YES or NO__X__Yes_______

If yes, please explain how the duplicate samples can be found in the dataset, or where to find the replicate dataset if they are not included in this dataset.

Replicate samples where not systematically duplicated,however, occasional duplication occurred while conducting culvert assessments or upon request. The replicate dataset is attached or following the original dataset on the raw data forms.

If yes, Did comparisons with the replicate dataset raise any concerns? Please explain.

___Yes, as expected, habitat boundaries were extended on systems revisited after the emergency ruling was implemented. In addition, occasionally a last fish point was extending further up the system.

F) Data Management.

1) Attach sample of field data sheet.

2) Where is the raw (paper copy) data or paper map being kept?

At the Washington Trout Office

3) In what structure is the electronic data being kept (spreadsheet, tabular database, GIS)? Describe the software, including the version of the software. If none, write "none'.

Microsoft Access 2000 Table.

4) Attach details of data fields and data codes used in the electronic database.

DETAILED ITEM DEFINITION AND CODE EXPLANATION

ITEM: Twp

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION: TOWNSHIP AND RANGE THE POINT IS IN. EXAMPLES: T15R05W; T04R15E (NOTE: THE USE OF "N" (NORTH) IS NOT NECESSARY. THIS FORMAT COMPLIES WITH DNR DATA STANDARD FOR TOWNSHIP/RANGE). IF THE TOWNSHIP IS A "HALF TOWNSHIP, THEN PLACE THE "5" ON THE END (E.G., T39R41E5)

ITEM: Sect

FORMAT: TYPE: CHARACTER; LENGTH 2

DESCRIPTION:
THE TOWNSHIP SECTION THAT THE POINT IS IN. EXAMPLES: 05, 01, 15, 32.
(NOTE: PLEASE ADD THE ZERO (0) BEFORE A ONE DIGIT NUMBER).

ITEM: Survey_no

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION:
UNIQUE CODE FOR A PARTICULAR SURVEY OR HYDRO UPDATE MAP.
(EXAMPLES: HU12, SW23, WT23).

ITEM: Pt_id

FORMAT: TYPE: NUMERICAL, LENGTH 4

DESCRIPTION: USER-DEFINED POINT IDENTIFICATION NUMBER; WE SUGGEST THAT THE USER NUMBER THE POINTS INCREMENTALLY WITHIN A SPECIFIC SURVEY, SURVEY FORM OR HYDRO UPATE FORM.

ITEMS: SPONSOR

FORMAT: TYPE: CHARACTER, LENGTH: 16

DESCRIPTION: THE NAME OF AGENCY, GROUP, TRIBE OR COMPANY THAT IS CONDUCTING THE SURVEY. (EXAMPLES: WEYCO; DNR; WATROUT; WF&W; ETC.)

ITEMS: Date

FORMAT: TYPE: DATE: YYYYMMDD, LENGTH: 8

DESCRIPTION: DATE THE SURVEY WAS CONDUCTED.

Note: spreadsheets and info may use a different date format.
Please check and make sure any arcview conversions conform to above format.

THE FOLLOWING ITEMS (FIELDS) HAVE CODES AND CODE DESCRIPTIONS

ITEM: Protocol

FORMAT: TYPE: CHARACTER, LENGTH 4

DESCRIPTION: PROTOCOL OF FISH SURVEY

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID
PRE	PRE-EMERGENCY RULE PROTOCOLS
UNK	UNKNOWN

ITEM: Pt_type

FORMAT: TYPE: CHARACTER, LENGTH: 4

DESCRIPTION: THE TYPE OF POINT REPRESENTED UNDER THE SPECIFIED PROTOCOL.

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID

ITEM: Bnd_type

FORMAT: TYPE: CHARACTER, LENGTH: 2

DESCRIPTION: PHYSICAL PLACEMENT OF POINT (NEEDED FOR MODELING PURPOSES).

CODE	CODE DESCRIPTION
A	MID-CHANNEL END OF HABITAT
B	CONFLUENCE POINT (NON-FISH-BEARING STREAM LATERALLHY INTERSECTING A FISH-BEARING STREAM)
C	TRIBUTARY JUNCTION (TWO OR MORE NON FISH-BEARING STREAMS JOIN TO FORM A FISH-BEARING STREAM

ITEM: End_type
TITLE: END TYPE OF FISH POINT

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: THE REASON FOR THE PLACEMENT OF END POINT.

CODE CODE DESCRIPTION

1	NATURAL END (BND_TYPE B,C OR SIZE RELATED, (WIDTH/BASIN SIZE)
2	GRADIENT RELATED (e.g., WATER FALLS)
3	LARGE WOODY DEBRIS (LWD)
4	ROAD CULVERT
5	MASS WASTING EVENT (LANDSLIDE)
6	BEAVER DAM or other NON-PERMANENT DAM
7	OTHER DAM (PERMANENT)
8	WATER QUALITY LIMITER
9	NONE
10	UNKNOWN

ITEM: Det_met

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: METHOD USED TO DETECT POINT

CODE	CODE DESCRIPTION
1	ELECTRO-SHOCKING
2	DAY SNORKELING
3	NIGHT SNORKELING
4	VISUAL OBSERVATION

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATIONS)

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION

5) Where is the electronic copy being kept?

On Washington Trout's Document Server.

Curriculum Vitae

Stephen C. Conroy, Ph.D

Address: 10624 165th St.
Renton WA 98055

Telephone: (425) 277 7868 (home)
(425) 788 1167 (work)

email: watrout@eskimo.com

Undergraduate Degree: B.Sc. with Honours, 1980. University of Aberdeen, Scotland, U.K. Major: Biochemistry

Graduate Degree: Ph.D. 1984. University of Aberdeen, Scotland, U.K. Field of study: Enzymology

Employment History:

University of Aberdeen, Scotland, U.K.	Research Assistant.	1980-1984
University of Colorado, Denver, CO.	Research Fellow.	1984-1985
Case Western Reserve University, Cleveland, OH.	Research Associate.	1985-1987
University of Washington, Seattle, WA.	Senior Fellow.	1987-1992
Fred Hutchinson Cancer Research Center, Seattle, WA.	Staff Scientist.	1992-1995
Washington Trout, Duvall WA.	Science/Research Director	1996-present

Editorial Positions

Manuscript reviewer, "The Journal of Biological Chemistry" 1985-1987.
Manuscript reviewer, "Biochemistry" 1987-1994.
Manuscript reviewer, "Washington Trout Report" 1996-present

Grant Awards

Weiss Creek Restoration and Deer Creek Stream Typing. $300,000 from Washington Jobs For The Environment Program (JFE 9809)

North Fork Stillaguamish Engineered Log Jam Project. $160, 127 from Washington Department of Fish & Wildlife.

Griffin Creek Restoration. $49,600 from National Fish and Wildlife Foundation.

Skykomish Culvert Inventory & Analysis. $44,500 from Washington Department of Transportation.

Weiss Creek Demonstration Project. $40,000 from Snohomish Watershed Basin Work Group.

Salmonid habitat identification/stream typing project. $33,200 from King County Water Quality Block Grant.

Stream Typing and Culvert Analysis. $30,000 from the Bullitt Foundation.

Stream Typing and Culvert Analysis. $10,000 from the General Services Foundation.

Stream Typing and Culvert Analysis. $10,000 from the Horizons Foundation.

Stream Typing and Culvert Analysis. $5,000 from The Trout and Salmon Foundation.

Cherry Creek Riparian Restoration. $3,000 from Stilly-Snohomish Regional Fisheries Enhancement Group.

Tolt steelhead molecular genetics project. $250 from Puget Sound Flyfishers

Tolt summer steelhead monitoring project. $250 from Puget Sound Flyfishers

Typical Responsibilities

Supervised up to eight field biologists performing stream typing across the Western Cascades and in the Lower Columbia. Obtained grants and contracts for stream typing and in-stream restoration projects, published technical reports, supervised budgetary requirements, participated in TFW technical committees. Taught stream typing courses to TFW partners and consultants. Participated in snorkel surveys and electrofishing surveys. Experienced in non-lethal tissue sampling from fish for DNA analysis.
Coordinated culvert inventory and analysis projects, analyzed data, maintained databases and prioritized projects for restoration. Participated in formal training courses regarding culvert assessments and helped refine class materials and content.
Project manager for in-stream restoration in Weiss Creek and Griffin Creek. Projects involve permit acquisition, channel construction, LWD placement, riparian planting and fencing, and public outreach and education. Delivered oral and written reports to grantors and agencies.

Published Essays (Fisheries/Ecology)

Conroy, S.C. "Genetic Diversity in *Salmonidae*" The Osprey, 12: 5 (1991).

Conroy, S.C. Habitat Lost and Found; Part 1. Washington Trout Report (1996)

Conroy, S.C. Molecular Biology Comes to the Tolt. Washington Trout Report (1996)

Conroy, S.C. Habitat Lost and Found; Part 2. Washington Trout Report (1997)

Conroy, S.C. Stream Typing. Northwest Fishing Holes, (1996)

Conroy, S.C. Atlantic Salmon; Friend or Foe? Northwest Fishing Holes, (1997)

Conroy, S.C. Genetic Diversity in Salmon. Washington Wildlife Magazine, volume I, number II, 1997

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Conroy, S.C.; Adams, B.; Pain, R.H.; Fothergill, L.A. "3-Phosphoglycerate Kinase Purified by Affinity Elution has Tightly Bound 3-Phosphoglycerate." FEBS Letts. 128 353-355 (1981).

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Conroy, S.C.; Dever, T.E.; Owens, C.L.; and Merrick, W.C. "Characterization of the 46,000-Dalton Subunit of eIF-4F." Arch. Biochem. Biophys. 282 363-371 (1990)

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Hagen, F.S.; Arguelles, C.; Sui, L.; Zhang, W.; Seidel, P.R.; Conroy, S.C.; Petra, P.H. "Construction of a Full-Length cDNA for the Sex Steroid Binding Protein of Human Plasma or Androgen Binding Protein of Human Testis (SBP/ABP or SHBG/ABP). Expression and Preliminary Characterization of the Recombinant Protein." FEBS Letts. 299 23-27 (1992).

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Conroy, S.C., Morales, T.H., Stuart, K. "Partial Purification and Characterization of a Terminal Uridyl Transferase from *Leishmania tarantolae*." Manuscript in preparation.

Bonin, L, Tedford, K., Perez-Reyes, N., McDougall, J.K. & Conroy, S.C. "Gene expression in extended life-span human smooth muscle cells derived from atherosclerotic plaque." In press.

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Conroy, S.C., Hart, C.E., Perez-Reyes, N., McDougall, J.K. "Phenotypic Characterization of Immortalized Vascular Smooth Muscle Cells." FASEB J 7:A758, 1993.

Scatena, M., Conroy, S.C., Tedford, K. & McDougall, J.K. "Increased ubiquitin expression in human atherosclerotic plaque-derived smooth muscle cells." FASEB J. 1996.

Conroy, S.C. "Habitat Lost and Found" 1st Annual Wildlife Congress. Washington Department of Fish and Wildlife. January 1997.

Mary Lou White
2905 Birchwood
Bellingham, WA 98225
(360) 671-8839

Experience:

1994-Present

Field Biologist/Project Manager
Washington Trout • Duvall, Washington

- Crew leader and field biologist for fish habitat assessments, stream typing, scientific data collection, culvert assessments, riparian planting and monitoring, 1994-present.
- Project manager for culvert replacement, stream channel restoration, road abandonment, and riparian revegetation grant projects completed in 1996 & 1997; combined worth of grants over $500,000. Supervised 30 people, including five contractors working simultaneously on six road abandonment and three restoration projects.
- Additional responsibilities include the following: (1) documenting and entering data; (2) preparing contracts; (3) obtaining permits; (4) writing quarterly and final reports; (5) instructing restoration and culvert assessment workshops.

1992-Present

Owner/Hydrologic Technician & Environmental Consultant • Bellingham, Washington

Representative clients: Washington Trout, Water Resource Consulting, Puget Power, Joanne Greenberg (N-SEA).

Assist hydrologic consultants in gathering, documenting and presenting information for impending watershed projects.

- Determine flow line estimates for application in determining time-of concentration.
- Research private landowner water rights.
- Using S.C.S. method, time-of-concentration and curve number assignments, calculate runoff flow from an urban watershed.
- Utilize aerial photos to determine land use activities.
- Measure lateral movement of channels based on aerial photo interpretation.
- Planimeter or digitize basins and sub-basins.
- Use maps, Quattro Pro, Excel, WordPerfect, Microsoft Word, or R-base, to document data or assemble reports.
- Conducted Wellhead Protection Program for Everson, WA.

1991-1992 • **Fisheries Technician** • Center for Streamside Studies • University of Washington, Seattle, Washington.

- Timber/Fish/Wildlife ambient monitoring; collected data on stream discharge, bankfull width and depth, gradient, fish habitat, mass wasting, valley bottom and riparian characteristics.
- Established photo points for long-term monitoring of stream channel changes.
- Used scantron for data documentation.

1989-1990 **Hydrologic Technician** • U.S.F.S. Mount Baker Ranger District • Sedro Woolley, WA.

- Assisted in layout and preparation of watershed/fisheries habitat improvement projects; monitored completed projects by recording graphics and establishing photo points.
- Created a stream file monitoring guide.
- Assisted in spotted owl surveys.

1984-1989 **Forestry Technician** • U.S.F.S. Fernan Ranger District • Coeur d'Alene, Idaho.

- Project supervisor - Fish habitat improvement structure installations; watershed inventories; coring and embeddedness surveys.
- Inventoried system and non-system roads; updated drainage map with culvert and road erosion site locations; documented problems and prescribed solutions.
- Arranged and assembled district watershed atlas for 62 stream drainages.
- Collected water samples and stream flow measurements; electrofished and snorkeled.
- Created a Future Fish Habitat Improvement Guide.
- Conducted field studies and documented data for fish habitat, elk browse, piliated woodpecker range management and watershed inventories.
- Assembled historical information for G.I.S. input.
- Served on initial attack crew for wild fire suppression.

Skills:

- **Computer**: Microsoft Word, WordPerfect, Excel, Quattro Pro and Quicken.
- **Habitat Assessments**: All modules of TFW methodology, or Hankin & Reeves. TFW quality assurance qualified.
- **Stream typing**: DNR certified.
- **Surveying**: Stream profiles (longitudinal or cross section), culvert assessments, or road abandonment.
- **Aerial Photo Interpretation.**
- **Equipment**: Compass, clinometer, planimeter, McNeil sampler, electroshocker, increment borer, flow meter.

Training:

- Timber Fish Wildlife Ambient Monitoring Workshops 1994-97
- Stream Typing Emergency Ruling workshop, DNR 1997
- 319 Grant Request Workshop, 1997
- Culvert College, Washington Trout, 1995
- CPR, 1993, 1994
- Effective management, U.S.F.S. 1988
- Defensive Driving - U.S.F.S. 1984-89
- Baci to Basics - Compass & First Aid Training, 1989
- Fire Suppression & Saw Training, 1984, 1985.

Awards:

- Recognized for significant contribution to the success of the Mt. Baker Ranger District Fisheries & Watershed Program during the 1989 field season.
- Awarded Certificate of Merit and Cash Award for extra effort and positive attitude in data base input and maintenance of fisheries, habitat database on Fernan District and for outstanding effort and high quality road condition inventories and work on the watershed road inventory database.

Education:

June 1994	**Bachelor of Science** Western Washington Univeristy, Bellingham, WA Major: Watershed Studies; Minor: Biology.
May 1979	**Associate of Arts** Lincoln Land Community College, Springfield, IL.
	Relevant courses: Water resources, soils, stream ecology, hydrology, water quality, fluvial geomorphology, ichthyology, watershed management, limnology, entomology, botany, biometrics and biology.

References:

Kurt Beardslee, Executive Director
Washington Trout, Duvall, WA (425) 788-1167

Steve Conroy, Ph.D. Science/Research Director
Washington Trout, Duvall, WA (425) 78-1167

Karen F. Welch, M.S., or Peter Willing, Ph.D., Hydrologist
Water Resource Consultants
1903 Broadway, Bellingham, WA (360) 734-1445

Robin Sanders, Hydrologist
Olympic National Forest, 1835 Black Lake Blvd. SW, Olympia, WA (360) 956-2433

Ed Lider, Fisheries Biologist
Fernan Ranger District, Coeur d'Alene, Idaho (208) 752-1221, 664-2318

Caroline Hidy, Fisheries Biologist
2695 Highway 200, Box 212
Trout Creek, MT 59874, (406) 599-2714.

David Crabb
17425 Turtle Lane
Bow, WA 98232
phone: (360) 724-4902

Education:	Master of Science in Geography with Planning Western Washington University, Bellingham, Washington 1985.
	Secondary Teacher Certification (Social Studies) Western Washington University, 1982
	Fifth Year History, San Diego State University, San Diego CA, 1973
	Bachelor of Arts in History, Grove City College, Grove City PA, 1971
Teaching Experience	Graduate Teaching Assistant in Physical and Human Geography, Western Washington University, Bellingham, WA 1984-1985
	Substitute Teacher grades 7-12 in Sedro-Wooley, Burlington-Edison, Mt. Vernon and Arlington school districts 1982-83
Work History	1994-present: Washington Trout, Cuvall, WA. Watershed analysis water typing, fish habitat restoration, riparian protection and revegetation.
	1976-present: Forest Contractor, providing tree planting and inventory survey skills for reforestation, forest management plans.
	1977-1978: Scott Paper Company, Hamilton, WA . Reforestation, pre-commercial thinning.
	1974: Whatcom Falls Park Fish Hatchery, Bellingham, WA. Hatchery maintenance, landscaping and rockeries.
Skills	All aspects of reforestation, crew leadeership and training, culvert analysis, stream typing, rockeries.

Training	Culvert assessment, water typing methodology, electrofishing, habitat surveying, spawning surveys, riparian revegetation, salmonid identification.
Personal Data	Born 1949, married, two children, health excellent, take pleasure in all family-oriented activities, especially backpacking and camping, gardening and basketball. Interested in reading and stewardship of the environment.

Bill McMillan

Perhaps best known as an author and master of fishing for steelhead trout using dry lines, Bill McMillan has devoted the greater part of a lifetime to fishing Northwestern rivers and sharing the enchantment of the experience through the written word and public speaking.

McMillan has authored numerous articles in *Salmon Trout Steelheader* magazine, *Wild Steelhead and Atlantic Salmon* magazine, and many others. His book *Dry Line Steelhead* has been described as "a graduate course in steelhead fly fishing." Most recently, McMillan spent two seasons on Russia's Kamchatka Peninsula as resident camp director for the joint Russian/American scientific expedition coordinated by the Wild Salmon Foundation.

For 40 years, McMillan's attention has been focused on the plight of wild salmonids, particularly regarding competition with hatchery-raised fish and the decline of their habitat's quality and availability. Concerns he raised decades ago regarding threats to wild salmonids have all been substantiated and vindicated. His extensive and precise field journals have filled a gap in statistics that the Washington State Department of Fish & Wildlife never kept, and he is widely quoted in academic fisheries papers.

An internationally esteemed author on conservation, fish, flyfishing and nature topics, he served on the Gifford Pinchot Forest's Spotted Owl Citizen's Advisory Board from 1989-1990 and on the Washington Department of Wildlife's Fishery Policy Task Force from 1990-1993.

McMillan, a founding board member and past President who has served on Washington Trout's board for all but two years, studied fisheries, English and philosophy at Clark College, University of Washington, Portland State and Central Washington. He co-founded the Clark-Skamania Flyfishers in 1975 and initiated spawning surveys in 1979 and snorkel surveys in 1983 on several rivers in Southwest Washington. An early and ardent conservationist, he has spent a lifetime advocating for the wild fish.

JOHN E. MEANS
2710 114th Way S.W.
Olympia, Washington 98512

RESUME OF QUALIFICATIONS

(206)-956-9103

OBJECTIVE . WATERSHED ANALYSIS TECHNICIAN

EDUCATION:

CULVERT ANALYSIS TRAINING
Washington Trout, Duvall , WA 1994

COLLEGE COURSE WORK
South Sound Commmunity College
Olympia, WA 1994

Everett Community College, Everett , WA 1983

HIGH SCHOOL
Juanita High School, Kirkland, WA 1977

EXPERIENCE:....

- o Field Service, research and data collection,
- o Computer applications and hardware support
- o Installation management, procurement, layout
- o Provide liaison between customers and company, follow up, solve problems and ensure customer satisfaction. Customer training and support.
- o Performance of a wide variety of mechanical electrical and construction skills.

EMPLOYMENT HISTORY

June 1988 to present

Washington State Dept of Fisheries.
Wild Salmon Production and Survival Evaluation Program.
This program has measured wild coho smolt production, harvest and escapement through trapping and coded wire tagging of juveniles in various river systems. During the 1993 and 1994 coho smolt migration periods I was stationed at the Bingham Creek (Satsop River) trap facility and the Skagit River trap in 1992. Specific duties were, 24 hour trap operation, species identification (vertebrate and invertebrate) and enumeration, recording of catch and tagging data, coded wire tagging, length frequencies of salmonids, specimen preservation and physical measurements of stream conditions, ie. Lux, stream height, TSS sampling, Imhoff cone and temperature. I was also responsible for establishing the protocol for safe and efficient fish handling procedures. During this time I was also a member of the NATURES team and provided the same services to this WDF and NMFS research project. Being stationed at this location allowed me the opportunity to observe and study the stream ecosystem which was of great personal interest.

WDF. Harvest Management, Soft Data Unit.
From 1990 thru 1993 during the commercial fishing season (July to Jan) I was responsible for monitoring commercial salmon catch data, ensuring accurate principle data sources, summarization and processing data for the Auxilary Fish Catch Record System that is used for in-season harvest management. I was also responsible for biological and catch corrections in processed data in the Prime computer system files. The job required a thorough knowledge of the commercial fishing industry, salmon stock composition and run timing. Our unit was also responsible for PC hardware and software support for the harvest management division. At this time I also participated in Puget Sound purse seine test fishing, in which I performed GSI, fecundity, scale and catch composition sampling. During slow periods of commercial fishing I was charged with finding and sampling little known sport fisheries on the beaches and estuary's of South Puget Sound and Hood Canal.

WDF.Puget Sound Sport Emphasis Sampling.
As a Sport Sampler in 1989 and 1990 I conducted interviews with sport salmon anglers on Puget Sound and the Straight of Juan de Fuca, recording angler catch, effort and biological data. Scale sampling and coded wire tag recovery were also performed.

Related volunteer experience.:
South Sound Fly Fishers, Director.
The following is a list of activities and accomplishments which I have been involved with that are combined efforts of the So. Sound Fly Fishers and Washington Dept of Fish and Wildlife.

I was lead person for a cooperative project with WDFW doing a creel census on the South Fork Toutle River during the Feb-March wild winter steelhead fishery in 1993 and 1994.

I am the SSFF representative on the citizen advisory committee to WDFW's Wild Salmonid Policy meetings.

Conducted electro-fishing projects on the North Fork Toutle and Green River tributaries in cooperation with WDFW for five consecutive years, establishing base line data of juvenile wild salmonid populations and stream habitat analysis.

Began work on a Sea-run Cutthroat Trout Bibliographic Database. This work has received wide support from conservation, sport, and government organizations. It is expected to be a 3 year project.

Participated in snorkel survey's in the Tolt, Washougal and Wind rivers in conjunction with Clark-Skamania Fly Fishers and Washington Trout. These surveys are to continue baseline data of wild summer steelhead populations in these rivers.

Dec. 1982 to June 88	Cutting Edge Floor Covering As part owner of Cutting Edge Floorcovering I had many responsibility's in the operation of a small business. Contract commercial floorcovering of large office buildings such as the Columbia Center, Century Tower, etc. provided the business base. My specific duties included, sales, small - business management, blueprint takeoffs, materials estimations, procurement and layout. A thorough understanding of floor covering technologies and building construction techniques were also required. Coordination of workspace, material transport and time scheduling between the prime contractor, sub-contractor's and my crew was done on a daily basis to achieve timely completion of the job and assure customer satisfaction.
Jan. 82 to Dec. 82	Design Interiors Floorcovering installation apprentice. Assisted and installed all types of commercial floorcoverings in new construction and renovation of large office buildings in downtown Seattle
Feb. 79 to Dec.81	Seattle Industrial Controlled Heat Seattle Industrial Controlled Heat was a company that specialized in the manufacture of portable industrial heat treating and stress relieving equipment. My position with them was essentially two fold. As a shop electrician/mechanic my duties involved welding, fitting, and mechanical fabrication of the equipment. I also participated in the schematic drafting and design and the subsequent electrical wiring and installation of the equipment. We also provided a nationwide heat treating and stress relieving service of industrial apparatus in oil refinery's, shipyards, nuclear plants, etc. As a field service technician I would travel with the equipment to the site for installation which included wiring and any training required by the customer. During this time I held a limited industrial electricians license.

Personal Data: Married, 3 children, excellent health.
Hobby: Fly fishing for salmon and steelhead.

Personal and professional references are available on request

E. Dale Russell

RESS 6320-A CADY Rd.

290-1006

Forest Worker

TITLE III - ASSESSMENT INFORMATION

List previous paid jobs. Please answer the following questions completely, starting with your most recent job and working backward in order to show your employment for the last three years.

a. Employer Absolute Cleaning Services
MailingAddress 4403 Russell Rd #116
City Mukilteo State WA ZipCode 9[illegible]
Phone Number 745-6909 Dates Worked 5/2/93 to 6/3/[illegible]
Job Title Operation Manager Supervisor Sid Mc[illegible]
Duties Scheduling, [illegible] safety [illegible], employee discipline, training, [illegible]
Please list equipment or tools operated on a regular basis as a part of this job. Network computer, phones, calculator, [illegible], [illegible] press, chop saw, trucks, etc.
PayRate $10.-/hr
How did you get this job? Refer to apply by old Supervisor
Reason for leaving lay off

b. Employer Boeing
MailingAddress [illegible]
City Everett, State WA Zip [illegible]
Phone Number 2[illegible] 9[illegible] Dates Worked 3/[illegible]/199[illegible]
JobTitle Factory Clerk C Supervisor Brad Mar[illegible]
Duties Receiving and shipping parts and material [illegible] into work station, locate hot jobs, expedite parts [illegible]
Please list equipment or tools operated on a regular basis of this job. [illegible] tools, [illegible] [illegible], fueling, prepare [illegible]
PayRate $15.53/hr
How did you get this job? [illegible] applied
Reason for leaving layoff

c. Employer [illegible] Corp
Mailing [illegible]
City Oak Harbor State WA [illegible]
Phone [illegible] Dates Worked 10/[illegible]/88 [illegible]
[illegible] Supervisor [illegible] Shane [illegible]
[illegible]

pallet jacks.
PayRate 5.25/hr
How did you get this job Applied.
Reason for leaving Take job at Boeing.

d. Employer Northwest Taxidermy
MailingAddress Parker Rd
City Coupeville State WA ZipCode
Phone Number [illegible] Dates Worked 10/ /86 to 10/
JobTitle Owner/Operator Supervisor
Duties Receive items for work, bookkeeping, sales, marketing advertising, inventory control, mounting items, painting
Please list equipment or tools operated on a regular basis as of this job paint guns & air brush, band saw, hand tools, pe carpentry tools, pneumatic Tools, etc.
Pay Rate piece work
How did you get this job? started it with partner
Reason for leaving Dissolved partnership.

e. Employer Alaska Dept of Fish & Game, Comm. Fish
MailingAddress P.O. Box 87
City [illegible] State AK ZipCode [illegible]
Phone Number 907 822- Dates Worked [illegible]
Job Title Fisheries Tech/Biologist Supervisor Ken Roberson
Duties Construction of camps research facilities, Data collection analysis, recording, research writing, sampling, [illegible]
Please list equipment or tools operated on a regular basis of this job Computer, calculator, boats ATV, [illegible] sonar counters, power carpentry tools, radios, etc
Pay Rate $13.83/hr
How did you get this job? Applied
Reason for leaving Because Married did not want to be away for more than 3 months a year

f. Employer
MailingAddress
City State Zip Code
Phone Number Dates Worked / / to
Job Title
Duties
Please list equipment or tools operated on a regular basis

ADDITIONAL OCCUPATIONAL SKILLS

You may have marketable skills which you have developed outsi[de] [of] employment. Please review your education, hobbies, interests [and] everyday activities. Include any machinery, equipment or tools you [have] used. Also, list any special licenses you possess or work processes yo[u are] familiar with. You need only include those skills not listed on the [work] history section of this application.

SKILL INVENTORY

Skills acquired on the job: (other than previously listed)
landscaping, customer service, typing, ten key, [illegible] [illegible] fishing trolling and gillnetting, forklift operations, deliver truck [illegible] [illegible], stone sheetmetal work.

Skills acquired through classroom training:
[illegible], optic measuring, Quality assurance, blueprint reading, CPR [illegible] [illegible] tools.

Skills acquired through hobbies, interests and life experiences:
[illegible], carpentery, fitness

List any tools, machines, equipment you can operate power [illegible] [illegible] pneumatic tools, forklift, 34,000 lb gross axle wt. truck [illegible] [illegible] paint gun & airbrush, chainsaw, [illegible] power [illegible] calculator, general office equipment [illegible] mowers, [illegible]

Special licenses Propane fueling permit, CPR & First Aid Cert.

DENNIS O. BROWN
15309.5 PORTLAND AVE. SW
TACOMA, WASHINGTON 98498
(206) 588-1794

April 2, 1996

TO WHOM IT MAY IT CONCERN:

This is a work history of Dennis O. Brown.

WORK HISTORY

Sept. 6, 1995 to Feb. 20, 1996	Bates Technical College Long-Haul Trucking Program South Campus 2201 South 78th Street Tacoma, Washington 98409-5847 (206) 596-1753 (Sharon Wade)	(GPA 95%)
Nov. 93 to Aug. 95	Witcraft & Swope Contract Cutters 7901 Holiday Valley Ct. NW Olympia, Washington 98504 (360) 866-9110 (Steve or Marti Witcraft)	Timber Faller $30.00 per. hr.
Mar. 88 to Nov. 93	#208 Shake & Shingle Griffiths Inc. PO Box 208 Moclips, Washington 98562 (360) 276-4640 (Annette Griffiths)	Everything From Truck Driver to Millwright
Feb. 85 to Mar. 88	Pearson Forest Products Molips, Washington 98562 (Out of business/no phone)	Everything From Truck Driver to Millwright

DENNIS O. BROWN
15309.5 PORTLAND AVE. SW
TACOMA, WASHINGTON 98498
(206) 588-1794

April 2, 1996

SKILLS

TRUCKS DRIVEN

Straight Trucks, Tandum and Single Axles, Hydraulic or Air Brakes.

Flatbeds, Dump Trucks, GI Duce and a Half, Geophysical Vibrators (6 x 6 on and off road), Buses.

Tractor Trailer: Semi-dumps, Flatbeds, Vans, and Doubles.

EQUIPMENT OPERATED

Most types and brands of Forklifts, Front-end Loaders, Loggstackers, Cats, and Lumber Carriers.

RELATED WORK

Maintenance Mechanic on equipment operated, (Trucks and Loaders, etc...)

Industrial Millwright, including Welding and Maintenance Mechanic for Shake and Shingle mills, Sawmills, and other production type sites.

Electrician: Commercial, Industrial, and Residential.

I have also been superintendent, manager, and foreman for companies that I have worked for in the past.

Frank Staller
16 Malone Hill Branch Road
Elma, Washington 98541
(360) 482-2960

Education & Training

St. Benedict's High School, Chicago, Illinois, 1974 diploma.

DeVry Institute of Technology, Chicago, Illinois, Electronics Technician degree, 1976.

Grays Harbor College, Aberdeen, Washington, Environmental Services Contracting Certificate 1996.

Northwest Indian Fisheries Commission, TFW Monitoring Training Workshop, 1997.

Department of Natural Resources & Quinault Nation: DNR Stream Typing Updated Rulings & Electroshocking Workshop, 1997.

Specialized Training

Power Squadron boating course; U.S. Forest Service forest fire training; defensive driving certificate; First Aid and CPR; Hazmat Awareness Level; Swiftwater First Responder; Swiftwater Boat Rescue; Wilderness Survival; Wilderness First Aid; Helicopter I evacuation, safety and man-tracking, and culvert analysis.

Streamtyping Experience

Washington Trout, P.O. Box 402, Duvall, WA 98019
Scientific Field Technician: Three years of stream surveying, using maps and compass to report on condition of streams related to fish presence, barriers and condition for re-typing classification. I submitted reports and upgraded maps after streamtyping. I also did culvert analysis on Type 3 waters. I worked on road closure and culvert replacement projects, operated pumps, assisted in surveying and stream monitoring.

Washington Department of Fish & Wildlife, Montesano:
Stream surveyor using maps and compass to collect information on streams related to fish presence and barriers for stream type verification.

Self-employed timber salvage contractor: Eight years subcontracting cedar salvage through Weyerhaeuser and other private landowners to salvage down and dead cedar logs for roofing material. I ran chainsaw, graded blocks and partook in helicopter logging operations. We cut down dead fir logs into cants with portable chainsaw mill and flew them out with helicopter assistance.

Timber Faller: For six months I felled and bucked timber for private landowners for partial and clear-cut operations.

Forestry technician for USDA Forest Service, Quinault, WA for four nine-month seasons: set up logging areas by traversing boundaries, surveyed for new roads, prepared profile surveys, assisted in cruise plots and marked trees, plus assisted in transient

survey of national forest boundaries, placing section corner markers and marking bearing trees.

Other work has included two seasons as a fire crewman, three years in horticulture/landscaping, experience planting and thinning trees, building and maintaining the Quinault trail system plus two years as electronic technician.

Volunteer Activities

Grays Harbor Search & Rescue, Chehalis Valley Restoration wood Duck Project, Washington Department of Fish & Wildlife elk relocation project plus oak habitat mapping.

Gregory Ericksen
2832 Pacific
Hoquiam, Washington 98550
360-533-2058

General Summary	20 years' experience in positions requiring coordinated mental and physical skills to ensure productivity and safety. Work equally well in a teaming environment or with minimal supervision. My varied work experiences indicate willingness and ability to learn.
Streamtyping Experience	Washington Trout, Duvall, WA.: I have taught stream typing to crews and TFW partners and participated in restoration projects including road closures, culvert surveys and replacement, and collected scientific data for Washington Trout and for Thomas Travis Young, Olympia (consultant). I have performed streamtyping for the Washington Department of Natural Resources, Olympic Peninsula Office, Aberdeen, WA, the Department of Fish & Wildlife at Montesano, WA and stream typing plus tree planting for Weyerhaeuser. I have more than three years' experience in streamtyping.
Other Experience	Heavy equipment operator Rigging operator Mechanic Carpenter Landscaping Supervisory Watershed Restoration
Education	Washington State University survey class, Adopt-A-Stream, Everett WA. Grays Harbor College, Aberdeen, Washington: Watershed analysis/data collection. Department of Natural Resources wetland verification class, Forks, WA. Hoquiam High School, Hoquiam, Washington.
References	Available upon request.

1 ITT Rayonier Pulp Mill 1977-1982
Yard Crew Run Equipment Fork lifts all sizes, Front End-loader, Back Hoe, Bob Cats, Riggin Slinger for lifting + Replacing Equipment Motor's, Pumps, Steam lines ect. Basically Anything in mill. Leadman for Crews + Work Alone. Take care of all safety equipment in the entire mill + Order + Replace.

2 Earley tire Co. 1983-1988
Auto Mech. Certified in Diagnostic Scope, Brake's, Air Cond. Tune-ups + Brakeman + Service A/C systems was work Done Schooling to Be Certified for all Area's.

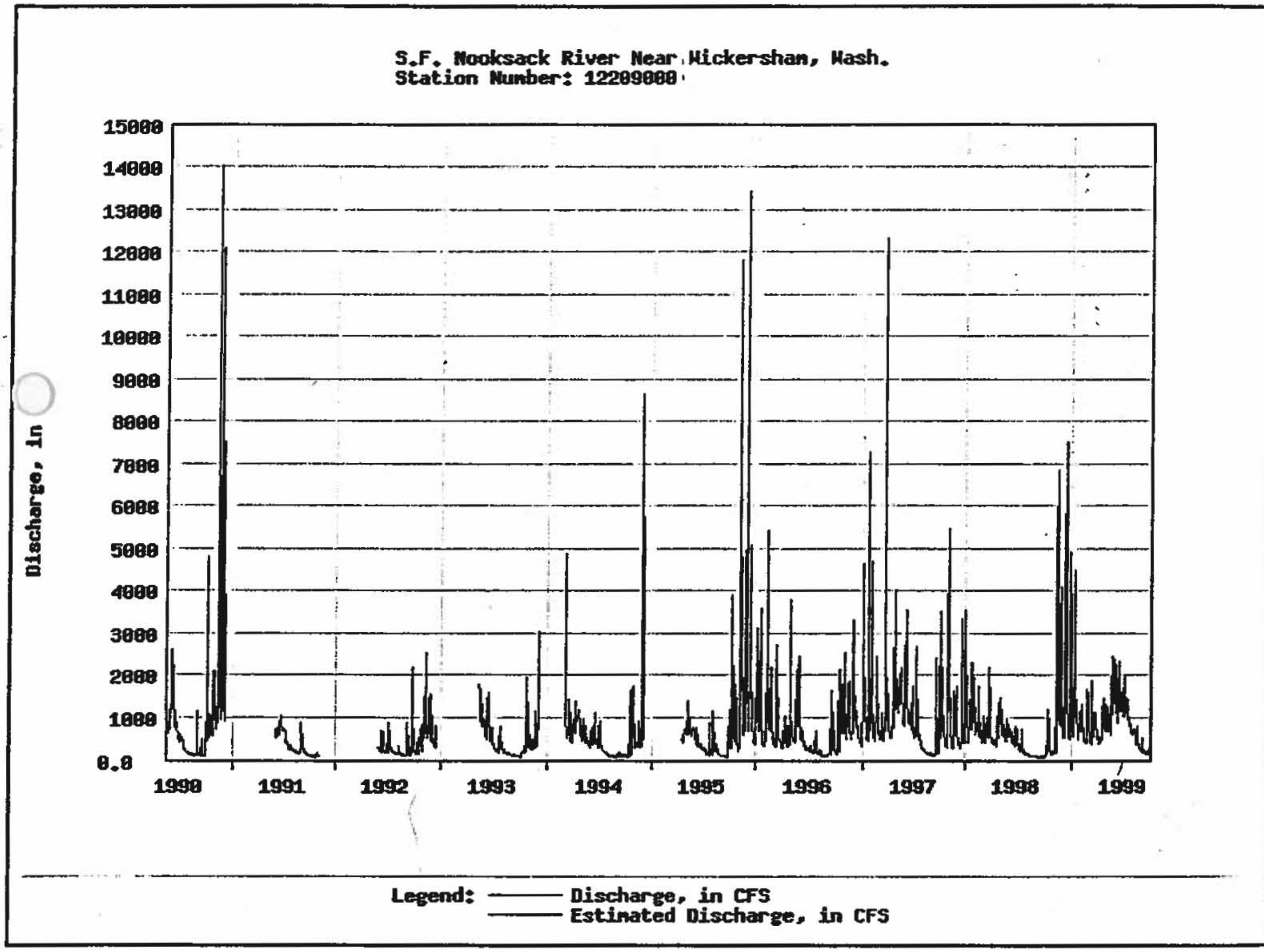
3 Weyco. 1989-90 Plant trees for them + contract Work for them in tree planting Area of Work and Some Cedar Block cutting for them contract cutting

4 Work for Quality Homes const. Clark + Son + Locke Const. Building houses from ground up + foundation's also with Clark + Son was all commercial Building's
From 89-1994

5 Washington Dept. fish + Wildlife 1995
Stream Retyping + Mapping of Streams + Restoration Work

Greg Ericksen

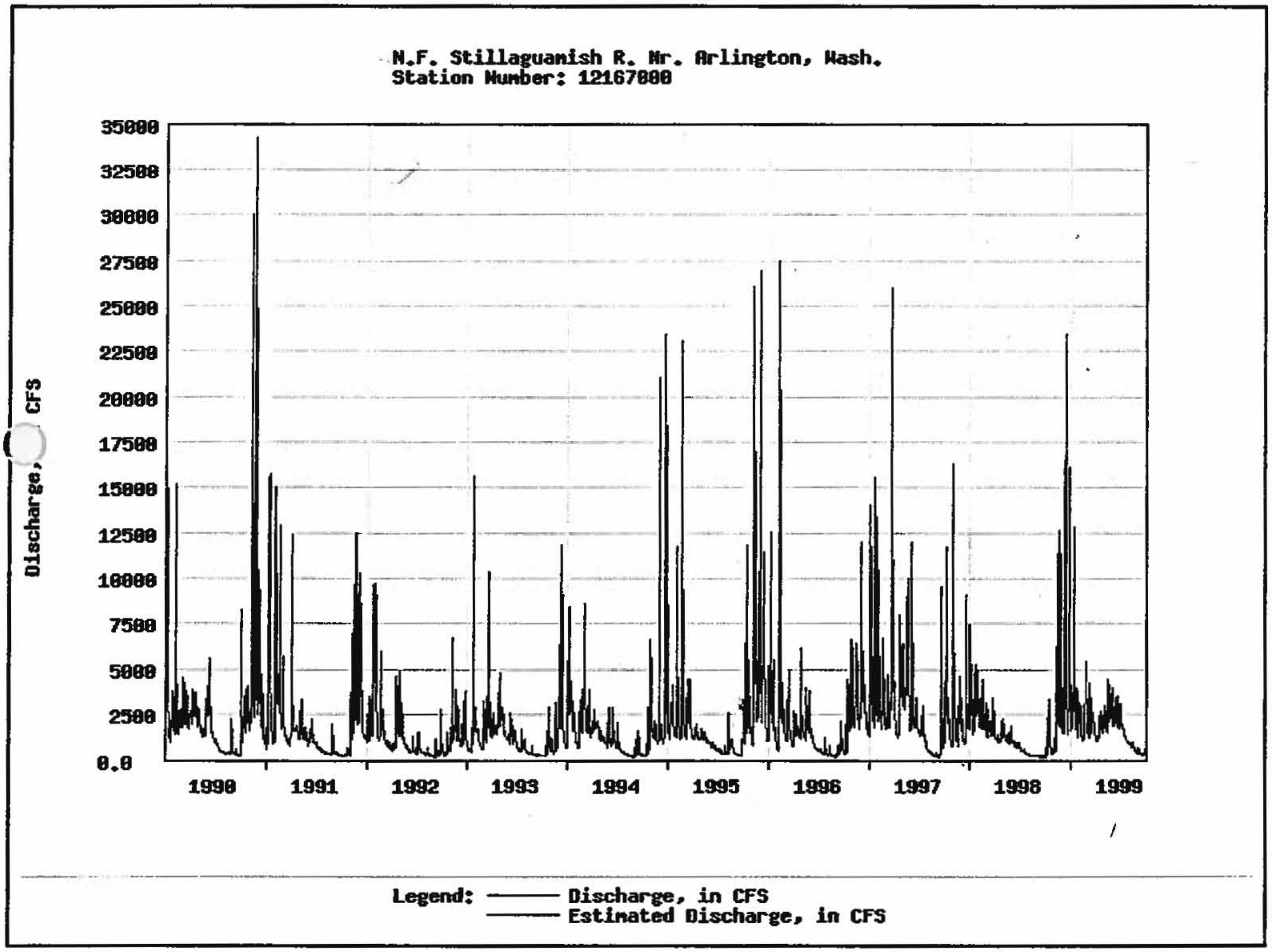
Historical Streamflow Daily Values Graph for S.F. Nooksack River Near Wickersham, Wash. (12209000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

USGS
science for a changing world

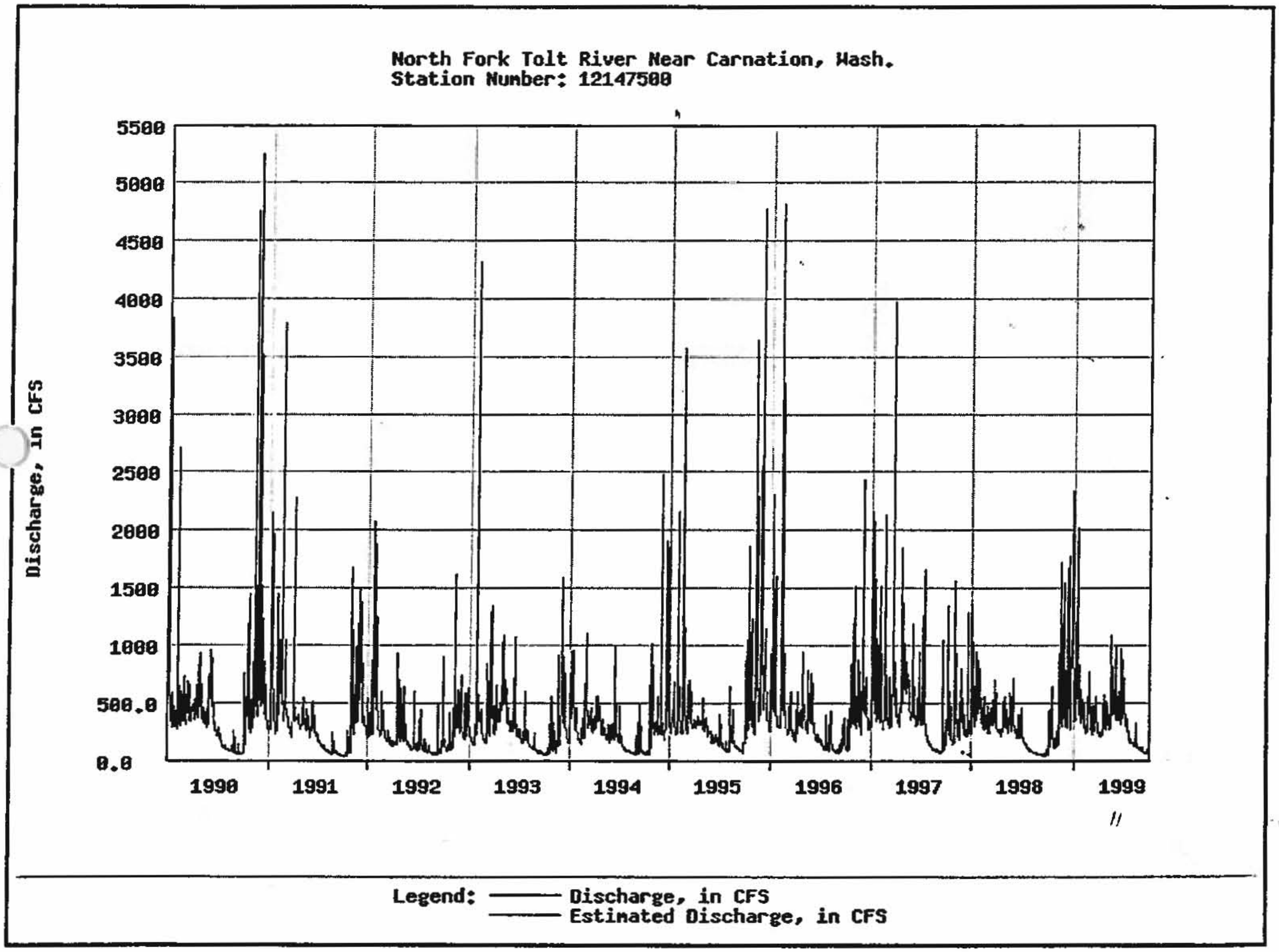
Historical Streamflow Daily Values Graph for N.F. Stillaguamish R. Nr. Arlington, Wash. (12167000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn | Why you might press this button

Historical Streamflow Daily Values Graph for North Fork Tolt River Near Carnation, Wash. (12147500)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

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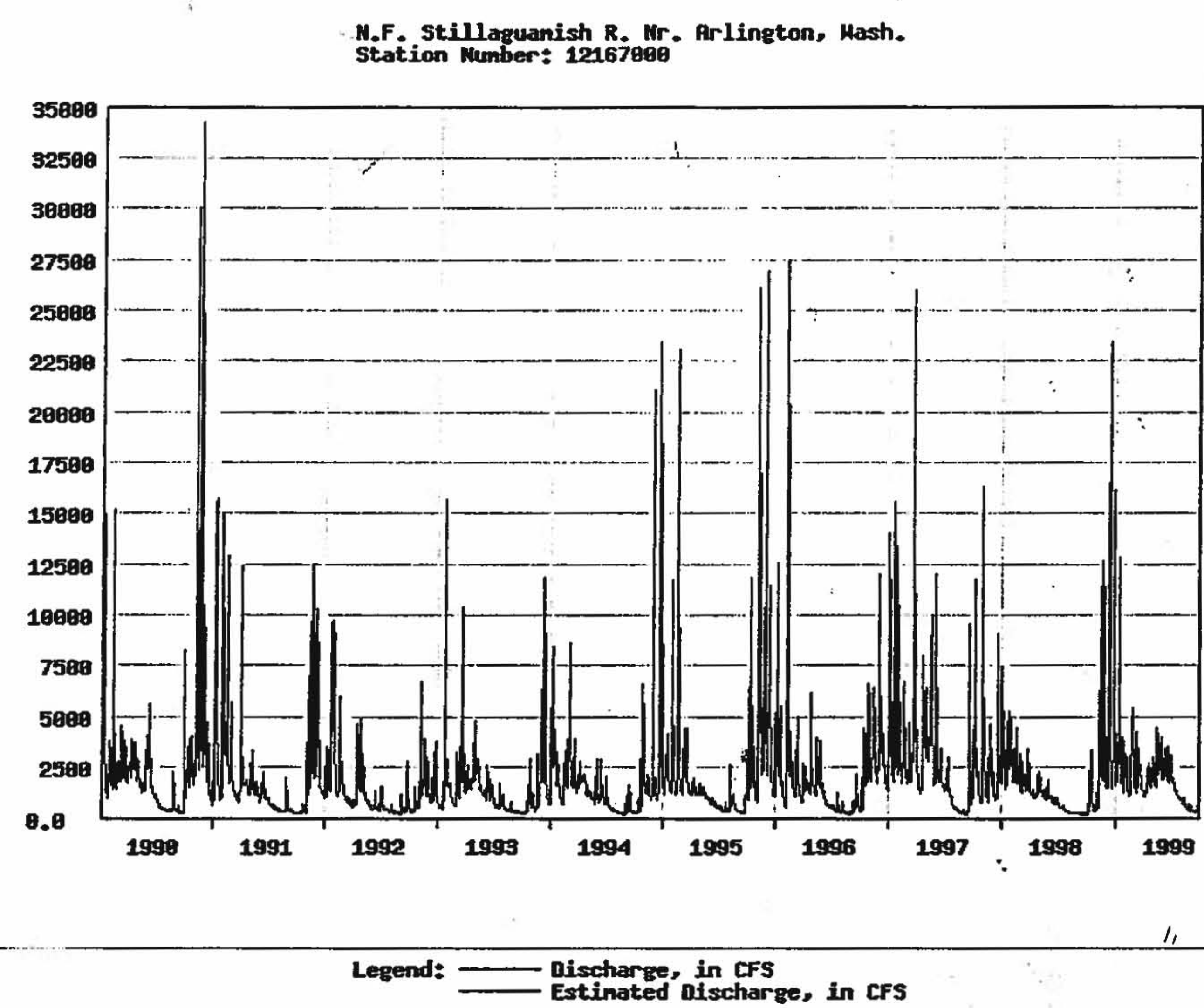
Historical Streamflow Daily Values Graph for N.F. Stillaguamish R. Nr. Arlington, Wash. (12167000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

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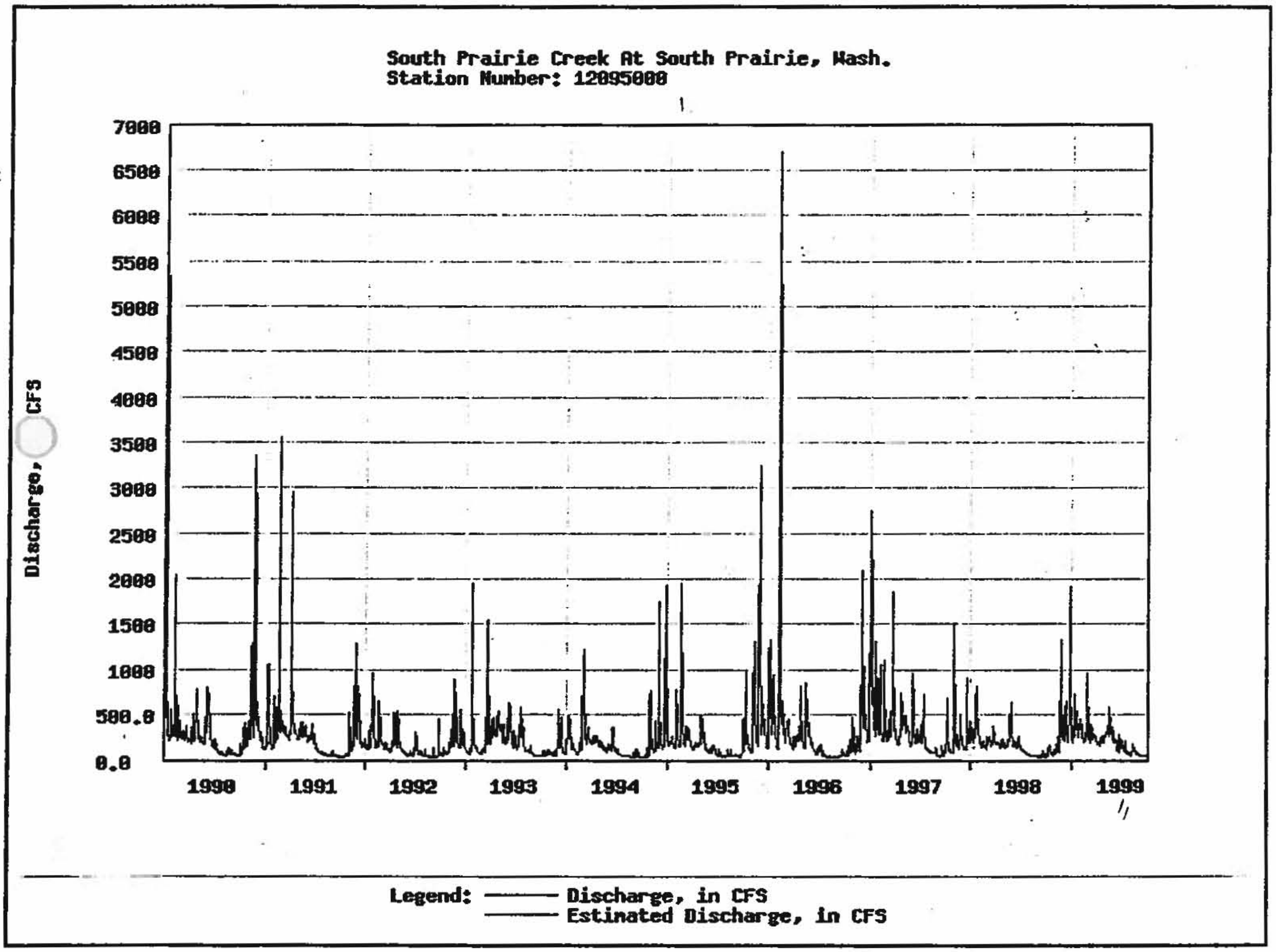
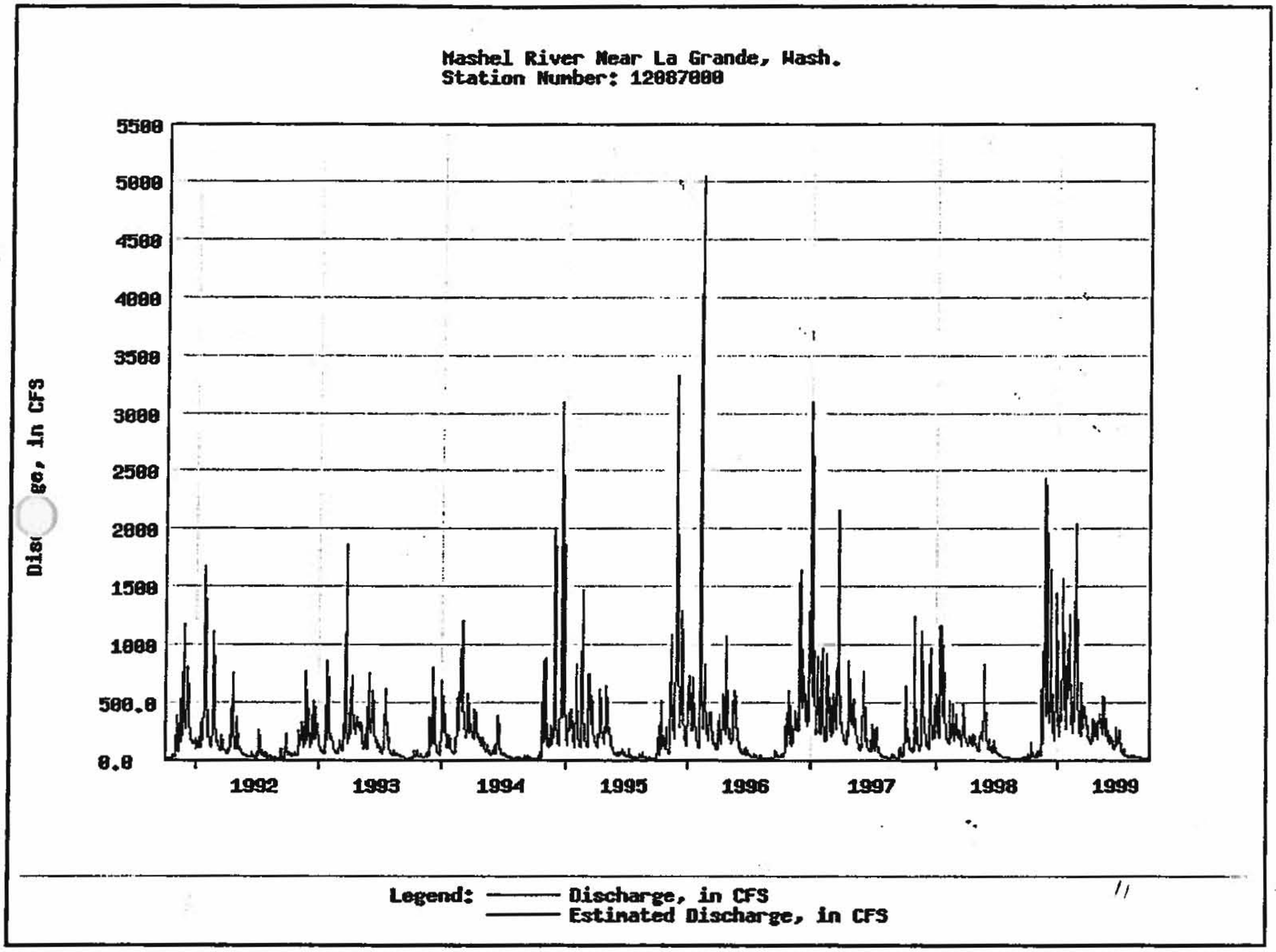
Historical Streamflow Daily Values Graph for South Prairie Creek At South Prairie, Wash. (12095000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

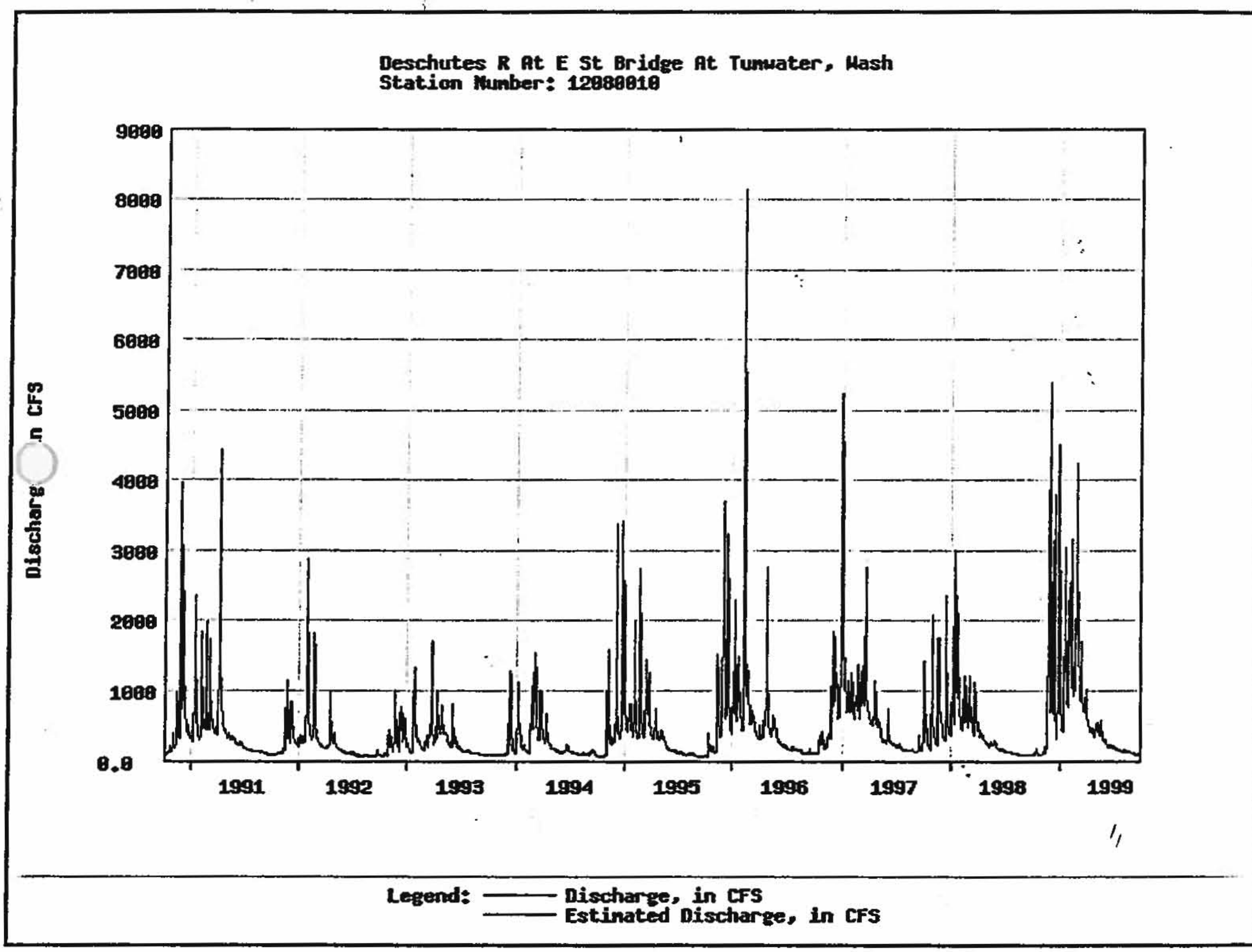
Historical Streamflow Daily Values Graph for Mashel River Near La Grande, Wash. (12087000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn Why you might press this button

Historical Streamflow Daily Values Graph for Deschutes R At E St Bridge At Tumwater, Wash (12080010)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Nooksack Basin (Hutchinson Creek / WRIA 010310)

Basin Description -Washinton Trout's water typing surveys encompassed only the tributaries entering the Hutchinson Creek drainage which were likely to be upgraded to type 3 waters. Hutchinson Creek, located near Acme, WA, is the largest watershed in the lower eight miles of the South Fork Nooksack. Its tributaries are characterized by stretches of low to moderate gradients in their lower reach (1 – 12%) with moderate to high gradients (12% - > 50%) in the middle to upper reaches. Riparian areas along the mid to upper reaches of the Hutchinson Creek tributaries are dominated by abundant to moderate stands of mature second growth, 8 to 30" in DBH, conifers - Western Hemlock and Douglas-fir, with smaller intermittent stands of Western Red Cedar and Spruce. Deciduous species, Alder, Cottonwood, Vine Maple, Big leaf Maple and Salmonberry dominate the lower reaches near the mainstem of Hutchinson.

Salmonid Utilization – Several unidentified salmonids were noted in the washington trout water typing data for the Hunchinson creek tributaries. Washington Trout crews identified only cutthroat trout (*Oncorhynchus clarki*) and brook trout (*Salvelinus fontinalis*), during their surveys of the Hutchinson Creek tributaries, however, Chinook (*Oncorhynchus tshawytscha*), coho (*Oncorhynchus kisutch*), Pink (*Oncorhynchus gorbuscha*), chum salmon (*Oncorhynchus keta*), and rainbow trout (*Oncorhynchus mykiss*) have been known to utilize the Hutchinson Creek mainstem. Although the Washington trout crews could not positively identify them as such, it is possible that one or more of the unidentified salmonids are of the salmonid species known to be in the mainstem.

Ownership – The upper watershed, surveyed by Washington Trout Crews, is state land owned by the Washington Department of Natural Resources. A small portion of land also surveyed, located in the lower reaches of the tributaries coming directly off of the mainstem Hutchinson, is privately owned.

SOUTH FORK NOOKSACK
Deming Area

This section covers the lower 13 miles of South Fork Nooksack River plus 16 tributaries that enter this reach adding nearly 60 linear stream miles. The area is located about 15 miles east of Bellingham in west-central Whatcom County. Access is via the Mt. Baker Highway and the Valley Highway between Deming and Wickersham.

Stream Description

From Saxon Road bridge northeast of Wickersham the South Fork winds northwest 6 miles to just below the small community of Acme, then north about 7 miles to its confluence with the mainstem Nooksack (R.M. 36.6). Principal tributaries include Saxon, Hutchinson, Jones, McCarty and Black Slough creeks.

The river valley is quite narrow at the Saxon Bridge; however, it opens abruptly into relatively broad, flat bottomland downstream with the sidehills rising sharply from the valley floor. Steeper mountain side slopes moderate considerably moving down the valley, maintaining mostly dense conifer forest with increasing mixed deciduous timber and underbrush at lower elevations. The valley floor is cleared and developed mostly to agriculture, with scattered rural residences and the small communities of Saxon, Acme, Clipper, and VanZandt. Some land along the lower river is under Nooksack Indian tribal jurisdiction. Logging is evident along the adjacent hillsides. The area supports light to moderate recreation activity, principally hunting and fishing.

Over the upper 5 miles of this stretch the river exhibits a moderate gradient character, with the confined channel producing good to excellent pool-riffle stream character. Fall stream widths range generally from 15 to 25 yards. The bottom is predominantly mixed rubble and gravel with a few scattered boulder sections. Banks are mostly stable, moderately high, natural earth cuts with a number of narrow, gently sloping rubble side beaches. Stream-side cover along this stretch consists of moderately dense deciduous strips or small stands of conifer timber.

The South Fork's lower 8 miles contain alternating moderate and gentle gradient conditions. The stable channel broadens considerably through this stretch, producing a meandering stream course with occasional broad channel splitting. Fall stream widths range from 20 to nearly 40 yards. A good to excellent pool-riffle balance prevails over most of this stretch; however, pools and lengthy glides predominate in the gentle gradient sections. The bottom is predominantly gravel and rubble with extensive long and broad gravel riffles. Banks are mostly low natural earth cuts or broad, gently sloping gravel-rubble side beaches. Stream-side cover is sparse, consisting of occasional strips or small thickets of deciduous trees and underbrush, separated by cleared farmland.

Hutchinson Creek, the largest tributary in this reach, exhibits moderate gradient over much of its length. Except for a steeper cascade stretch below R.M. 2.0, it offers good to excellent pool-riffle conditions nearly to its headwaters. The bottom is predominantly gravel with occasional rubble stretches. It has dense deciduous trees and underbrush along its banks that provide excellent cover. Other smaller tributaries provide short stretches of moderate gradient along their lower reaches. Their upper drainages are over steep mountain terrain where numerous cascades, rapids and large rock bottom materials are prevalent.

Salmon Utilization

This river section provides transportation, spawning, and rearing habitat, and is utilized by chinook, pink, chum, and coho. Coho spawn principally in the accessible tributaries along with some pink and chum. These species also utilize sections of the mainstem river. The upper 5 miles of this stretch receives the most intense spawning use, particularly by chinook. Rearing occurs throughout the accessible waters, with coho and some spring chinook having year around habitation.

Limiting Factors

The principal factors affecting salmon production include stream bank clearing and channel alterations along the tributaries, and gravel removal from the mainstem river. A relatively intense Indian gill net fishery near the mouth also impacts some spawning populations. Low stream flows, particularly in the tributaries, often present additional limitations.

Beneficial Developments

Fish passage facilities have been installed in the cascade section of lower Hutchinson Creek (R.M. 1.9), as well as at a small private dam upstream (R.M. 3.9). Other than occasional juvenile salmon plantings there have been no projects or programs designed specifically to benefit salmon production.

Habitat Needs

The principal requirements to maintain salmon production habitat within this section include preserving existing stream-side cover and maintaining stream and streambed conditions in as near a natural state as possible.

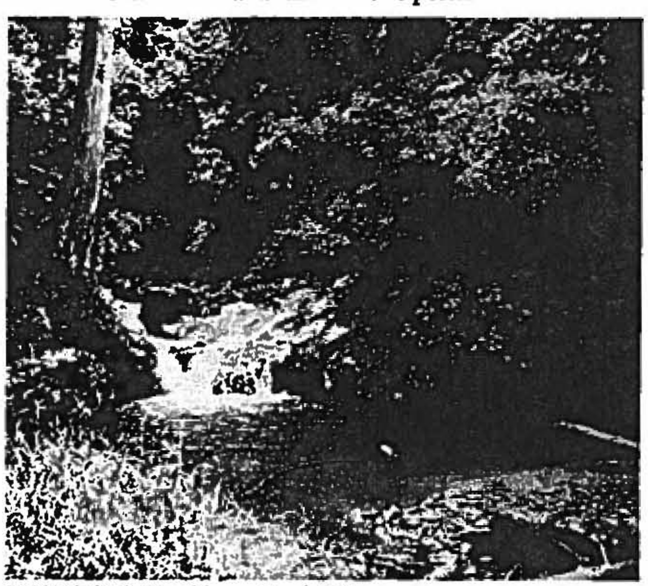
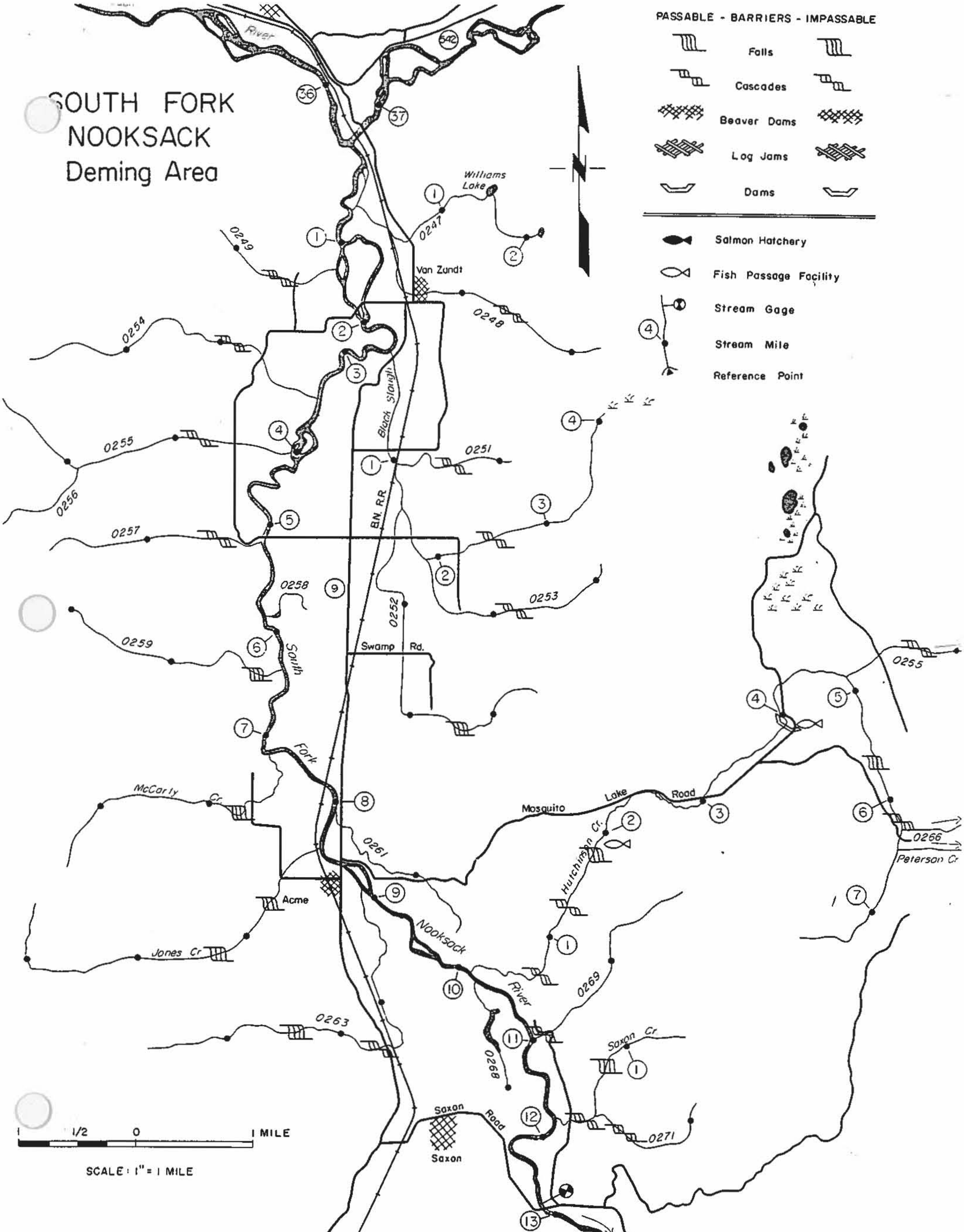


PHOTO 01-8. Hutchinson Creek falls.

SOUTH FORK NOOKSACK
Deming Area



Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0120	Nooksack River				Chin., Coho, Pink Chum, Sockeye
0246	So. Fk. Nooksack River	LB-36.6	39.6	—	Chin., Coho, Pink, Chum
0247	Unnamed	RB-0.65	2.15	—	Coho, Chum
0248	Unnamed	LB-0.41	2.4	—	Unknown
	Williams Lake	Outlet-1.4	—	—	
	Unnamed Lake	Outlet-2.15	—	—	
0249	Unnamed	LB-1.4	1.2	—	(Coho)
0250	Black Slough	RB-2.5	4.1	—	Coho, Chum
0251	Unnamed	RB-1.01	1.1	—	(Coho)
0252	Unnamed	LB-1.4	3.5	—	Coho, (Chum)
0253	Unnamed	LB-1.9	2.2	—	Coho, (Chum)
0254	Unnamed	LB-3.5	2.9	—	Coho, Chum
0255	Unnamed	LB-4.0	2.7	—	Coho
0257	Unnamed	LB-5.2	1.8	—	Coho
0259	Unnamed	LB-6.3	2.0	—	Coho
0260	McCarty Creek	LB-7.2	2.6	—	Coho, Chum
0261	Unnamed	RB-8.1	1.7	—	Coho, Chum
0262	Jones Creek	LB-8.4	3.5	—	Coho, Chum
0263	Unnamed	LB-8.9	3.6	—	Coho, Chum
0264	Hutchinson Creek	RB-10.1	7.6	14.8	Chin., Coho, Pink, Chum
0265	Unnamed	RB-4.9	2.9	—	Coho
0266	Unnamed	RB-6.35	2.2	—	None
0267	Peterson Creek	RB-6.45	2.4	—	None
0268	Unnamed	LB-10.2	1.0	—	(Coho)
0269	Unnamed	RB-11.0	1.9	—	Coho, Chum
0270	Saxon Creek	RB-11.8	1.5	—	Coho, Chum
0271	Unnamed	LB-0.3	1.1	—	None
	(Cont. Nooksack 603)				

Stillaguamish (Deer Creek / WRIA 050201)

Basin Discription – Washington trout crews surveyed all of the upper Deer Creek Watershed owned by the United States Forest Service and a large portion of the middle watershed owned primarily by Hancock Insurance company with intermittent parcels owned by Washington Department of Natural Resources. The lower portion of the Deer Cr. watershed owned by Washington department of Natural Resources, MRGC and private landowners was water typed by Washington Trout Crews and Tulalip Tribes. The water typing consolidation data submitted by Washington Trout does not include the water typing data collected by the Tulalip Tribes. A very small portion of the watershed < 5%, owned by Port Blakley was not water typed to my knowledge.

Deer Creek is a major salmonid spawning tributary of the NF Stillaguamish located north of Hwy 530, near the town of Oso, Wa. The mainstem is approximately 24 miles long with over 20 individual tributaries entering it. The middle and upper portions of the watershed, composed primarily of the Higgins and Little Deer drainages are undeveloped and could be considered unspoiled if not for the logging roads and clear-cuts evident throughout the Little Deer drainage, which has been heavily logged, contributing to the significant silt loading and flooding tendancies in the mainstem.

A collaborative watershed restoration effort has been ongoing in the North Fork since 1985 in response to a massive land slide in the Little Deer Watershed. This effort includes state, federal, and local agencies, Indian tribes, conservation groups, educational institutions, small and large private landowners and interested citizens.

A very narrow valley floor constricted by a canyon encompasses much of the lower five miles of the watershed; the remaining 21 miles of mainstem valley bottom are narrow with intermittent broad sections. In general, tributary gradients are steep, in the lower reaches due to the ravine or canyon, and in the upper reaches due to mountain terrain. The riparian areas, with the exception of the uppermost headwaters and areas influenced by logging, are dominated by moderate to heavy forest cover composed of Douglas-fir, western hemlock, silver fir, western red cedar and intermittent stands of old growth spruce.

Salmonid Utilization – Although the Washington Department of Fish and Wildlife was unaware of a cutthroat population in the Deer Creek Tributaries. Washington Trout crews identified cutthroat (Oncorhynchus clarki), along with rainbow (Oncorhynchus mykiss), coho (Oncorhynchus kisutch), and native char (Salvelinus malma, during their surveys of the Deer Creek tributaries.

DEER CREEK DRAINAGE

This stream section covers the entire Deer Creek drainage from its mountainous headwaters north of the Stillaguamish Valley downstream to its confluence with the North Fork Stillaguamish River at the town of Oso. It includes approximately 24 miles of mainstem stream plus 23 individual tributaries adding a total of nearly 56 additional stream miles.

Stream Description

From its headwaters Deer Creek courses generally west about 16 miles, then south 8 miles to its confluence with the North Fork. Its major tributaries are Higgins Creek and Little Deer Creek. These, along with the majority of smaller tributaries, exhibit steep gradient characteristics common to mountain streams.

Throughout the drainage the valley floor is quite narrow, with only a few intermittent broad sections. Adjacent hillsides rise quickly away from the streambed and, except where logging has occurred, are densely forested. Very narrow, ravine and sometimes canyon-like conditions predominate in the lower 5 miles. The upper watershed is almost entirely undeveloped. The major portion of all tributaries entering above mile 13, plus the remainder of upper Deer Creek drainage above mile 17, are located within Mt. Baker National Forest. Clear-cut logging is evident throughout much of the upper drainage, and is especially heavy in the Little Deer Creek watershed. Logging roads provide the principal access throughout most of the area. There are a few rural residences in the lower reaches, with Oso the only community development. The watershed receives relatively heavy recreation use, especially in the summer and early fall months.

Stream gradient is moderately steep throughout most of the drainage, with some very steep sections in the canyon between mile 1.5 and 5.0. A number of channel sections exhibit flood plain characteristics, particularly where a somewhat broader valley floor exists. In such areas, channel splitting and extensive broad gravel riffles and gently sloped gravel beaches predominate. For most of the stream length, however, bottom composition is mainly boulder-strewn, interspersed with rubble, and only a few riffle and patch gravel sections. In spite of apparent flooding effects, the major portion of the channel appears quite stable. Stream widths throughout most of the upper drainage range from 5 to 12 yards. In the lower 1.5 miles, below the ravine and canyon-like area, widths range from 12-20 yards. Natural, stable stream banks prevail throughout the drainage, most of them relatively low earth cuts or boulder-strewn beaches. Steep slopes with some vertical walls exist in the lower canyon section. Except where logging has approached the immediate stream bank, cover is moderate to dense, composed mainly of conifers and mixed deciduous trees and underbrush.

Salmon Utilization

Deer Creek is accessible to anadromous fish runs nearly to its headwaters. It serves spawning and rearing fall chinook, spring chinook, and coho with some pink and an occasional chum observed. Most tributaries provide relatively short access; however, a number received heavy spawning concentrations of coho. Since most of the tributaries are quite small and provide limited rearing area, most salmon juveniles spend the major portion of their fresh-water life in Deer Creek proper.

Limiting Factors

One of the principal factors limiting salmon production in the Deer Creek drainage is its flash flooding tendency, with consequential heavy silt loading of the stream. This condition is aggravated by extensive clear-cut logging practices in the upper watershed. Steep gradient conditions in the lower canyon, particularly between miles 1.5 and 3, may present at least a partial barrier to salmon migration, probably blocking most pink and chum salmon. The heavy silt deposition existing over riffle areas in the lower 2 miles would affect pink and chum the most. In the upper watershed, stream sections exhibiting considerable channel splitting have a definite lack of adequate shade and cover. Also, during low summer flow periods, water in these stretches tends to spread out, often forming potholes, trapping juvenile fish. Increasing stream gradient above R.M. 17 may present obstacles to migration. Also, considerable logging debris along the stream course could intermittently create barriers at some locations.

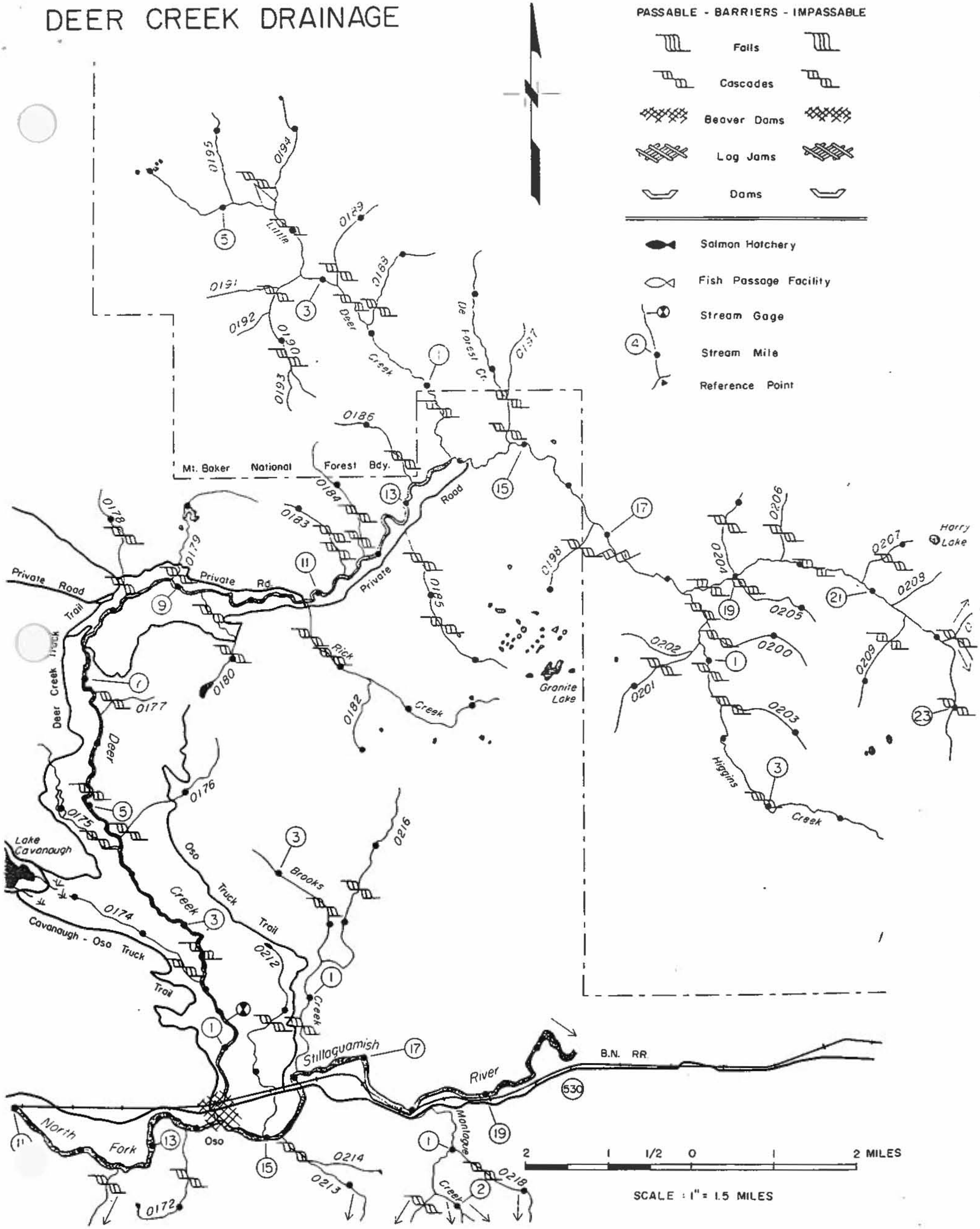
Beneficial Developments

No facilities or programs have been undertaken in this drainage area to specifically benefit salmon production.

Habitat Needs

A major requirement to maintain fish production in this section is to insure that forest logging activities are performed in accordance with the Forest Practices Act protecting the natural stream habitat. In addition, cleaning of streambed gravel over the lower 2 miles would be of considerable benefit.

DEER CREEK DRAINAGE



DEER CREEK DRAINAGE
Stillaguamish River Basin — WRIA 05

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Stillaguamish River				
0135	N. F. Stillaguamish R.				Chin., Coho, Pink, Chum
0173	Deer Creek	RB-14.3	23.7	—	Chin., Pink, Coho
0174	Unnamed	RB-2.1	2.6	—	Unknown
0175	Unnamed	RB-4.3	1.8	—	Unknown
0176	Unnamed	LB-4.4	1.9	—	Coho
0178	Unnamed	RB-8.2	1.4	—	Unknown
0179	Unnamed	RB-8.8	1.9	—	Unknown
	Unnamed Pond	Outlet-0.8	—	—	
0180	Unnamed	LB-9.3	1.3	—	Coho
	Unnamed Lake	Outlet-1.3	—	—	
0181	Rick Creek	LB-10.7	3.3	—	Coho
0182	Unnamed	LB-1.4	1.0	—	None
0183	Unnamed	RB-11.4	1.1	—	Unknown
0184	Unnamed	RB-11.8	1.7	—	Unknown
0185	Unnamed	LB-12.8	2.4	—	Coho
0186	Unnamed	RB-13.3	1.3	—	Unknown
0187	Little Deer Cr.	RB-13.9	6.0	—	Coho
0188	Unnamed	LB-2.1	1.4	—	None
0189	Unnamed	LB-2.8	1.2	—	None
0190	Unnamed	RB-3.3	1.9	—	None
0194	Unnamed	LB-4.4	1.5	—	None
0195	Unnamed	LB-4.9	1.2	—	None
0196	DeForest Creek	RB-14.9	2.6	—	Unknown
0198	Unnamed	LB-16.8	1.0	—	Unknown
0199	Higgins Creek	LB-18.4	4.6	—	Coho
0200	Unnamed	RB-0.5	1.5	—	Unknown
0201	Unnamed	LB-0.8	1.6	—	Unknown
0203	Unnamed	RB-1.6	1.2	—	None
0204	Unnamed	RB-19.0	1.1	—	Coho
0205	Unnamed	LB-19.05	1.2	—	Unknown
0207	Unnamed	RB-20.9	1.2	—	Unknown
0209	Unnamed	LB-21.55	1.3	—	Unknown
0210	Unnamed	RB-22.1	1.4	—	Unknown
	Segelsen Lake	Outlet-1.4	—	—	

SNOQUALMIE RIVER
Lower Mainstem

This drainage section includes the lower 12 miles of Snoqualmie River from a few miles above Duvall downstream to the confluence with the Skykomish River (R.M. 20.5). Eleven tributaries enter in this section, adding more than 83 total stream miles. Principal access in this northwest King-southwest Snohomish counties section is provided by State Highway 203 running south from Monroe.

Stream Description

From stream mile 12.0 the Snoqualmie River meanders northeast approximately five miles to Cherry Creek, then northwest to the confluence with the kykomish River. Principal tributaries include Tuck, Cherry, and Peoples creeks.

The flat valley floor is two miles wide and is cleared with only occasional strips or small thickets of deciduous trees and underbrush. The low, rolling hills bordering the valley are moderately steep-sloped with deciduous and some mixed conifer cover. Land use is almost exclusively agricultural pasture land. Recreation use is heavy, consisting of both fishing and hunting. The only community development is Duvall; however, there are a few widely scattered rural residences within this section. Some logging occurs in the upper Cherry Creek watershed.

Through this section, the Snoqualmie River is contained within a broad channel ranging from 30 to 45 yards during fall months. The gradient is gentle with a few nearly flat stretches. The channel meanders back and forth across the valley, forming oxbows. Stream flow is sluggish in many stretches, with numerous long, deep pools and slow-moving glides predominating. Stream bottom is primarily sand and silt, with only a few short, scattered gravel-riffle sections, generally heavily silted. Most banks are moderately high, sharply sloped earth cuts, with a few gently sloped sand-gravel beaches. Some bank protection work has taken place at certain locations within this stretch of river in the form of artificial contour and rock riprap, cabled logs, and discarded car bodies or other large debris to divert flow from easily eroded banks.

Bank cover is sparse to moderately dense, consisting almost entirely of intermittent strips or small thickets of deciduous trees and underbrush. In many areas this growth actually overhangs the banks, and with numerous logs and accumulated debris extending out from the shore, provides favorable protective cover for fish life.

Tributaries in this section exhibit gentle to moderate gradients over their lower reaches as they course across the valley floor. Their upper slopes, however, are quite steep and generally offer limited access to salmon. Through their accessible reaches, most of these streams contain good pool-riffle conditions within relatively narrow stream channels. Stream bottoms are predominantly gravel and sand over the lower reaches, with gravel and some rubble materials above. Tributary cover is usually moderate to dense growth of mainly deciduous trees and underbrush.

Salmon Utilization

This lower Snoqualmie River section provides transportation for all salmon utilizing the upper drainage. Chinook, coho, pink, and chum salmon inhabit these waters. Only limited spawning habitat is available in the Snoqualmie; however, tributaries, including Cherry, Peoples, and Tuck creeks, support good to excellent spawning populations. These tributaries as well as this section of mainstem river provide important rearing habitat for juvenile salmon.

Limiting Factors

One factor limiting salmon production is low summer stream flow in some of the smaller tributaries. This restricts rearing potential and, when continuing into the fall months, can inhibit adult salmon access. One activity which could potentially limit production is clear-cut logging over some reaches of upper tributary drainages. Such logging can influence the productive capacity of streams emerging from such areas, as well as affect production in their drainagesbelow. Another potential limiting condition involves water quality throughout the lower mainstem Snoqualmie. The slow-moving water lacks cover and is more easily warmed, and offers the potential for concentrating pollutants that could severely affect the natural production capabilities. Occasionally, heavy poaching activity occurs on adult salmon in some of the smaller tributaries.

Beneficial Developments

No facilities or programs have been undertaken in this drainage section to specifically benefit salmon production. Occasionally, stream maintenance activities involving removal of minor jams are undertaken on small streams.

Habitat Needs

The major requirement to maintain salmon production potential in this section is to protect the natural conditions that presently exist, i.e. natural stream cover, pool-riffle character, quantity and quality of stream gravel, good water quality, etc. Restoration of natural stream cover where it has already been eliminated is highly desirable, particularly on the tributary drainages.

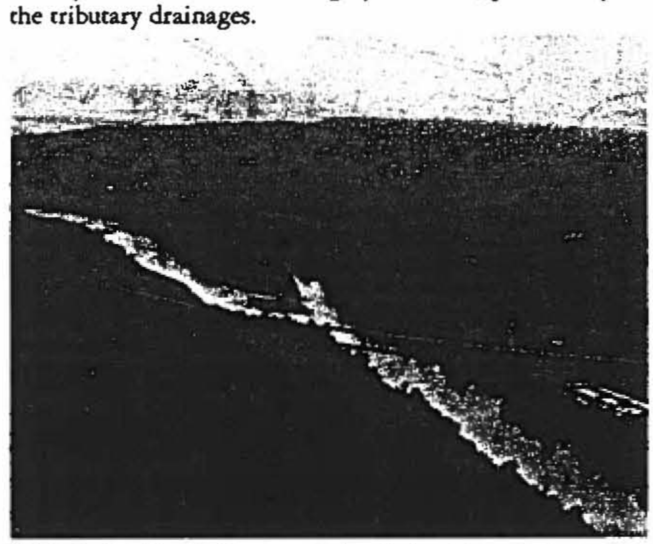
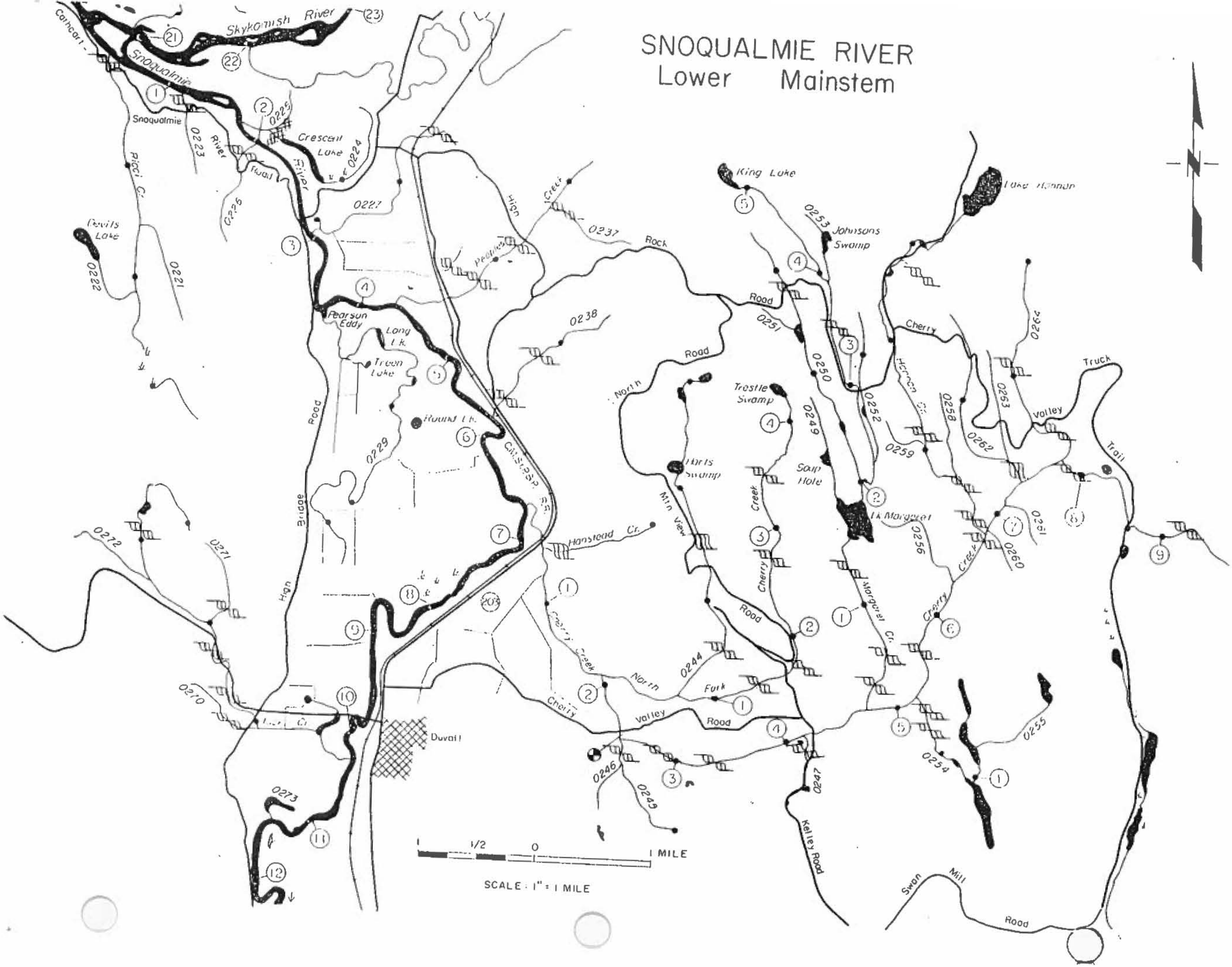


PHOTO 07-19. Confluence of the Skykomish and Snoqualmie Rivers.


SNOQUALMIE RIVER
Lower Mainstem
Skykomish River
Snoqualmie
Snoqualmie River
Crescent Lake
Devils Lake
Ricci Cr.
Pearson Eddy
Long Lk.
Treen Lake
Round Lk.
High Bridge Road
C.M.St.P.&P. R.R.
Hanstead Cr.
Peoples Creek
High Rock Road
North Road
King Lake
Johnsons Swamp
Lake Hannan
Trestle Swamp
Harts Swamp
Soap Hole
Lk Margaret
Margaret Cr.
Cherry Creek
Mtn View Road
North Fork
Cherry Valley Road
Kelley Road
Duvall
Hanson Cr.
Cherry Valley Truck Trail
Swan Mill Road
0221
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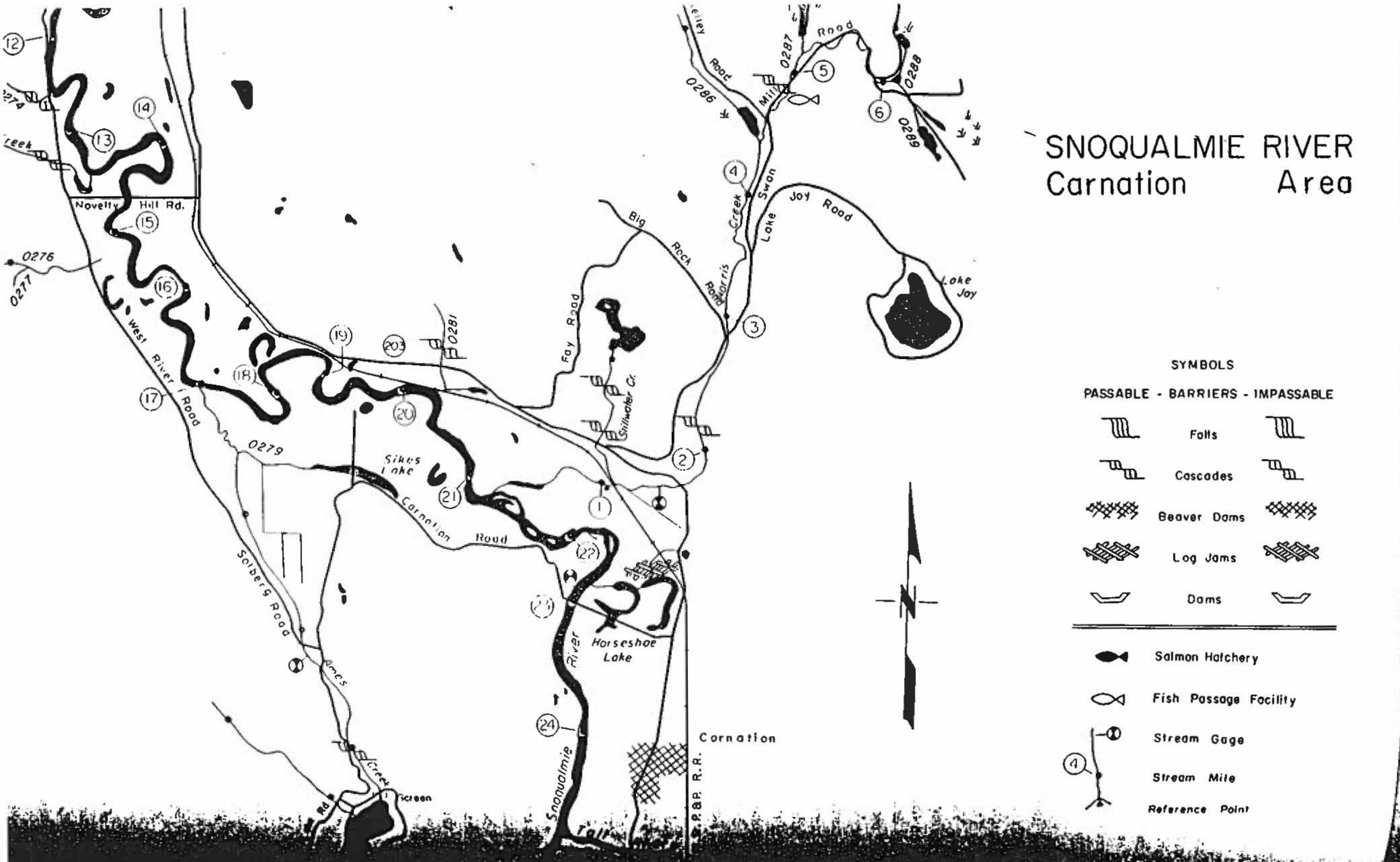
1 MILE
SCALE: 1" = 1 MILE

SNOQUALMIE RIVER — LOWER MAINSTEM
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho Pink, Chum
0219	Snoqualmie River	LB-20.5	84.55	693.0	Chin., Coho, Pink, Chum
0220	Ricci Creek	LB-0.4	3.5	—	(Coho)
0224	Unnamed	RB-1.7	1.7	—	Unknown
	Crescent Lake	Outlet-0.35	—	—	
0227	Unnamed	RB-2.9	1.9	—	(Coho)
	Drainage Ditch	LB-0.2	~ 2.1	—	Unknown
0229	Pearson Eddy Creek	LB-3.6	4.35	—	Unknown
	Long Lake	Outlet-1.0	—	—	
0233	Drainage Ditch	RB-3.85	~ 1.3	—	Unknown
0236	Peoples Creek	RB-4.3	2.3	—	Coho
0238	Unnamed (Duvall Cr)	RB-5.7	1.5	—	(Coho)
0240	Cherry Creek	RB-6.7	9.9	—	Chin., Coho, Pink, (Chum)
0241	Hanstead Creek	RB-0.5	1.0	—	Unknown
0242	Drainage Ditch	LB-0.75	~ 3.5	—	Unknown
0243	N. Fk. Cherry Cr.	RB-1.9	4.2	—	Coho, (Pink), (Chum)
0244	Unnamed	RB-0.7	3.1	—	(Coho)
	Harts Swamp	Outlet-2.15	—	—	
	Unnamed Lk.	Outlet-2.8	—	—	
	Unnamed Lk.	Outlet-3.1	—	—	
	Trestle Swamp	Outlet-4.2		—	
0245	Unnamed	LB-2.5	1.0	—	Unknown
0248	Margaret Creek	RB-4.7	5.1	—	(Coho)
	Margaret Lk.	Outlet-1.55	—	—	
0250	Unnamed	RB-2.0	2.4	—	None
	Roth's Sw.	Outlet-0.45	—	—	
	Unnamed Lk.	Outlet-1.35	—	—	
0252	Unnamed	LB-2.2	1.3	—	
	King Lake	Outlet-5.1	—	—	
0254	Unnamed	LB-5.2	1.6	—	Unknown
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-0.85	—	—	
	Unnamed Lk.	Outlet-1.15	—	—	
	Unnamed Lk.	Outlet-1.6	—	—	
0257	Hannan Cr.	RB-6.8	3.55	—	(Coho)

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
	Unnamed Lk.	Outlet-2.65	—	—	
	Lake Hannan	Outlet-3.55	—	—	
0262	Unnamed	RB-7.4	1.9	—	None
0264	Unnamed	RB-7.8	2.0	—	(Coho)
	Cherry Lake	Outlet-9.9	—	—	
0267	Tuck Creek	LB-10.3	4.05	—	Coho, (Chum)
0268	Drainage Ditch	LB-0.4	~ 1.1	—	Unknown
	Unnamed Lake	Outlet-3.25	—	—	

(Cont. Snohomish 703)


SNOQUALMIE RIVER
Carnation Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Novelty Hill Rd.
West River Road
Solberg Road
Carnation Road
Big Rock Road
Fay Road
Lake Joy Road
Lake Joy
Sikes Lake
Horseshoe Lake
Snoqualmie River
Stillwater Cr.
Carnation
0276
0277
0279
0281
0286
0287
0288
6820

SNOQUALMIE RIVER — CARNATION AREA
Snohomish River Basin — WRIA 07

Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
...omish River				Chin., Coho, Pink, Chum
Snoqualmie River				Chin., Coho, Pink, Chum
Adair Creek	LB-13.35	1.65	—	Unknown
Unnamed	LB-15.1	1.05	—	Unknown
Ames Creek	LB-17.0	5.2	—	Coho, (Chum)
Unnamed	RB-0.55	0.7	—	Unknown
Drain. Ditch	LB-0.25	~ 1.6	—	Unknown
Sikes Lake	Outlet-0.7			
Ames Lake	Outlet-3.5	—	—	
Harris Creek	RB-21.3	6.45	—	Coho, (Chum)
Unnamed Lake	Outlet-0.2	—	—	
Stillwater Cr.	RB-1.11	1.1	—	Coho
Unnamed	RB-4.45	1.1	—	Coho
Unnamed Lake	Outlet-6.1	—	—	
Unnamed Lake	Outlet-6.45	—	—	
Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)

(See Snohomish 803)
(... Snohomish 1003)

This section includes the lower 9.0 miles of Tolt River with nine tributaries, excluding the South Fork, providing an additional 13.2 stream miles. The Tolt River originates in the range of mountains including Mt. Index, Red Mountain, and Mt. Phelps east of the Snoqualmie River, then flows southwest to its confluence with the Snoqualmie (R.M. 24.9) near the town of Carnation. The entire watershed lies within King County and road access to the lower river is provided by the Tolt River Road along the north bank, upstream from about six miles, and by the Bunker Road on the south bank from the mouth to river mile 1.8. Stossel Creek is the principal tributary and is accessible from the Tolt Truck Trail. The upper watershed will be discussed with Map 901.

Stream Description

The lower Tolt River includes the 9.0 miles below the confluence of the North and South forks. Flows are controlled by the spillway releases from the Seattle Water Supply Reservoir on the South Fork. The peaks of the upper watershed mountain range extend to 5,000-foot elevation and drop rapidly from steep canyon boulder zones to the 450 -foot elevation near the forks. The Tolt River Valley broadens below this point and becomes predominantly of floodway character. Stream width varies from 45 to 75 feet above river mile 5.0 and extends to 90 feet in the lower river. Channel splitting and overflow side channels occur below river mile 4.0. Above river mile 5.0 the streambed is comprised mostly of rubble and boulders with few patch gravel areas. Flows are mostly of fast riffle character with a few rapids. Below river mile 5.0 the bottom composition changes, with the streambed exhibiting rubble and gravel with a few boulder-strewn sections. Proceeding downstream from R.M. 5.0 there are increasing sections of gravel riffles and generally good pool-riffle balance.

Land use is confined to a few permanent small rural farms in the lower 2 miles, with heavy recreational use up to river mile 6.0 at the end of the Tolt River Road. Some logging occurs in the upper section near the forks. Stossel Creek is the principal tributary providing 4.45 miles of accessible stream. This tributary contains several reaches of beaver ponds. There are 8 short tributaries that also provide considerable drainage runoff to this system. These contain good shade cover and some sections suitable for salmon production.

Salmon Utilization

Chinook, coho, chum and pink inhabit the lower Tolt River with chinook and coho ascending this entire section and chum and pink utilizing the lower 4.0 miles, particularly the channel splits and overflow channels. Coho ascend all of the accessible portions of the tributaries, particularly Stossel Creek and Langlois Creek.

Limiting Factors

Steep gradients, cascades and falls restrict some fish use in the smaller unnamed tributaries. Gravel removal, particularly in the lower river, has altered the streambed conditions. Riprapping and other flood control measures below river mile 4.0 has tended to eliminate natural overflow channels and construct the main channel in some cases. Cleared logged-off slopes in the upper watershed contribute to the flash flooding and silting in the basin. Large boulders in the streambed limit the spawning areas. The Seattle-Tolt Water Reservoir controls the flows from the South Fork, reducing summer rearing capacity.

Beneficial Developments

A U.S.G.S. gaging station, located about 0.5 mile downstream of the confluence of the South Fork, has continuously recorded stream flow measurements from the Seattle Water Reservoir since 1952. Another U.S.G.S. gaging station, with records dating back to 1928, is located near the mouth of Stossel Creek. Negotiations for minimum flow releases for fish use were initiated in 1957 but have never been consummated into a formal agreement. Based on average flows of 200 cfs from September 15 to June 1, and 125 cfs from June 1 to September 15, as measured below Stossel Creek, releases from the Seattle Storage Dam would amount to 38 cfs in the winter period and 24.5 cfs in the summer period. In critical water years, which occur one out of ten, the reduction of 30% in these quantities would be made in the monthly release schedule.

Habitat Needs

A firm minimum flow agreement should be negotiated through the Department of Ecology with Seattle Water Department for Tolt River Reservoir releases for fish use. Gravel removal operations in the lower Tolt River should be prohibited as recruitment of gravel is minimal in this river.

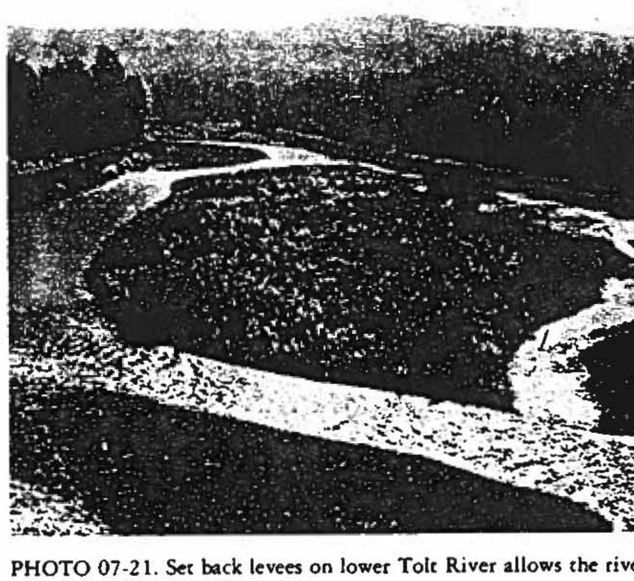
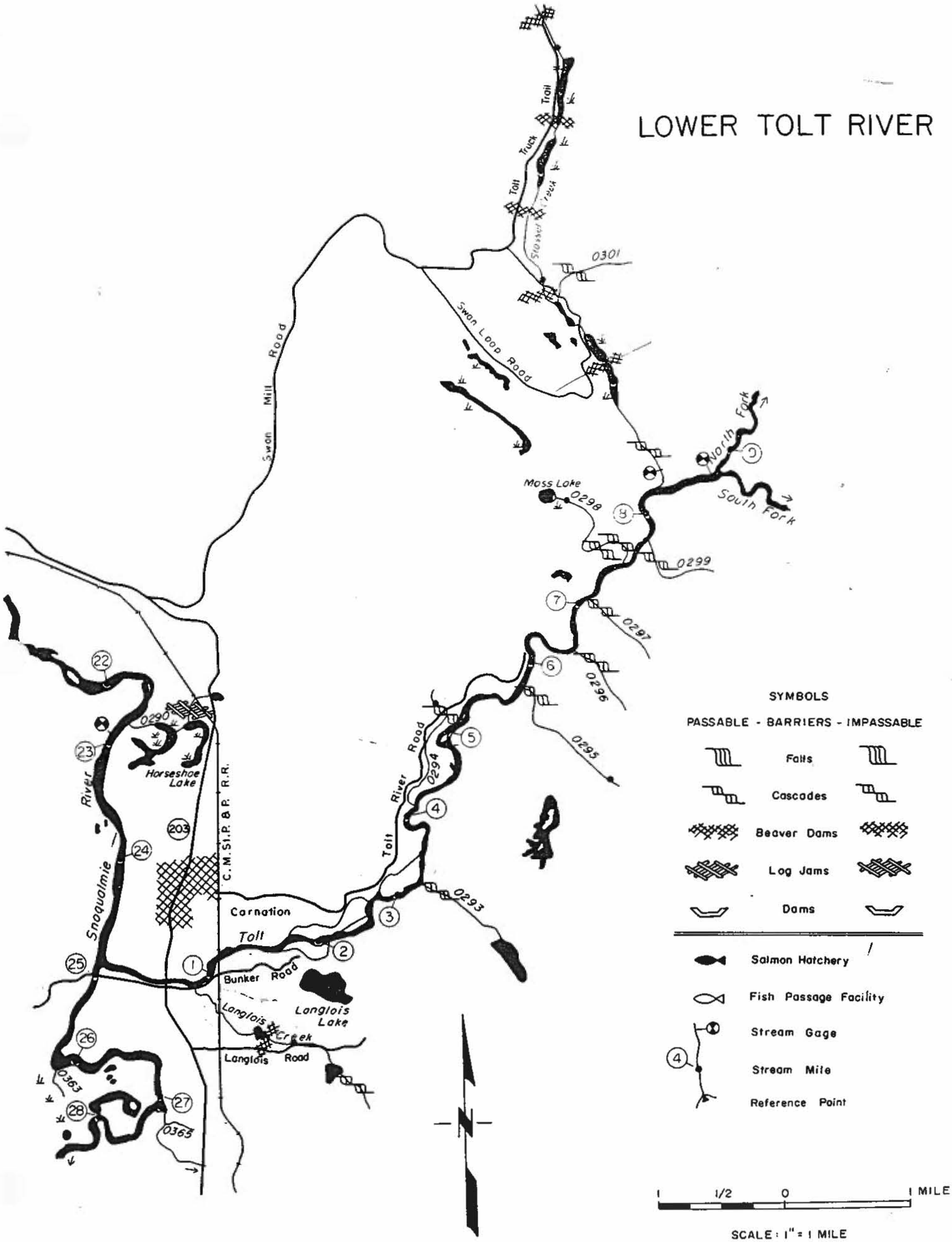


PHOTO 07-21. Set back levees on lower Tolt River allows the river to meander.

LOWER TOLT RIVER



LOWER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)
0292	Langlois Creek	LB-0.85	1.85	—	Coho
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-1.4	—	—	
0294	Unnamed	RB-4.1	1.1	—	(Chin), Coho
0295	Unnamed	LB-5.8	1.1	—	Unknown
0298	Unnamed	RB-7.5	1.15	—	(Coho)
0300	Stossel Cr.	RB-8.3	4.45	—	Coho
	Unnamed Lk.	Outlet-0.8	—	—	
	Unnamed Lk.	Outlet-1.2	—	—	
	Unnamed Lk.	Outlet-1.56	—	—	
	Unnamed Lk.	Outlet-2.9	—	—	
	Unnamed Lk.	Outlet-3.4	—	—	
	Unnamed Lk.	Outlet-4.45	—	—	
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
	(See Snohomish 903)				
	Tolt R. cont. as	(@ mi. 8.81)	—	—	
	No. Fk. Tolt R.				
	(Cont. Snohomish 903)				

This section covers the upper Tolt River basin. Above the South Fork (R.M. 8.8) it continues as North Fork more than 17 miles. Some 22 tributaries and 50 stream miles. The South Fork is also about 17 miles long, with 15 tributaries adding 30 stream miles. The area is located six miles east of Carnation, in north-central King County. Access is via logging roads from the town of Snoqualmie. The North Fork and tributaries above R.M. 18 are within Snoqualmie National Forest. Also, much of the area is managed as watershed by the City of Seattle.

Stream Description

From the northwest slopes of Red Mountain the North Fork flows first northwest, then west about eight miles, then southwest nine miles to the South Fork confluence. The only large tributary other than the South Fork is North Fork Creek.

Over its upper 6-7 miles the North Fork cuts through a narrow, steep-sloped valley. The upper three or so miles hold dense conifer forest; the lower slopes mostly clear-cut. Downstream from Titicaca Creek (R.M. 20.6) the valley shallows and broadens for six miles, showing many clear-cuts and various stages of reforestation. The lower six miles cut through deep ravine-canyon terrain, where most side slopes are thickly forested. Similar mountain terrain exists over the South Fork; however, most slopes here hold dense forest cover. Little development has occurred in the upper drainage. Principal activity is logging, with some recreation.

The North Fork's upper six miles are mostly steep, the stream's narrow channel holding some falls, numerous cascades, a few short pool-riffle stretches. Widths range 2-6 yards, the bottom mainly boulder and rubble, little gravel.

The gradient over the next six miles is mostly moderate. Fall widths range 5-10 yards, with some channel splitting. There are a number of good pool-riffle stretches, with the bottom being mainly rubble and gravel, and a few boulder areas. Banks are mostly low earth or rock cuts, with a few gravel-rubble beaches. Cover consists of patches or strips of mainly deciduous growth and some mixed conifer.

Over the next 3-4 miles, the ravine-canyon area presents mostly steep gradient, with numerous falls, cascades, and rapids, and only a few deep pools and short riffles. One large falls, exceeding 25 feet, is located about R.M. 10.8. Stream widths above the falls range from 4 to 9 yards. The bottom is mostly large rock and boulders, with some bedrock and a few rubble-patch gravel stretches.

The lower two miles of the reach present moderately steep gradient. The channel remains confined, ranging 5-12 yards in width in the fall, exhibiting numerous cascades and rapids, and occasional pools and short riffles. The bottom is boulder and rubble, with some patch gravel. Banks are steep -sloped, maintaining moderate to dense deciduous/conifer cover where logging has not occurred.

The South Fork's upper three miles is steep gradient stream, with conditions much the same as in the upper North Fork. For the next three miles, the gradient is moderately steep, with the stream presenting mostly fast riffles, a few cascades, and some short pool-riffle stretches. Here, fall widths range 3-5 yards, with the bottom composed mostly of rubble and scattered boulders, and some patch gravel areas. Cover is mostly conifer timber, with some mixed deciduous growth. Seattle's South Fork Tolt Reservoir encompasses the next 3.5 miles (R.M. 8.5-12.0). A large falls is located just downstream from the dam. Over the remaining eight or so miles the South Fork presents moderately steep to steep gradient, with mostly fast riffles and some cascades, particularly in a short canyon (R.M. 2.5-3.5). Stream widths range from 5 to 14 yards. Some deep pools, with a few short riffles, exist along this lower stretch. The bottom is mainly rubble and boulders, with a few short gravel riffles and patch gravel strips. The South Fork banks are generally sharp earth or rock cuts holding dense cover, except for the lower river stretches where clear-cut logging has occurred.

Nearly all smaller tributaries exhibit steep mountain stream character, with numerous cascades and rapids, and mostly boulder and rubble bottoms.

Salmon Utilization

This section receives limited salmon use, some chinook and coho ascending the North Fork about a mile, the South Fork as far as eight miles. Chinook juveniles rear for a short time in these waters, coho having year-round habitation.

Limiting Factors

Natural salmon production limitations include the North Fork and South Fork falls, plus the steep gradient restricting spawning habitat within accessible stream reaches. Additional factors include low flows during critical dry seasons, and occasional heavy siltation from a South Fork slide.

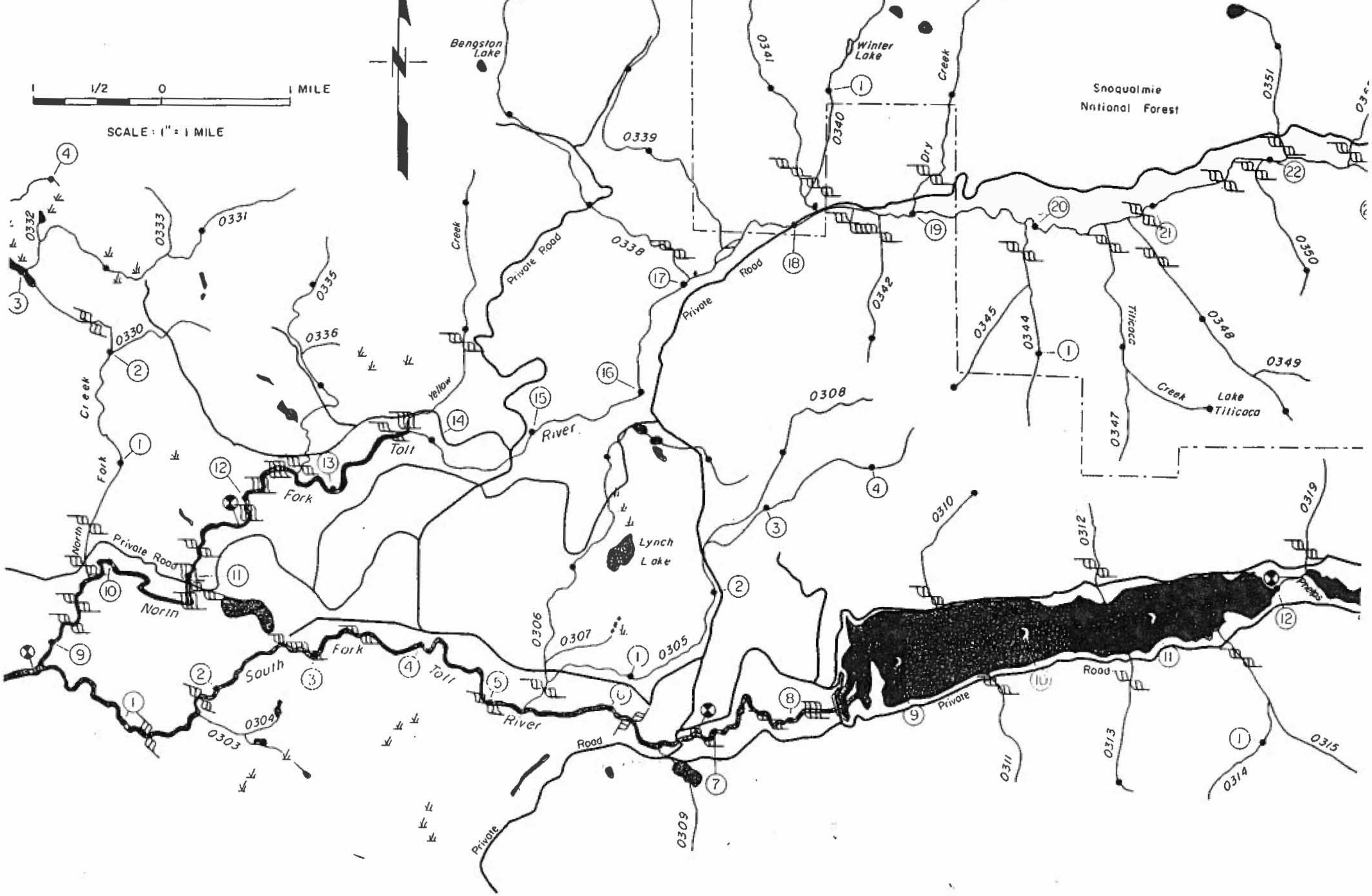
Beneficial Developments

The only programs to benefit salmon production is a minimum flow agreement with the City of Seattle to insure against severe flow reductions.

Habitat Needs

Requirements to maintain production habitat include preserving stream side cover, and maintaining stream conditions in a near natural state. Containment of the South Fork slide would benefit the more productive areas downstream.

UPPER TOLT RIVER



UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River				Chin., Coho, Pink, (Chum)
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
0305	Unnamed	RB-5.3	4.5	—	Unknown
0306	Unnamed	RB-0.3	3.4	—	None
	Unnamed Lake	Outlet-2.3	—	—	
	Unnamed Lake	Outlet-2.5	—	—	
0308	Unnamed	RB-2.45	1.9	—	None
	Tolt-Seattle Water Sup. Res.	Outlet-8.4	—	—	
0310	Unnamed	RB-9.4	1.0	—	None
0313	Unnamed	LB-10.8	1.1	—	None
1314	Unnamed	LB-11.5	1.6	—	None
0315	Unnamed	RB-0.7	1.0	—	None
0316	Phelps Cr.	LB-12.3	2.2	—	None
0320	Unnamed	RB-12.9	1.0	—	None
0323	Unnamed	RB-14.5	1.0	—	None
	Tolt R. cont. as N. F. Tolt R.	@ mi. 8.81	—	49.3	
0329	N. Fork Creek	RB-9.7	4.1	7.53	Unknown
	Unnamed Lake	Outlet-2.85	—	—	
0331	Unnamed	LB-3.0	2.8	—	None
	Unnamed Lake	Outlet-3.55	—	—	
0335	Unnamed	RB-12.6	2.5	—	None
0337	Yellow Creek	RB-13.8	2.2	—	None
0338	Unnamed	RB-17.05	3.7	—	None
0339	Unnamed	RB-17.4	2.9	—	None
0340	Unnamed	RB-18.25	3.0	—	None
0341	Unnamed	RB-0.15	2.7	—	None
	Winter Lake	Outlet-1.35	—	—	
0342	Unnamed	LB-18.7	1.2	—	None
0343	Dry Creek	RB-19.0	2.4	—	None
0344	Unnamed	LB-19.9	1.6	—	None
0345	Unnamed	LB-0.5	1.0	—	None

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0346	Titacaca Creek	LB-20.6	1.9	—	None
	Lk. Titicaca	Outlet-1.9	—	—	
0348	Unnamed	LB-20.8	2.1	—	None
0350	Unnamed	LB-21.9	1.2	—	None
0351	Unnamed	RB-22.1	1.4	—	None
0352	Unnamed	RB-22.6	1.1	—	None
0353	Unnamed	RB-23.1	1.2	—	None
0354	Unnamed	RB-23.39	1.4	—	None
0355	Titicaed Cr.	LB-23.4	1.65	—	None
	Titicaed Lk.	Outlet-1.65	—	—	
0358	Unnamed	RB-23.55	1.1	—	None

SNOQUALMIE RIVER
Tolt Area

Thirteen miles of main Snoqualmie River are covered in this section from Tolt River upstream to Tokul Creek, plus fourteen tributaries exclusive of the Raging River, providing an additional 51.0 stream miles. The principal town in this valley section is Fall City located near the confluence of the Raging River with the Snoqualmie River at mile 36.0. Access along this stretch of river is by the Fall City to Monroe State Highway 203 on the east valley, and by the west valley road which connects to the Redmond-Fall City State Highway 522 two miles northwest of Fall City. This portion of the Snoqualmie River lies within King County. The Raging River will be presented in Map 1101.

Stream Description

This section of the Snoqualmie River from river mile 25.0 at the mouth of the Tolt River upstream to river mile 39.3 near Tokul Creek, about a mile below Snoqualmie Falls, provides the floodway for the extensive mountainous headwaters of this watershed above the falls. The Snoqualmie River winds in shallow bends downstream to river mile 33.5, below which it forms extensive oxbows and zigzags across the valley floor in serpentine fashion downstream to the town of Carnation. The valley averages about 1.5 miles in width with hillsides rising to the 400-foot elevation, forming valley walls on either side. Many large side sloughs formed by overflow waters are located in this stretch, with the largest group located on the east valley side between river mile 36.0 and 33.0 below Fall City. The mainstem Snoqualmie varies in width from 150 to 400 feet, averaging about 250 feet over much of the distance. Gradient is extremely shallow, descending from 100-foot elevation to 55-foot elevation within this 13.8 mile distance, with only a five-foot drop in the lower 6 miles. Below river mile 33.0 the river becomes a slow, deep slough, confined within diked banks with heavy mud and silt bottoms. Few patch gravel shoreline bars are present even on inside curves. Long gravel riffles with goo gravel composition occur between river mile 34.0 and 35.0. Above this point, the river again becomes deep and slow moving. Good tree cover with brush-covered banks occurs throughout this section. Land use is essentially agricultural and pastural. Due to annual flooding in the valley, there are only scattered rural homes.

Griffin Creek is a major tributary providing some 13 stream miles of drainage. The creek ranges from 10 to 25 feet in width with fair gravel composition. The average flow from 20 years of record is 42.3 cfs. Many beaver dams and swamps occur above stream mile 5.0 and much of the upper watershed has been logged off. Many summer homes are located on the lower stream.

Patterson Creek is 9.25 miles in length with an additional 9.7 miles of tributaries. It is a typical lowland-type stream with fair to good gravel, good pool-riffle balance and excellent shade and cover. Average discharge for 19 years of record is 32.2 cfs.

Salmon Utilization

Chinook, coho, chum and pink salmon utilize the mainstem Snoqualmie within this section for transportation, spawning and rearing. Chinook spawning is intense between river mile 34.0 and 35.0 with some chum and pink utilizing this same area as well as the mouth of the Raging River. Below R.M. 33.5 there is minimal spawning area with only a few shoreline gravel sections. Coho utilize mainly the tributaries; especially Griffin Creek, Patterson Creek, Skunk Creek, and the lower accessible portions of the other small unnamed tributaries. In Griffin Creek the main coho spawning occurs between R.M. 3.0 and 5.1 at the outlet of the lower swamp lake.

Limiting Factors

Heavy snowmelts and runoffs from above Snoqualmie Falls create heavy flooding in the valley. The I-90 road construction on Snoqualmie Pass Highway causes heavy silt loads in the lower river. Heavy deposits of silt and mud are found throughout the deep, slow oxbows of the lower river. Logging in the headwaters of Griffin Creek creates heavy runoff and gravel bed shifting in this stream. Steep gradients and cascades of the small independent tributaries reduce the streams to minimum salmon usage.

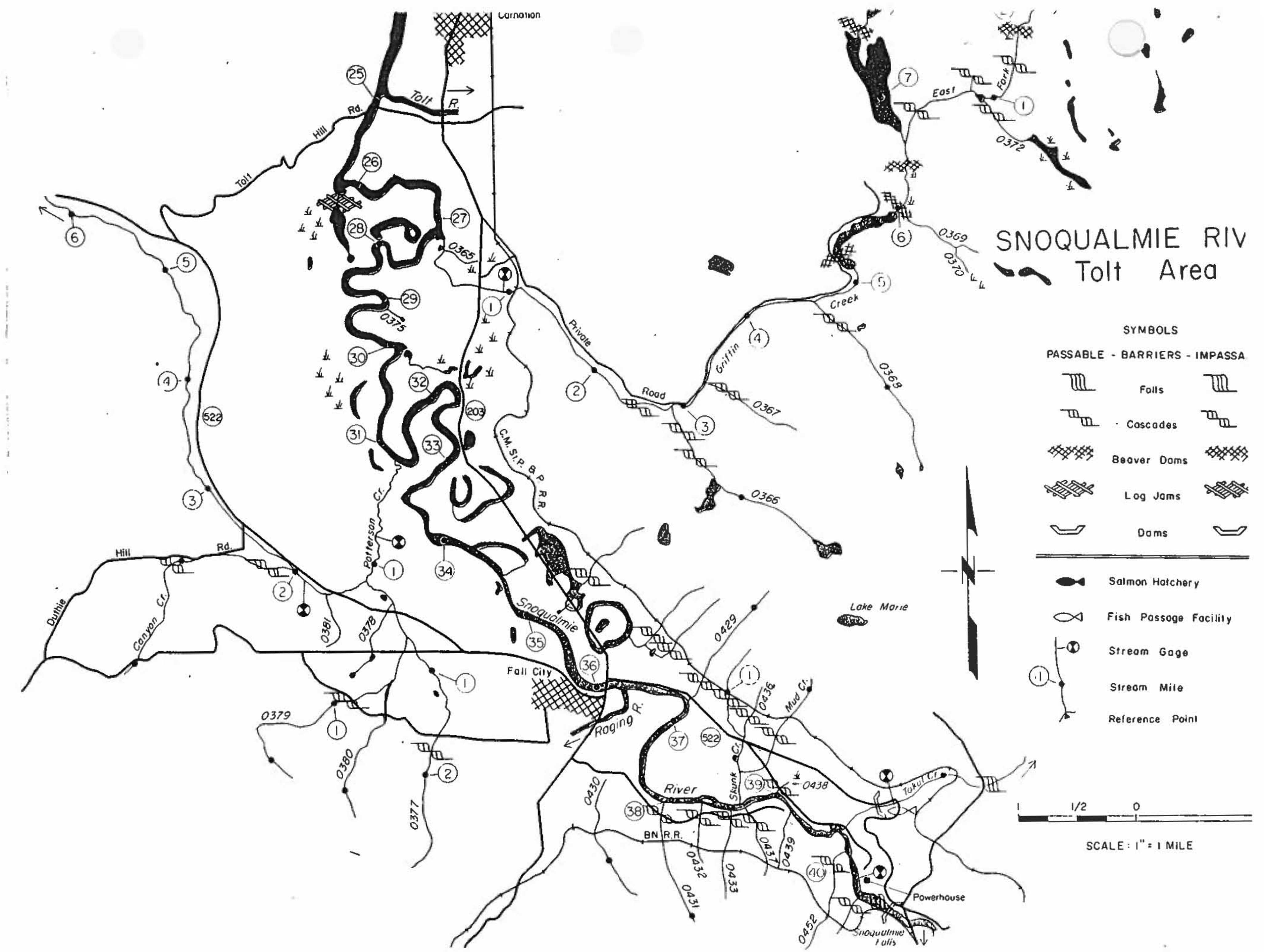
Beneficial Developments

No facilities or programs have been undertaken in this section to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production habitat in this section include: developing zoning laws preventing construction of permanent buildings within the flood plain; coordinating flood control activities with King County Flood Control; and the development of a good watershed management plan to preserve the environment.

PHOTO 07-22. Good chinook riffles on Snoqualmie River.


SNOQUALMIE RIV
Tolt Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSA
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
SCALE: 1" = 1 MILE
Carnation
Tolt R.
Tolt Hill Rd.
Hill Rd.
Private Road
Griffin Creek
East Fork
Snoqualmie River
Raging R.
Fall City
Patterson Cr.
Canyon Cr.
Duthie
Mud Cr.
Skunk Cr.
Tokul Cr.
Lake Marie
C.M.St.P. & P. R.R.
BN R.R.
Powerhouse
Snoqualmie Falls
522
203

SNOQUALMIE RIVER — TOLT AREA
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River			—	Chin., Coho, Pink, Chum
0219	Snoqualmie River	LB-20.5		—	Chin., Coho, Pink, Chum
0364	Griffin Creek	RB-27.2	11.4	—	Chin., Coho, Pink, (Chum)
0366	Unnamed	LB-2.9	1.75	—	(Coho)
	Unnamed Lk.	Outlet-0.75	—	—	
	Unnamed Lk.	Outlet-1.75		—	—
0368	Unnamed	LB-4.6	1.7	—	(Coho)
	Unnamed Lk.	Outlet-5.1	—	—	
0371	East Fork	LB-6.6	3.3	—	Coho
	Unnamed Lk.	Outlet-0.9	—	—	
	Unnamed Lk.	Outlet-2.6	—	—	
	Hull Lake	Outlet-3.05	—	—	
	Unnamed Lk.	Outlet-3.3	—	—	
	Unnamed Lk.	Outlet-6.75	—	—	
	Unnamed Lk.	Outlet-7.8	—	—	
	Unnamed Lk.	Outlet-8.9	—	—	
	Unnamed Lk.	Outlet-11.0	—	—	
0376	Patterson Creek	LB-31.2	9.25	—	Coho
0377	Unnamed	RB-1.2	2.9	—	Coho
0379	Unnamed	LB-0.6	2.2	—	Unknown
0380	Unnamed	RB-0.55	1.2	—	Unknown
0382	Canyon Creek	RB-2.0	2.1	—	(Coho)
0383	Unnamed	RB-6.5	1.3	—	Unknown
	Unnamed Lake	Outlet-9.25	—	—	
0384	Raging River	LB-36.2	15.2	—	Chin., Coho, Pink, (Chum)
	(See Snohomish 1103)				
0429	Unnamed	RB-36.8	1.2	—	Unknown
0430	Unnamed	LB-37.65	1.4	—	Unknown
0431	Unnamed	LB-37.95	1.0	—	Unknown
0434	Skunk Creek	RB-38.64	1.4	—	Coho
0435	Mud Creek	LB-0.3	1.1	—	(Coho)
	(Cont. Snohomish 1303)				

UPPER SOUTH PRAIRIE CREEK

This drainage section covers the upper South Prairie Creek above R.M. 12.0. The headwaters lie in the Snoqualmie National Forest near Old Baldy Mountain, Burnt Mountain, and the Three Sisters Mountain near the northwest corner of Mount Rainier National Park in Pierce County. From here the stream generally courses northwesterly towards the town of Buckley. Within this ten-mile section of upper South Prairie Creek, three major tributaries plus eight smaller tributaries provide an additional 34.65 stream miles.

Stream Description

The headwaters of the South Fork and East Fork originate near the Burnt Mountain and Old Baldy Mountain range at the 4,000-foot elevation. The upper headwaters of Beaver Creek and New Pond Creek flow from the Three Sisters Mountain range, several miles north, at the 3,200-foot elevation. They flow generally westward to their confluence with South Prairie Creek. The entire upper South Prairie Creek watershed lies in densely forested mountainous terrain above any major towns or communities. Logging is the principal activity throughout this area, with selective clear-cut sections. Much of the upper watersheds above the forks and along the creek bottoms have been extensively logged in years past. Some mining activity occurs in the mountain peak areas along the Carbon Ridge. Many small mountain lakes, which attract recreational use, also are found throughout this range.

The only access to the upper watershed is out of the town of Wilkeson by two logging roads, the Littlejohn Road and the East Prairie Road. Jeep trails branching off these roads are the only other accesses to the tributaries of the upper watershed.

Above R.M. 14.5 the upper South Prairie Creek and its tributaries course through steep-sloped high mountain terrain containing moderately steep gradients with numerous cascades and rapids and few pools or riffles. Bottom composition is primarily of boulder and rubble with some patch gravel areas. The mainstem stream banks and streambeds below New Pond Creek are quite stable with only a few natural earth-cut exposed areas. Except for the logged-off portions along the upper stream sections, there is good stream cover and shade from dense conifer timber stands.

Salmon Utilization

Salmon use within this area is restricted below R.M. 15.0 where steep cascade sections are located. A diversion dam at stream mile 15.7 provides a total block to salmon migration. Chinook, coho, and pink salmon utilize the stream below. Beaver Creek is inhabited by chinook, pink, and coho in the lower portion and coho in the upper portion, while only coho salmon utilize New Pond Creek. Juvenile chinook and coho rear in the lower three miles between R.M. 12 and 15 of this section.

Limiting Factors

The steep terrain, swift velocities, and many falls and cascades above stream mile 15.0 offer little potential for anadromous production. No fish passage facilities are associated with the diversion dam at R.M. 15.7. Heavy flood runoff waters associated with the steep mountainous terrain have scoured away much of the spawning gravel through the deep ravines and cascade sections of the upper watershed. Boulders, logs, and debris jams also limit the available areas for fish use. Logging and road construction in the upper watersheds have caused considerable silting in lower South Prairie Creek.

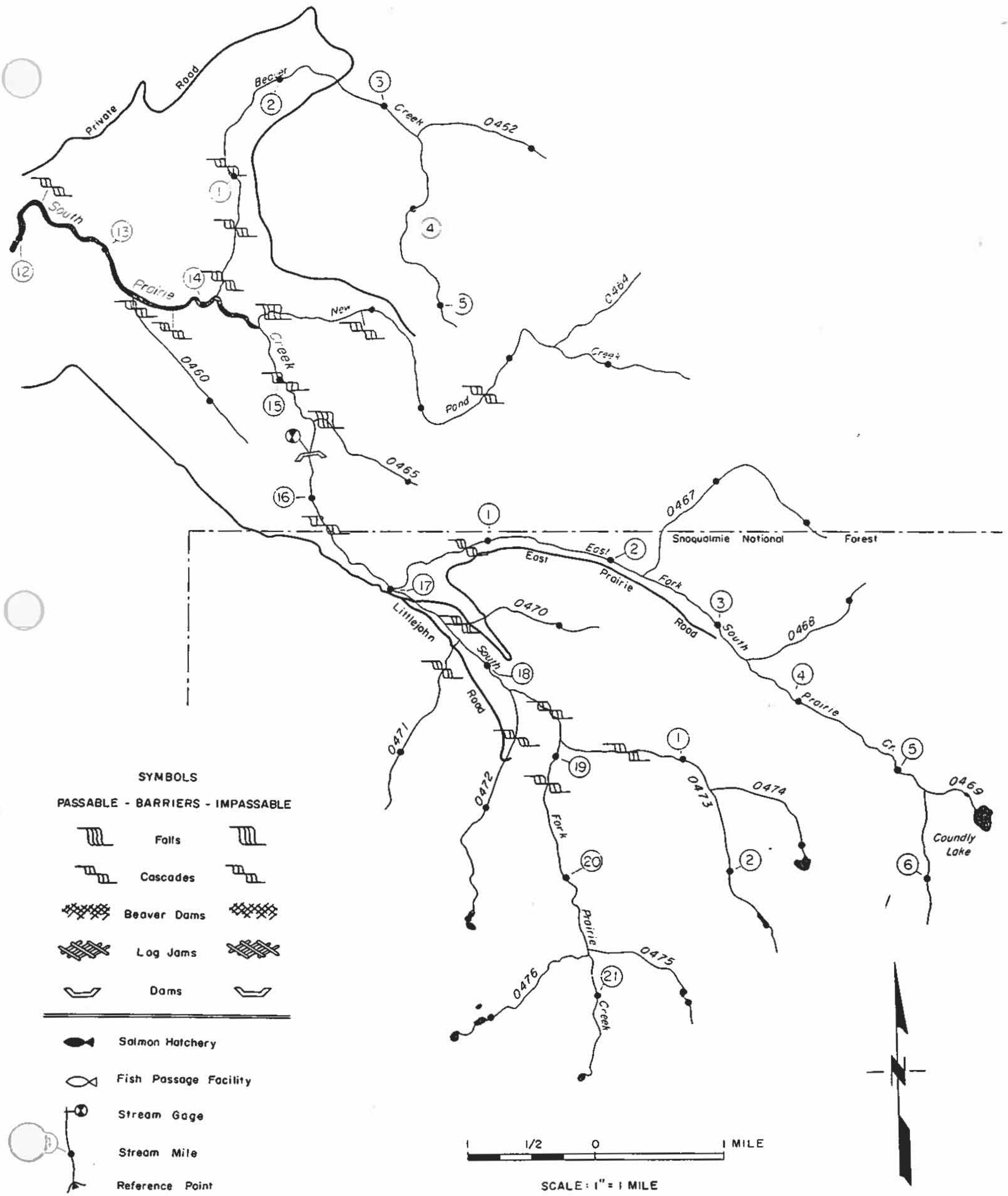
Beneficial Developments

No projects have been undertaken within this section to benefit salmon production.

Habitat Needs

This entire watershed, except for logged areas, remains essentially in its natural pristine state. Logging and road building operations throughout the upper watershed should conform to practices that will maintain clean, free-flowing streams. Buffer strips should be left in the logging areas near the upper watershed streams. Reforestation is mandatory and should be carried out as soon as possible after logging operations have ceased.

UPPER SOUTH PRAIRIE CREEK



UPPER SOUTH PRAIRIE CREEK
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0413	Carbon River				Chin., Coho, Pink, Chum
0429	S. Prairie Cr.				Chin., Coho, Pink, Chum
0460	Unnamed	LB-13.4	1.5	—	Unknown
0461	Beaver Creek	RB-14.1	5.25	—	(Chin.), Coho, (Chum)
0462	Unnamed	RB-3.35	1.15	—	None
0463	New Pond Creek	RB-14.55	4.65	—	(Coho)
0465	Unnamed	RB-15.4	1.05	—	Unknown
0466	East Fork S. Prairie Cr.	RB-17.0	6.4	—	None
0467	Unnamed	RB-2.3	2.2	—	None
0468	Unnamed	RB-3.4	1.2	—	None
	S. Prairie Cr. cont. as S.Fk. Prairie Cr.	@ mi. 17.01		—	
0470	Unnamed	RB-17.5	1.3	—	None
0471	Unnamed	LB-17.7	1.5	—	None
0472	Unnamed	LB-18.25	2.0	—	None
0473	Unnamed	RB-18.85	2.85	—	None
0474	Unnamed	RB-1.3	1.1	—	None
0475	Unnamed	RB-20.6	1.2	—	None
0476	Unnamed	LB-20.65	1.3	—	None

This section includes the lower 12 miles of South Prairie Creek above its confluence with the Carbon River on the right bank at R.M. 5.9 immediately below the State Highway 162 bridge. Wilkeson Creek is a major tributary along with eight smaller tributaries having a total of 41.9 linear stream miles. The watershed is located near the communities of Wilkeson, Burnett, and South Prairie in Pierce County. Access to this area is by State Highway 162 and by the Spiketon-Wilkeson Road.

Stream Description

From R.M. 12.0 South Prairie Creek generally zigzags for 7 miles to the town of South Prairie where it then turns and flows southwest to its confluence with the Carbon River at R.M. 5.9. Within the upper 4 miles of this section the creek cuts through steep ravine-type terrain, with a confined stream channel. At R.M. 8.0 near the community of Burnett, the hillsides give way to more gently sloping terrain and widening valley floor. From this point downstream the creek flows through well defined channels. The valley floor intermittently broadens and narrows downstream to the mouth. This lower section contains increasing amounts of open farmlands separated by intermittent stands or strips of deciduous trees and brush. Land use is agricultural in the lower valley and logging and mining in the upper watershed.

South Prairie Creek exhibits a moderate gradient throughout the valley floor. The stream contains good shade and cover with overhanging banks and has an average discharge of 250 cfs at the gage at South Prairie. Stream widths vary from 10 to 70 yards. The valley hillsides rise from 500 to 700-foot elevation and are covered with mixed deciduous and coniferous forests. Most of these 12 miles contain good pool-riffle proportions and excellent stream substrate.

Wilkeson Creek is the major tributary within this section and contains 12.3 miles of stream plus 5 smaller tributaries providing an additional 21.3 linear miles. The upper headwaters are formed from the South Fork Gail Creek and from West Fork Gail Creek which originate in the Gleason Hills. This drainage flows northerly through the town of Wilkeson to its confluence with South Prairie Creek at R.M. 6.7. The upper watershed originates in a rather pristine area of mountainous terrain with steep gradient, numerous cascades, and is heavily forested. A steep cascade at R.M. 6.8 is a total barrier to fish passage. The lower stream contains excellent pool-riffle balance and much good gravel substrate. The moderately steep gradient shallows in the lower 3 miles. This stream is well covered with deciduous trees and brush along the banks throughout the entire length.

Salmon Utilization

The lower 8 miles of South Prairie Creek provides the major spawning habitat within the system and this drainage is utilized by chinook, pink, chum, and coho. The lower 6.8 stream miles of Wilkeson Creek provide excellent spawning and rearing habitat, with heaviest usage by coho. Each of the accessible unnamed tributaries receives annual runs of coho and a few are utilized by chum in the lower reaches.

Limiting Factors

The major limiting factor within this drainage section is the natural occurrence of low summer flows that reduce the available rearing area throughout the stream. Flood control measures have been undertaken in the lower stream section including gravel removal, bank erosion controls, and channel changes. Heavy silting and gravel compaction have resulted from these types of operations. Coal waste from former mining operations in the upper Wilkeson watershed has settled in the lower stream. Poaching has always been a serious problem in this lower South Prairie Creek area.

Beneficial Developments

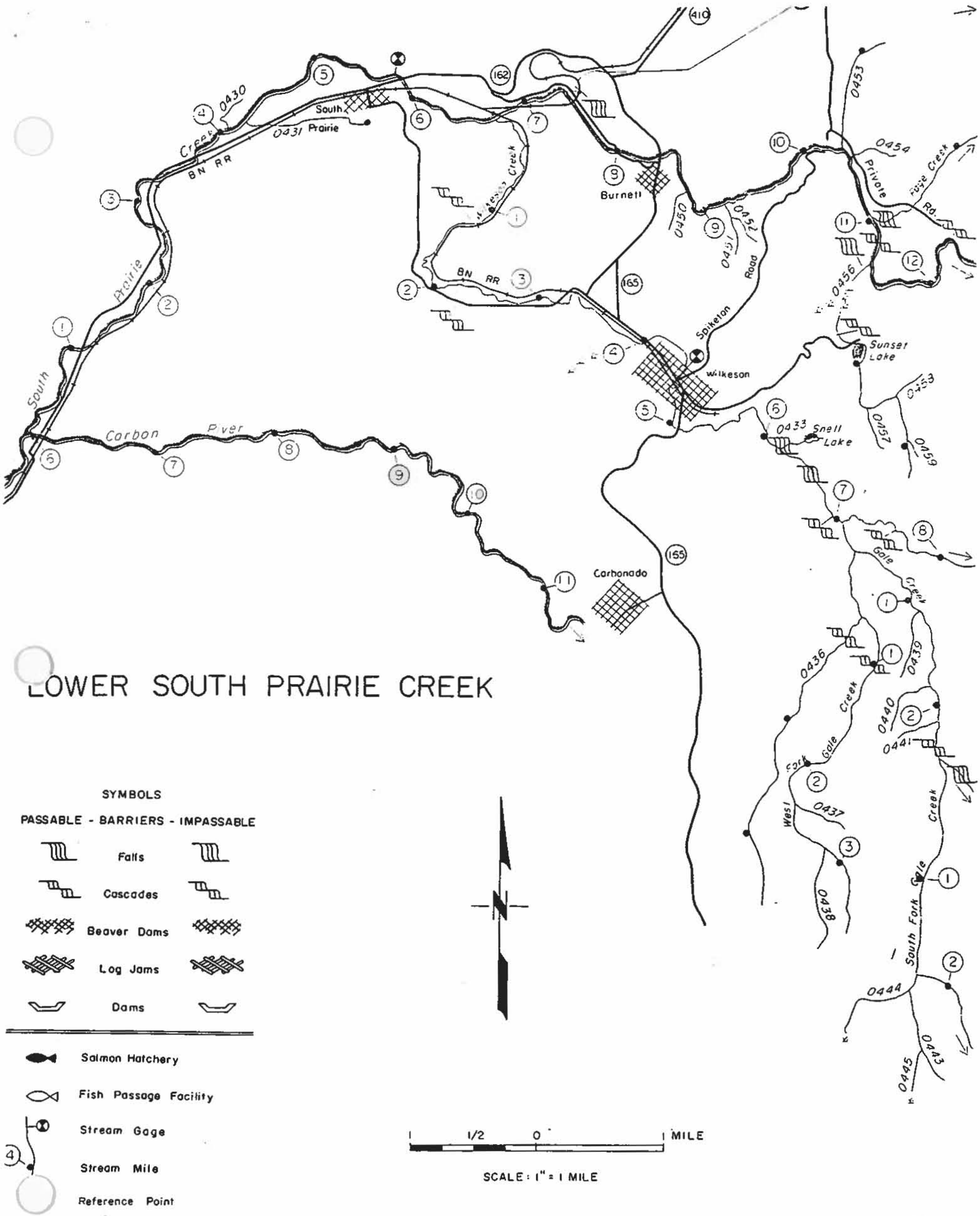
No facility developments or programs have been undertaken within this section to benefit salmon production.

Habitat Needs

A major requirement for maintaining salmon production potential within this drainage section is to preserve existing stream cover and the natural pool-riffle balance. Future mining operations in the upper watershed, particularly for coal, should be monitored closely to preserve the water quality of the area. A good watershed management plan should be developed under the Shorelines Management Act by the local communities to preserve this watershed in its natural state.

PHOTO 10-18. South Prairie Creek has a gentle gradient.

LOWER SOUTH PRAIRIE CREEK



LOWER SOUTH PRAIRIE CREEK
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0413	Carbon River				Chin., Coho, Pink, Chum
0429	S. Prairie Creek	RB-5.9	21.65	—	Chin., Coho, Pink, Chum
0431	Unnamed	LB-4.2	1.0	—	(Coho), (Chum)
0432	Wilkeson Creek	LB-6.7	12.3	—	Chin., Coho, Pink, (Chum)
0434	Gale Creek	LB-7.05	7.7	—	None
0435	West Fork Gale Creek	LB-0.3	3.6	—	None
0436	Unnamed	LB-0.5	2.6	—	None
0442	South Fork	LB-2.4	3.2	—	None
	Gale Creek	LB-2.4	3.2	—	None
0446	Unnamed	LB-5.5	1.4	—	None
0447	Unnamed	RB-5.8	2.0	—	None
0448	Unnamed	RB-8.6	2.6	—	None
0449	Drainage Ditch	RB-7.4	~ 4.15	—	Coho,Pink,(Chum)
0453	Unnamed	RB-10.2	1.1	—	Coho, (Chum)
0455	Page Creek	RB-11.0	2.25	—	Unknown
0456	Unnamed	LB-11.4	2.2	—	(Coho), (Chum)
	Sunset Lake	Outlet-0.85	—	—	
	(Cont. Puyallup 1103)				

MASHEL RIVER DRAINAGE

This section includes the entire Mashel River drainage with over 20 miles of mainstem plus seven tributaries providing another 67 linear stream miles. The majority of this drainage is located east of Eatonville in southern Pierce County. Access is via the Mount Rainier National Park Highway, and various county and private roads out of Eatonville.

Stream Description

From mountain slopes about ten miles east of Eatonville, the Mashel winds its way more than 20 miles west and southwest to enter the Nisqually River (R.M. 39.6) northwest of La Grande. Principal tributaries are Busy Wild and Beaver creeks in the upper drainage, and the Little Mashel River in the lower reaches.

Through the majority of its drainage the Mashel cuts through a shallow, relatively narrow, steep-sloped, forested valley. A number of short, canyon-ravine stretches are encountered. Only in the Eatonville vicinity does the valley broaden to any extent, and this extends for only about a mile. Cover is mainly mixed deciduous and coniferous growth over the upper drainage, and predominantly deciduous trees and brush below. Principal land use is timber production with some agriculture and recreation. Development is sparse with a few scattered rural residences, generally downstream from the town of Eatonville.

From its headwaters downstream about six miles to Busy Wild Creek (R.M. 14.5) the Mashel has a fairly steep gradient, with a few falls, and numerous cascades. These are interspersed with some fast riffles and a few pools. In its narrowly confined channel the bottom is largely boulder and rubble, some bedrock, and only occasional gravel-rubble riffles. Its banks are fairly steep-sided earth or rock cuts, maintaining little cover and much of this upper area has been clear-cut.

Below Busy Wild Creek for approximately 9 miles, the river's gradient is moderately steep. The channel remains quite confined, with fall season flows covering 6 to 12 yards. It is mostly a fast riffle stretch with some cascades and a few relatively large pools. Stream-side cover is dense deciduous trees and underbrush.

In the two miles below Eatonville, the river has a moderate gradient with relatively good pool-riffle stream conditions. The channel is fairly stable with some braiding. Fall season flows range from 8 to 15 yards in width. Here, the bottom is predominantly rubble and gravel, with a few scattered boulders. The banks are low earth cuts or gravel-rubble side beaches. Cover consists of moderate stands or strips of mostly deciduous growth.

Through the lower 4 miles, the Mashel cuts through a narrow, shallow valley, with alternating moderate to moderately steep gradients. The confined channel width ranges from 6 to 12 yards during the fall. The bottom is composed mostly of rubble and gravel, with some bedrock and a few boulder-strewn sections. This area contains fast riffle-type character with occasional good quality pool-riffle stretches, particularly over the lower half-mile. Stream banks are usually natural earth or rock cuts, and a few relatively narrow rubble-gravel beaches. Cover is mainly thick deciduous growth.

Busy Wild Creek has a moderate gradient for nearly 5 miles, with relatively good pool-riffle balance and predominantly gravel-rubble bottom. Its cover is moderate growths of deciduous and low coniferous trees. Beaver Creek and the

In the two miles below Eatonville, the river has a moderate gradient with relatively good pool-riffle stream conditions. Ohe channel is fairly stable with some braiding. Fall season flows range from 8 to 15 yards in width. Here, the bottom is predominantly rubble and gravel, with a few scattered boulders. The banks are low earth cuts or gravel-rubble side beaches. Cover consists of moderate stands or strips of mostly deciduous growth.

Through the lower 4 miles, the Mashel cuts through a narrow, shallow valley, with alternating moderate to moderately steep gradients. The confined channel width ranges from 6 to 12 yards during the fall. The bottom is composed mostly of rubble and gravel, with some bedrock and a few boulder-strewn sections. This area contains fast riffle-type character with occasional good quality pool-riffle stretches, particularly over the lower half-mile. Stream banks are usually natural earth or rock cuts, and a few relatively narrow rubble-gravel beaches. Cover is mainly thick deciduous growth.

Busy Wild Creek has a moderate gradient for nearly 5 miles, with relatively good pool-riffle balance and predominantly gravel-rubble bottom. Its cover is moderate growths of deciduous and low coniferous trees. Beaver Creek and the Little Mashel River each have falls very near their mouths. The areas above the falls contain moderate gradient stream character for most of their upper stream courses. Most smaller tributaries to the Mashel exhibit steeper mountain-type stream character over much of their lengths, with little access or favorable salmon habitat.

Salmon Utilization

The accessible reaches of the Mashel drainage are utilized primarily by chinook and coho, with pink extending to the Eatonville vicinity. Chum are confined primarily to lower river stretches. Chinook spawn principally in the main river with coho extending into accessible tributaries. Juvenile salmon rearing takes place throughout the accessible stream reaches, with coho having year around habitation.

Limiting Factors

The canyon above Eatonville creates fish passage delays, particularly during low flow periods. This is sometimes compounded by the buildup of logging debris in the stream. Also, flash flooding and unusually heavy siltation are considered problems. Poaching is sometimes prevalent in the lower half-mile.

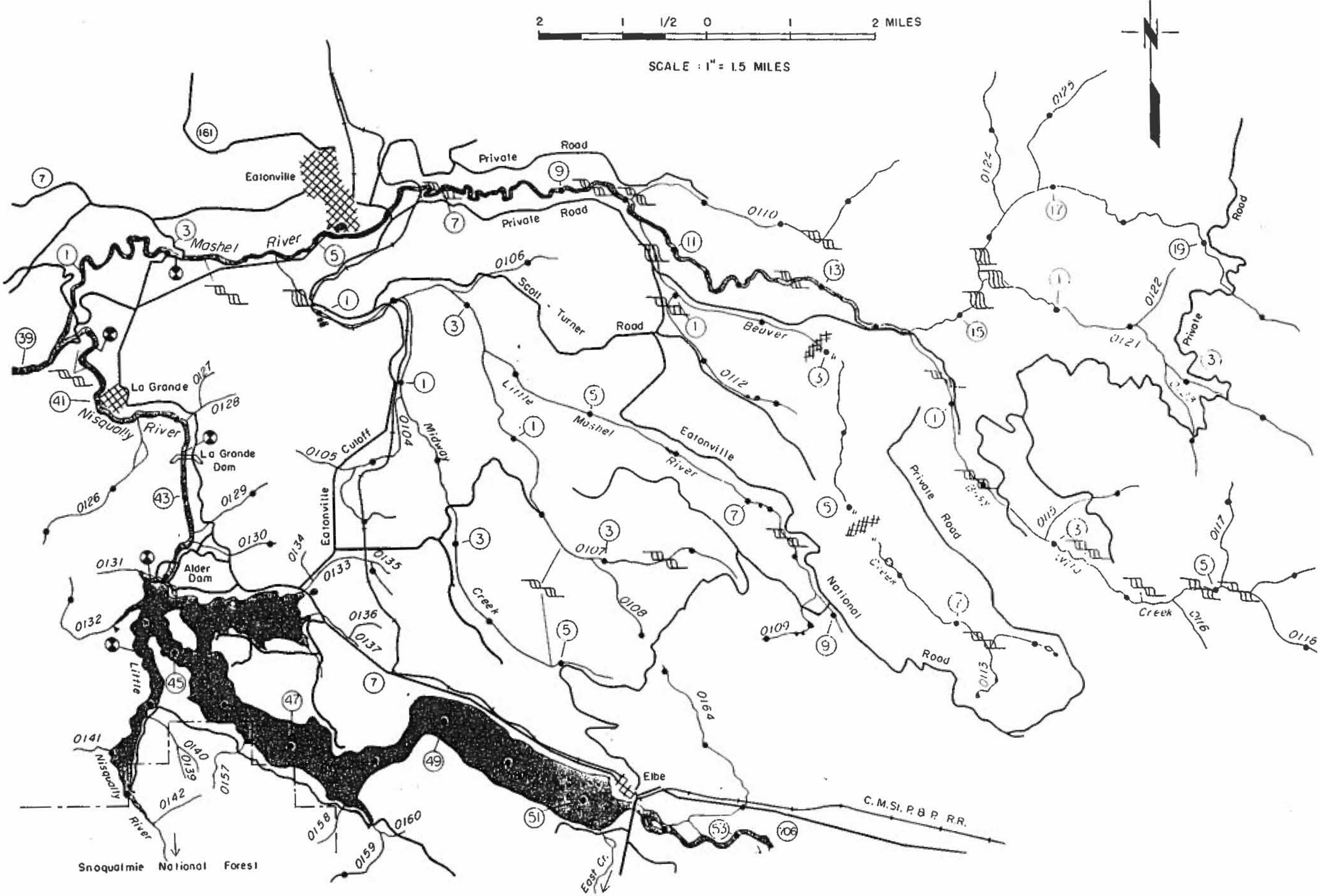
Beneficial Developments

Log jam removal and planting of hatchery-reared fish are the only projects that are performed benefiting salmon production in this section.

Habitat Needs

The principal requirement is to maintain stream and streambed conditions in as near natural state as possible.

MASHEL RIVER DRAINAGE



Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0008	Nisqually River				
0101	Mashel River	RB-39.6	20.5	83.5	Chin., Coho, Pink, (Chum)
0102	Little Mashel R.	LB-4.35	9.2	—	Coho
0103	Midway Creek	LB-2.1	5.6	7.24	None
0104	Unnamed	LB-1.2	2.4	—	None
0106	Unnamed	RB-2.8	1.3	—	None
0107	Unnamed	LB-3.6	4.7	—	None
0108	Unnamed	LB-2.9	1.1	—	None
0109	Unnamed	LB-8.6	1.0	—	None
0110	Unnamed	RB-10.1	3.75	—	Unknown
0111	Beaver Creek	LB-10.4	8.3	—	(Coho)
0112	Unnamed	LB-0.95	2.35	—	None
0114	Busy Wild Creek	LB-14.5	7.8	—	(Chin.), (Coho)
0115	Unnamed	RB-2.9	1.3	—	Unknown
0117	Unnamed	RB-5.1	1.15	—	None
0118	Unnamed	LB-5.45	2.7	—	None
0119	Unnamed	RB-6.4	1.4	—	None
0121	Unnamed	LB-15.6	4.75	—	None
0123	Unnamed	LB-2.7	1.4	—	None
0124	Unnamed	RB-16.4	1.7	—	None
0125	Unnamed	RB-16.85	1.9	—	None

DESCHUTES RIVER
Tumwater Area

This segment covers the lower 19 miles of the Deschutes River, plus 6 tributaries totalling nearly 24 linear miles of stream drainage. The area extends from the Olympia-Tumwater vicinity southeast toward the town of Rainier in central Thurston County, and is accessible via county roads.

Stream Description

From the vicinity of the Military Road crossing (R.M. 19.5), about 2.5 miles west of Rainier, the Deschutes River meanders in a northwest direction more than 17.5 miles to Tumwater Falls, from there into Capitol Lake, then north for about 1.5 miles to salt water at the southern tip of Budd Inlet. Six tributaries enter the Deschutes before it reaches Capitol Lake, the principal one being Spurgeon Creek. Percival Creek enters directly into Capitol Lake (see Deschutes-101).

The Deschutes River, plus a majority of its tributaries, flows over moderate to gently sloped terrain. Adjacent land is primarily agricultural, with scattered residential development. Intermittent sections have been cleared for grazing or annual crop production. Considerable land remains in second or third growth forest consisting of mixed deciduous and conifer growth. Increasing numbers of rural and suburban dwellings, plus a large golf course are encountered as a stream moves toward more heavily populated Tumwater and Olympia. Suburban development, particularly of summer and recreational housing, is increasing along the upper portion of this section. Considerable recreation use is also made of this area.

The Deschutes River meanders a great deal, offering a moderate gradient with a good to excellent pool-riffle balance. Channel widths range from 6 to over 20 yards, with numerous broad, clean gravel riffles. Bottom composition is mainly gravel and rubble, and is generally quite stable. Shorelines consist mainly of broad, gently sloping gravel beaches and low, steep slope earth banks. A few higher, steep, unprotected earth banks are found along this stretch. Along some stream sections, the bank has been contoured and riprapped for protection, particularly over the lower 4-5 miles. Stream-side cover consists of intermittent stands or strips of deciduous growth, interspersed by cleared farm or recreational use of land.

Capitol Lake is a shallow, 300 acre impoundment approximately 1.5 miles in length. The lake is situated in a relatively shallow basin, its shoreline consisting of riprap along the roads or steep slope, heavily wooded, sparsely developed hillsides.

Salmon Utilization

The lower Deschutes River, including Capitol Lake, is the major transportation reach for salmon using this system. The river in this section provides the main spawning habitat for chinook salmon in the entire Deschutes drainage. Coho also spawn here, as well as in each of the accessible tributaries. Juvenile chinook salmon rear through the spring and summer within these waters, while juvenile coho maintain year around residence. In addition to the natural fish production, highly significant numbers and pounds of chinook are reared in Capitol Lake by feeding artificial diets.

Limiting Factors

The major factors limiting salmon production in this section include warm summer temperatures, siltation in Capitol Lake and the lower 2-3 miles of river, low summer-fall flows in the Deschutes and its tributaries, plus streambed and bank alterations associated with land development and erosion control.

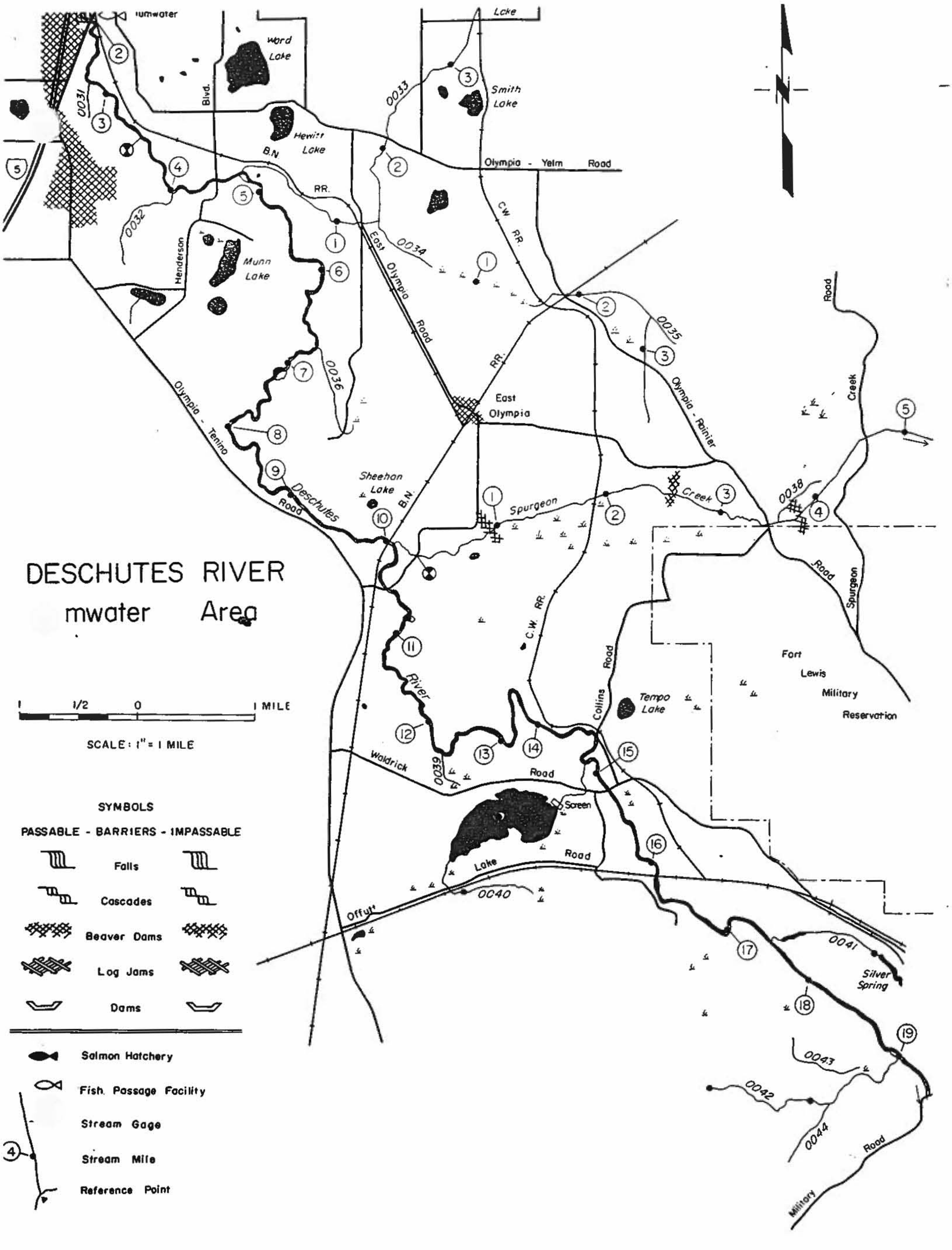
Beneficial Development

This section of the Deschutes River has two fish passage facilities. One is located at the dam impounding Capitol Lake, providing passage from salt to fresh water. The other is at Tumwater Falls consisting of three ladder facilities providing access to the upper river. Trapping facilities are available at the upper Tumwater ladder where chinook eggs are taken for artificial production. Hatchery produced juvenile chinook are planted into Capitol Lake, many of which are fed artificial diets and other that utilize the lake's natural productivity.

Habitat Needs

Any alterations of the existing environment in this section must be compatible to fish requirements. Capitol Lake should be reclaimed by selective dredging and future sedimentation or land fills carefully controlled to maintain present and future production.

PHOTO 13-11. Typical river section above Tumwater Falls.


DESCHUTES RIVER
mwater Area
1 1/2 0 1 MILE
SCALE: 1" = 1 MILE
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Ward Lake
Smith Lake
Hewitt Lake
Munn Lake
Sheehan Lake
Tempo Lake
Olympia - Yelm Road
Olympia - Tenino Road
East Olympia Road
Olympia - Rainier
East Olympia
Henderson
Blvd.
B.N. RR.
C.W. RR.
Spurgeon Creek
Deschutes River
Waldrick Road
Lake Road
Collins Road
Offutt
Screen
Military Road
Fort Lewis Military Reservation
Silver Spring
0031
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DESCHUTES RIVER — TUMWATER AREA
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River			—	Chin., Coho, (Chum)
0033	Unnamed	RB-4.7	4.15	—	Coho
0034	Unnamed	LB-1.4	3.6	—	Unknown
	Little Chambers Lake	Outlet-3.65	—	—	
	Chambers Lake	Outlet-4.15	—	—	
0037	Spurgeon Creek	RB-10.01	5.8	—	(Chin.), Coho
0040	Unnamed	LB-14.8	2.6	—	Coho
	Offutt Lake	Outlet-0.5	—	—	
0041	Unnamed (Silver Springs-local name)	RB-17.5	1.0	—	Coho
0042	Unnamed	LB-18.9	2.0	—	Coho
	(Cont. Deschutes 303)				

DESCHUTES RIVER
Lake Lawrence Area

This section covers approximately 12 miles of the mainstem Deschutes River, plus 4 smaller tributaries providing more than 17 additional stream miles. The area is located just a few miles south of the town of Rainier in southeastern Thurston County. Access is via Highway 507 out of Rainier, the Vail Loop Road, and private logging roads extending into the drainage.

Stream Description

From a point about a half-mile above Pipeline Creek (R.M. 31.0) the Deschutes River flows generally west-northwest for 12 miles, passing beneath the Rainier-Tenino Highway about 2.5 miles southwest of Rainier and Military Road immediately north of Lake McIntosh. Principal tributaries include Pipeline Creek, Lake Lawrence Outlet, Reichel Lake drainage, and one small unnamed spring feed stream (R.M. 20.9). Lake McIntosh does not provide a true surface connection with the Deschutes.

The Deschutes channel winds across a relatively broad, gently sloping valley floor through this section. The same is true with tributaries, except for the upper, steeper slope of Pipeline Creek and of one feeder tributary to the Reichel Lake drainage. The Deschutes skirts along the north rim of the valley bordered by mountainous terrain, and the steeper side slopes densely forested with mostly conifer timber. The valley floor has cleared farmland with intermittent stands of mixed deciduous and conifer growth. Aside from the small community of Vail, this section is developed mostly with rural-type residences and small summer home development along the river. Forested slopes on either side of the floor are managed principally for logging with numerous cleared sections, particularly over the upper drainage. Also, moderate to heavy recreation use is made of the area.

The Deschutes channel presents a moderate gradient through this section, with only occasional reaches showing steeper conditions. Stream widths range from 4 to 16 yards, averaging about 10 yards. A good pool-riffle balance exists and stream bank cover is generally dense, thus promoting exceptional rearing conditions through much of the area. The stream bottom is quite stable, comprised mainly of large rubble, with boulders and gravel interspersed across most riffles. Most pools are quite shallow and contain sand and fine gravel bottom material. Stream banks are generally quite low and stable and comprised of gently sloping gravel beaches with a few sharp earth cuts. Stream-side cover consists of moderate to dense stands or strips of deciduous trees and underbrush.

Salmon Utilization

This section of the Deschutes provides transportation for adult and juvenile salmon that utilize the upper drainage. Limited spawning area in this section is used largely by chinook and by some coho which also use the accessible tributaries. Juvenile chinook rear through the spring months in these waters with coho inhabiting the stream year around, particularly in stretches of dense stream-side cover.

Limiting Factors

Factors which limit salmon production in this section include low summer flows in the main channel as well as in the small feeder streams, stream bank clearing through logging or development projects, removal of streambed gravel, and poaching of adult salmon.

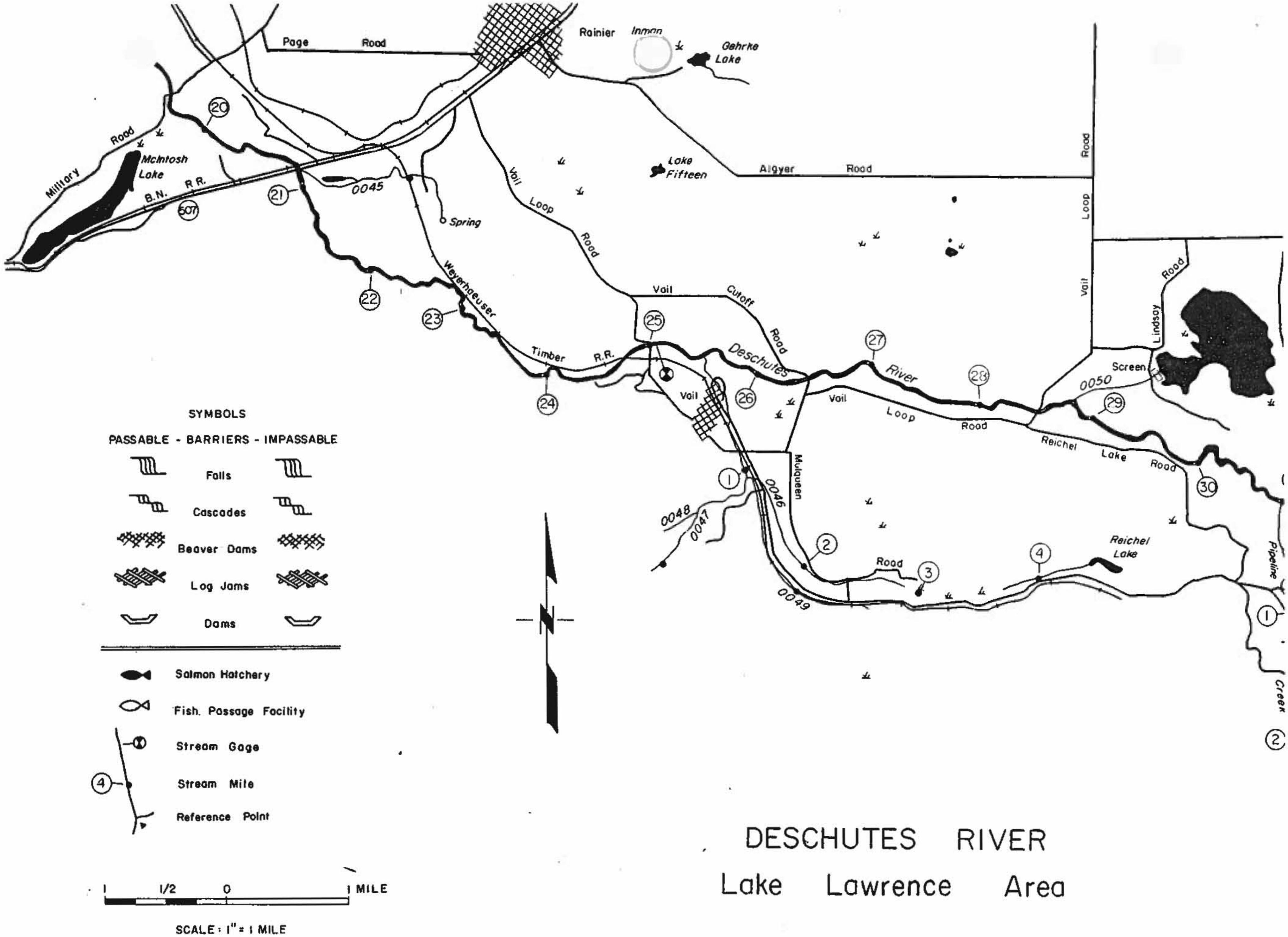
Beneficial Developments

No facilities or programs have been undertaken within this area to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production potential within this drainage section include preserving the existing stream bank cover, and curtailment of gravel removal projects. Logging plans and operations should be coordinated with Fisheries' needs to reduce the impact on the natural stream habitat.

PHOTO 13-12. Good pool riffle section in middle Deschutes River.



DESCHUTES RIVER

Lake Lawrence Area

DESCHUTES RIVER — LAKE LAWRENCE AREA
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River				Chin., Coho, (Chum)
0045	Unnamed	RB-20.85	1.6	—	Coho
0046	Unnamed	LB-25.5	4.5	—	Coho
0047	Unnamed	LB-1.1	1.1	—	Unknown
0049	Unnamed	LB-1.15	1.6	—	(Coho)
	Reichel Lake	Outlet-4.5	—	—	
0051	Pipeline Creek	LB-31.0	2.8	—	Coho
0052	Unnamed	RB-0.5	1.2	—	Coho
0053	Hull Creek	RB-0.9	2.0	—	(Coho)
	(Cont. Deschutes 403)				

DESCHUTES RIVER
Headwaters

This drainage section encompasses the entire upper Deschutes River including nearly 18 miles of mainstem, plus 21 tributaries adding nearly 92 stream miles. The area is located about six miles southwest of Alder Lake in eastern Thurston County. Access is available by private logging roads southeast of Rainier and the small community of Vail. The upper reaches of some tributaries, plus the upper main Deschutes, from just below Buck Creek, are within Snoqualmie National Forest.

Stream Description

From its mountain headwater southeast of Alder Lake, the Deschutes flows generally north for nearly seven miles to its major tributary, the Little Deschutes River (R.M. 42.5). From here it travels mainly west for more than six miles to the vicinity of Fall Creek (R.M. 35.3), then generally northwest toward Pipeline Creek (R.M. 31.0). In addition to the Little Deschutes River and Fall Creek, principal tributaries entering within this section include Lincoln, Thurston, Johnson, Huckleberry, and Mitchell creeks.

In this section, the Deschutes channel, as well as the majority of its tributaries, fall over mostly steep terrain with the streambeds confined by relatively narrow valleys. Adjacent slopes are quite steep and most are densely forested. Over the lower 3-4 miles of this section the Deschutes moves out onto a more gently sloping, wider valley floor. Here the adjacent hillsides are still densely forested, having mixed deciduous and conifer growth. Practically no development has taken place in the upper watershed, and only widely separated farms and a few recreational homes are located along the lower 5-6 miles.

The Deschutes River presents two slightly different environment types in this section. Above Deschutes Falls (R.M. 41.1), the gradient is moderately steep, in some sections presenting a series of short cascades. Stream widths range from 2 to 12 yards, averaging about seven yards. There are relatively high proportions of fast riffle and rapids sections. Pools, although somewhat scarce, are generally quite deep. The stream bottom is predominantly rubble and boulder with some lengthy sections of bedrock. Stream banks have moderate to dense conifer and deciduous growth, providing good to excellent cover for much of the area.

Below Deschutes Falls the channel gradient is mostly moderate, with only occasional rapid or cascade stretches. Stream widths range from 4 to over 17 yards, averaging near 10 yards. A good pool-riffle balance prevails, with most pools being quite deep and well shaded. The stream bottom is predominantly clean rubble and gravel, with only a few sections having a large proportion of boulders. Stream banks are mostly low and sharp cut, containing dense stands of mixed deciduous and conifer growth. The channel is well shaded and quite stable.

Virtually all tributaries entering the Deschutes in this section exhibit a swift-flowing character. Boulders and cascades predominate, with only the lower reaches of tributaries entering below Deschutes Falls offering relatively stable gravel and rubble bottoms, and fairly good pool-riffle conditions.

Salmon Utilization

Salmon use within this section is restricted to the mainstream river below Deschutes Falls, and to the lower reaches of tributaries entering just below the falls. The river receives scattered concentrations of chinook spawning, primarily in the lower 5 or 6 miles below Mitchell Creek. Some coho spawning takes place in the main channel up to the falls, as well as in the accessible portions of lower tributaries. Juvenile rearing occurs primarily in the main channel, and in those tributaries that maintain adequate summer flows. Juvenile chinook rear through the spring months, with coho inhabiting these waters year-round.

Limiting Factors

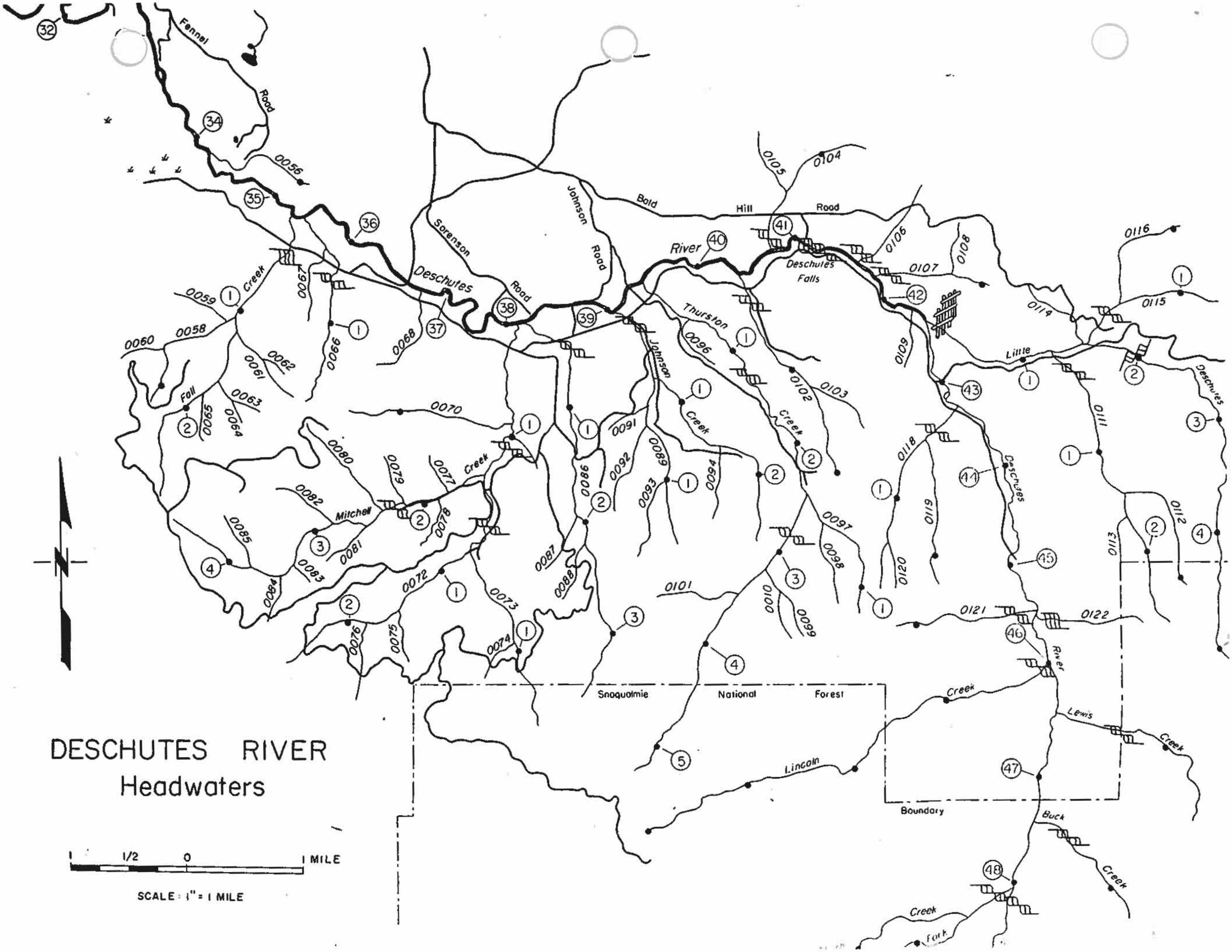
The principal factors limiting salmon production in this section include the total barrier at Deschutes Falls, and the occurrence of low summer flow conditions. Above Deschutes Falls additional cascades and falls, plus the general steep gradients, limit the salmon production potential. Clear-cut section logging and associated road building, along with occasional gravel removal operations, serve as further limitations to salmon production within this upper drainage.

Beneficial Developments

No other facilities, projects, or programs have been undertaken within this section to directly benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production potential of the upper Deschutes drainage include preserving existing streamnbank cover and curtailment of gravel removal and stream channel alterations. Replacement of stream-side cover along reaches already cleared would be highly desirable.



DESCHUTES RIVER
Headwaters

DESCHUTES RIVER — HEADWATERS
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River				Chin., Coho, (Chum)
0056	Unnamed	RB-34.2	1.1	—	Unknown
0057	Fall Creek	LB-35.3	2.9	—	Coho
0058	Unnamed	LB-1.1	1.2	—	None
0066	Unnamed	LB-35.4	1.7	—	Coho
0069	Mitchell Creek	LB-38.15	4.6	—	(Chin.), Coho
0070	Unnamed	LB-0.9	1.4	—	Unknown
0072	Unnamed	RB-1.4	2.8	—	None
0073	Unnamed	RB-0.75	1.7	—	None
0086	Unnamed (Huckleberry Cr.)	LB-38.2	3.6	—	(Chin.), Coho
0089	Johnson Creek	LB-39.1	2.6	—	(Coho)
0090	Unnamed	LB-0.7	1.7	—	None
0095	Thurston Creek	LB-39.4	5.3	—	(Chin.), Coho
0097	Unnamed	RB-2.5	1.2	—	None
0102	Unnamed	LB-40.4	2.0	—	(Coho)
0104	Unnamed	RB-40.7	1.4	—	Unknown
0107	Unnamed	RB-41.8	1.0	—	None
0110	Little Deschutes R.	RB-42.5	5.7	7.89	None
0111	Unnamed	LB-1.2	2.7	—	None
0112	Unnamed	RB-1.5	1.1	—	None
0115	Unnamed	RB-1.55	1.4	—	None
0116	Unnamed	RB-0.5	1.0	—	None
0117	Unnamed	RB-3.5	1.2	—	None
0118	Unnamed	LB-43.3	1.8	—	None
0119	Unnamed	RB-0.4	1.3	—	None
0121	Unnamed	LB-45.45	1.2	—	None
0123	Lincoln Creek	LB-46.0	4.0	—	None
0124	Lewis Creek	RB-46.5	1.7	—	None
0125	Buck Creek	RB-47.4	1.4	—	None
0126	W. Fk. Deschutes R.	LB-48.0	2.7	—	None
0127	Thorn Creek	LB-0.4	1.8	—	None
0128	Ware Creek	RB-48.6	1.0	—	None
0129	Hard Creek	RB-49.0	1.1	—	None
0130	Mine Creek	RB-49.6	1.1	—	None

This broad drainage description is presented as an orientation for the reader so that he can fully understand the relationship of the various salmon production areas to one another in southern Puget Sound. Numerous independent drainages enter the many bays and inlets that make up this drainage section. These confined inter-connecting passages offer ideal saltwater transition areas for juvenile salmon during the early portions of their life.

Stream Description

Streams in this area are all quite similar in regard to physical characteristics. They are typically less than 15 miles in total length, and generally head in low rolling foothills that are devoted to logging or Christmas tree farming. The lower areas of these streams usually have some agricultural or grazing lands and some moderate summer home or residential development. The physical characteristics of these streams generally include swampy or marshy lands in the headwaters and several have lakes in their upper areas. Most of these streams are accessible for anadromous fish use to points very near their headwaters. There are some notable exceptions to this, however, in both Kennedy and Perry creeks where impassable waterfalls block salmon use in major portions of their upstream areas.

All of the streams in this southern Puget Sound area have exceptional salmon production capabilities due to limited human development and land use practices that are compatible with fisheries resources. These various drainages, while providing suitable spawning and rearing areas for anadromous species, also contribute to the ecological makeup of estuarine and marine habitats at their confluence with salt water. These estuaries are of great importance, particularly to anadromous species, for they provide the critical transition zone for juvenile and adult fishes as they move from one environment to another. Inclosed marine waters of southern Puget Sound provide excellent rearing conditions for immature salmon.

Each of the specific drainage areas in southern Puget Sound is covered separately in individual stream reach discussions.

Salmon Utilization

Coho and chum salmon are the primary species produced in the numerous streams of southern Puget Sound. Coho usually spawn in the upstream sections of these drainages while the juveniles use all accessible areas for rearing. Spawning distribution of chum salmon is normally limited to the lower streams areas within several miles of tidewater. They do, however, extend their spawning distribution farther upstream during years of large escapement. Both return to virtually all southern Puget Sound streams where size and gradient afford access. Chinook and pink salmon occasionally occur in some of the larger drainages, and their distribution is generally limited to the lower stream reaches. For a more detailed assessment of salmon utilization and specific streams, refer to individual stream reach descriptions for Water Resource Inventory Area 14.

Limiting Factors

Two factors having the greatest limiting effect on anadromous fish production in the streams of this area would be low summer flows and illegal fishing for spawning salmon. Because of the type of drainages and relatively small stream sizes, little can be achieved to alleviate the low flow problems. Stream bank clearing has accentuated the flow problem by causing elevated water temperatures. In addition to these freshwater limiting factors there are several local marine areas that are experiencing a deterioration of water quality. The two major problem areas occur in the waters adjacent to the towns of Shelton and Olympia where rapid residential expansion and industrialization adversely affect the qualities of marine waters.

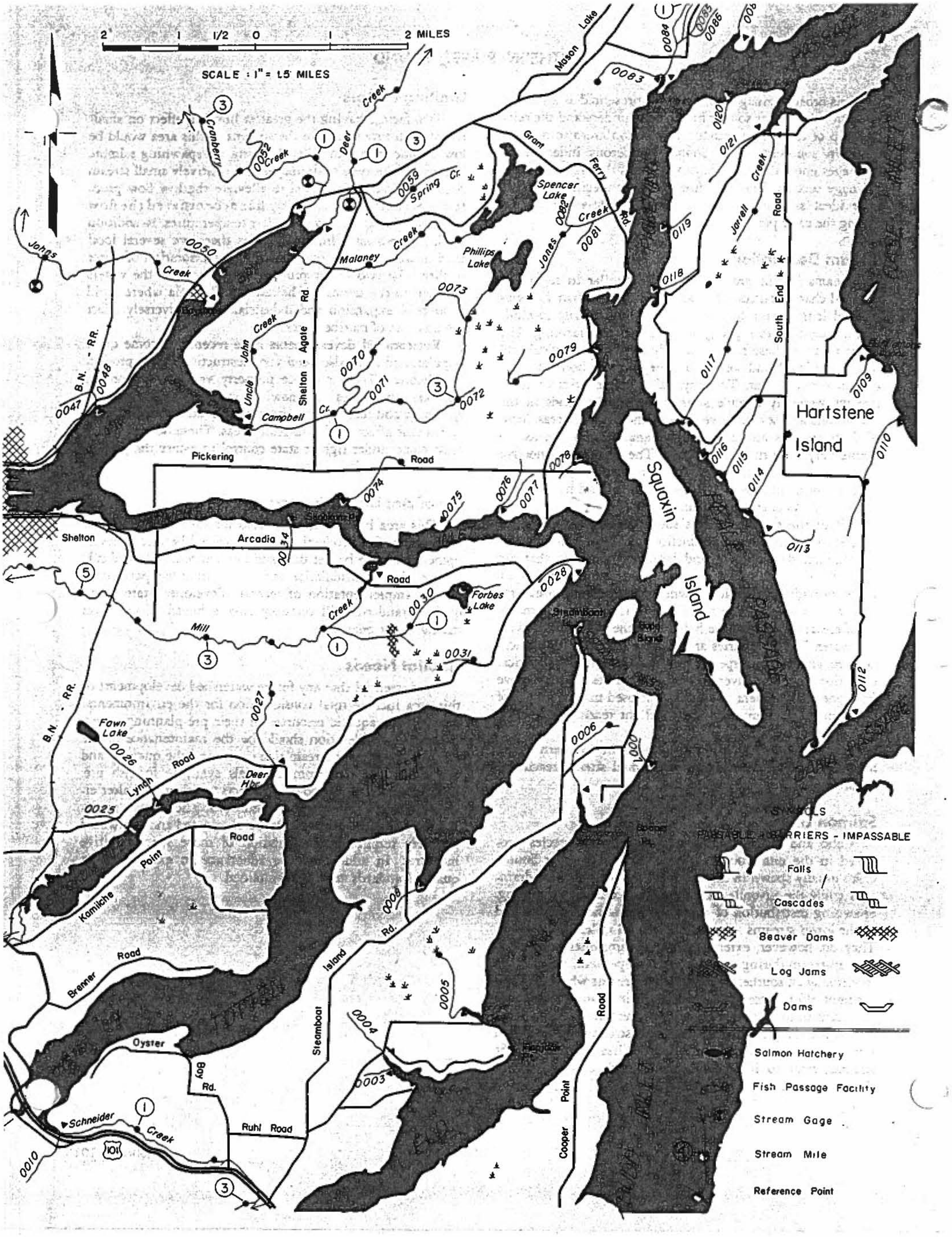
Recreational developments have recently become quite popular, and have also been very destructive to fish production habitat. These enhance property values by damming and creating lakes on flowing streams, but eliminate spawning and rearing area and cause elevated water temperatures that affect all downstream areas. These developments must come under tighter state control to assure the protection of the aquatic resource.

Beneficial Developments

This area has had limited need for projects to enhance anadromous fish production. Accomplished beneficial developments include beaver dam and log jam removal, road culvert repair, and installation and operation of fish passage facilities. Implementation of recently developed state water quality standards will certainly have a beneficial effect on marine water quality.

Habitat Needs

It is essential that any future watershed developments of this area include total consideration for the environmental needs of the aquatic resources in their pre-planning stages. Foremost consideration should be the maintenance of the amount and type of stream-side cover, and the quantity and quality of stream bottom materials available for fish use. Strict controls should govern projects which would alter either of these environmental conditions. The human predation on spawning salmon must be eliminated and this would probably require implementation of more strict punitive measures. In addition, close adherence to existing water quality standards must be maintained.



2 1 1/2 0 1 2 MILES
SCALE : 1" = 1.5 MILES
Mason Lake
Cranberry
0052 Creek
Deer Creek
0059 Spring Cr.
Grant
Ferry Rd.
Spencer Lake
0082
Jones Creek
0081
0083
0084
0086
0120
0121
Jarrell Creek
0119
Road
0118
South End
0117
0109
Hartstene Island
0110
0116
0115
0114
0113
0112
Johns Creek
0050
Malaney Creek
Phillips Lake
0073
John Creek
Uncle
Shelton - Agate Rd
0070
0071
0072
0079
B.N. - R.R.
0048
0047
Campbell Cr.
Pickering Road
0078
0074
0075
0076
0077
Squaxin Island
Shelton
Arcadia Road
0034
0028
Steamboat
Forbes Lake
0030 Creek
Mill
0031
0027
B.N. - R.R.
Fawn Lake
0026
Lynch Road
Deer Hbr.
0025
0006
0007
Road
Kamilche Point
0008
Steamboat Island Rd.
Brenner Road
0005
Oyster Bay Rd.
0004
0003
Road
Cooper Point
Schneider Creek
Ruhl Road
101
0010
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point

SOUTHERN PUGET SOUND
Shelton Basin — WRIA 14

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Perry Creek (See Shelton 203)	Sec13,T18N,R2W	4.5	—	Coho, Chum
0005	Unnamed	Sec19,T19N,R2W	1.0	—	Unknown
0006	Unnamed	Sec4,T19N,R2W	1.2	—	Unknown
0009	Schneider Creek (See Shelton 203)	Sec32,T19N,R2W	5.3	—	Coho, Chum
0012	Kennedy Creek (See Shelton 203)	Sec32,T19N,R2W	9.6	—	(Chin.), Coho, Chum
0020	Skookum Creek (See Shelton 203)	Sec17,T19N,R3W	9.0	—	(Chin.), Coho, Chum
0026	Unnamed (See Shelton 303)	Sec10,T19N,R3W	1.0	—	Unknown
0027	Unnamed (See Shelton 303)	Sec2,T19N,R3W	1.2	—	Unknown
0029	Mill Creek (See Shelton 303)	Sec25,T20N,R2W	16.0	—	(Chin.), Coho, Chum
0035	Goldsborough Creek (See Shelton 403)	Sec20,T20N,R3W	14.0	—	Chin.,Coho,Chum
0044	Shelton Creek (See Shelton 303)	Sec20,T20N,R3W	2.6	—	Coho, Chum
0049	Johns Creek (See Shelton 503)	Sec3,T20N,R3W	8.3	—	(Chin.), Coho, Chum
0051	Cranberry Creek (See Shelton 503)	Sec35,T21N,R3W	9.4	—	(Chin.), Coho, Chum
0057	Deer Creek (See Shelton 503)	Sec36,T21N,R3W	8.5	—	(Chin.) Coho, Chum
0067	Malaney Creek (See Shelton 503)	Sec2,T20N,R3W	2.9	—	Coho, Chum
0068	Uncle John Creek (See Shelton 503)	Sec14,T20N,R3W	1.9	—	Coho, (Chum)
0069	Campbell Creek (See Shelton 503)	Sec14,T20N,R3W	4.5	—	Coho, (Chum)
0074	Unnamed	Sec24,T20N,R3W	1.05	—	Unknown

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0079	Unnamed	Sec9,T20N,R2W	1.45	—	Unknown
0080	Jones Creek	Sec33,T21N,R2W	1.8	—	(Coho), (Chum)
0083	Unnamed	Sec22,T21N,R2W	1.0	—	Unknown
0084	Unnamed	Sec22,T21N,R2W	1.5	—	Unknown
	Unnamed Lake	Outlet-1.5			
0087	Unnamed	Sec23,T21N,R2W	1.8	—	Unknown
0088	Unnamed	RB-0.6	1.0	—	Unknown
0093	Unnamed	Sec32,T22N,R1W	1.0	—	Unknown
	(See Shelton 603)				
0094	Sherwood Creek	Sec20,T22N,R1W	18.3	—	Chin., Coho, Chum
	(See Shelton 603)				
	HARTSTENE ISLAND [1]				
0110	Unnamed	Sec18,T20N,R1W	1.6	—	Unknown
0114	Unnamed	Sec23,T20N,R2W	1.05	—	Unknown
0115	Unnamed	Sec14,T20N,R2W	1.6	—	Unknown
0117	Unnamed	Sec15,T20N,R2W	1.45	—	Unknown
0122	Jarrell Creek	Sec26,T21N,R2W	1.4	—	Unknown

[1] *Tributaries to Puget Sound listed clockwise around Island beginning at northernmost point (Dougall Point).*

Appendix B

Quality Assurance Information Report Form

Please see cover letter for instructions. Answer as many of these questions as you can. This is not a test, and not all questions need to be answered affirmatively or in a certain way for a dataset to be included in the model. The Water Type Committee will review the information on a dataset-by-dataset basis.

A) Who collected the data?

1) Agency or company. Include address:

Washington Trout
PO Box 402
Duvall, Washington 98019

2) Principal investigator. Name, professional address, and short paragraph of qualifications and background.

__Steve Conroy - Please B-1 in Appendix B.

3) Field survey crews. Names, short paragraph of qualifications and training in last fish or last habitat field methodologies. Attach additional pages if necessary.

Please see B-1 in Appendix B.

B) When and Where was the data collected?

1) Year in which the data was collected. Please use one year per dataset.

1997 - Pre-emergency Protocal

2) Months in which the data were collected.

January, March, April, July

Was the data collected in the sampling protocol window (March 15 through July 15)? ~28% were collected in the sampling window.

ii) How would you characterize stream flow during the sampling period? (I.e., Higher than average flow conditions, Average, lower than average or mixed)

Please see B-2 in Appendix B

3) What basins is the data from? (Use names, and WRIA codes).

Snoqualmie	- 070219
Puyallup (So. Prairie)	- 100429
Puyallup (White River)	- 100031
Nisqually (Mashel)	- 110101
Deschutes	- 130028
Chelhalis (Black river)	- 230649
Columbia	- ?

4) Describe the sampling area (basins, watersheds, ownerships, tribal U&As) in as much detail as possible.

Please see B-3 in Appendix B.

C) Sampling Objectives and Design.

1) Was this data collection effort exclusively for the purpose of collecting last fish or last habitat data? No.

If YES, what was the sampling design?

i) Complete sampling of watersheds, or basins?

ii) Complete or partial ownership sampling? ....

iii) Random sampling? .....

iv) Other? (Explain with attachment)...............

2) Was this data collection effort part of a last fish assessment associated with an FPA or prospective timber harvest site? No, although water typing was done in collaboration with the timber industry on streams in So. Prairie. Additionally, some streams were typed

by request from Weyerhauser for validation.

If YES:
i) Did sampling extend beyond the boundary of the harvest site as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

ii) Did sampling consistently extend beyond the ownership boundary as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

If you answer 'no' to either question above, do not submit dataset.

3) Was sampling incidental to other research or assessment objectives? Yes

If YES:
i) Were there aspects of the sampling design that would be considered non-random or potentially biased for the purposes of last fish or last habitat determination? Please specify at end of questionaire. Yes, Type 3/4 breaks were targeted in some basins. In addition, the pre-emergency protocal could be biased against Last Habitat Locations as gradient breaks were set at 12%.

ii) Did sampling target a specific species, elevation, ownership, etc.?
Sampling did not target specific ownership, however, wateryping locations were occasionally governed by grants.

D) What Field Methodology was Used?

1) Which field sampling protocol was used?

Forest Practice Board Manual Protocal (Pre-emergency ruling) was utilized with the following modifications: 1) streams were not methodically surveyed beyound the break for a minimum of 12 pools or ¼ mile 2) Although Washington Trout crews typically utilize electroshockers in determining fish presence, visual determination of presence are also made without using electroshockers.

In addition, a 16% gradient break was utilized for physical criterea under verbal request from the Department of Natural Resources after fish were found consistently beyond a 12% gradient break. Furthermore, breaks were made above 16% if warranted by fish presence.

2) What field equipment was used to validate fish present or absence? Electroshocker? Snorkeling? Night-time snorkeling? Other?

Electroshocker, Visual identification, or visual, followed by Electroshocking in the absence of visual confirmation.

3) Was sampling for fish systematically carried a full 0.25 miles above the last fish or last habitat?

No

If you answer 'no', do not submit dataset.

4) How was the last fish or last habitat location marked in the field, i.e., monumented for future reference? Describe the appearance of the monuments, and where they were place. Last fish points were not routinely marked; when points were marked they were labeled with flagging, noting last fish. Occasionally, date, organization, and surveyors names were also noted on last fish flagging. Break points were marked with one Aluminum tag and flagging placed on a tree on both sides of the stream, Water Type Breaks, Date, Organization, and Surveyors names were noted on the flagging, only water type breaks were noted on the tags.

5) Were channels subjected to mass wasting in the past decade excluded from sampling or identified in the field data? If they were identified, how were they identified?

Channels subjected to mass wasting were not excluded from the sampling, however, Mass wasting is addressed in the field form and Last Fish/Last Habitat points within these drainages could be easily eliminated. It is possible that some drainages whose geomorphology has been changed over time may have been missed during the survey process.

6) In situations where surface flows ended, did samplers make a determination as to whether there was a break in channel gradient or other feature (headwater lake or wetland) that would cause surface flow to re-emerge up-stream?

Yes

7) In situations where last fish was determined to be below a culvert, how was this information recorded?

Culvert barriers were noted on the field form and in the database.

Where these situations discarded from the dataset?

No

Were these situations uniquely coded so that these data points could be easily pulled out of the dataset? Although these situations are not uniquely coded, this data can easily be pulled out of the dataset.

Was the last habitat protocol applied above the culvert? Yes

E) Validation of Field Data.

1) Has the any of the data in this dataset been subjected to replicate sampling or verification, either within the same year or in a different year? If the replicate sample is in a different dataset, describe the location of this dataset. (Replicate sampling is not a requirement for dataset consideration.)

YES or NO__X__Yes______

If yes, please explain how the duplicate samples can be found in the dataset, or where to find the replicate dataset if they are not included in this dataset.

Replicate samples where not systematically duplicated, however, occasional duplication occurred while conducting culvert assessments or upon request. The replicate dataset is attached or following the original dataset on the raw data forms.

If yes, Did comparisons with the replicate dataset raise any concerns? Please explain.

___Yes, as expected, habitat boundaries were extended on systems revisited after the emergency ruling was implemented. In addition, occasionally a last fish point was extending further up the system.

F) Data Management.

1) Attach sample of field data sheet.

2) Where is the raw (paper copy) data or paper map being kept?

At the Washington Trout Office

3) In what structure is the electronic data being kept (spreadsheet, tabular database, GIS)? Describe the software, including the version of the software. If none, write "none'.

Microsoft Access 2000 Table.

4) Attach details of data fields and data codes used in the electronic database.

DETAILED ITEM DEFINITION AND CODE EXPLANATION

ITEM: Twp

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION: TOWNSHIP AND RANGE THE POINT IS IN. EXAMPLES: T15R05W; T04R15E (NOTE: THE USE OF "N" (NORTH) IS NOT NECESSARY. THIS FORMAT COMPLIES WITH DNR DATA STANDARD FOR TOWNSHIP/RANGE). IF THE TOWNSHIP IS A "HALF TOWNSHIP, THEN PLACE THE "5" ON THE END (E.G., T39R41E5)

ITEM: Sect

FORMAT: TYPE: CHARACTER; LENGTH 2

DESCRIPTION:
THE TOWNSHIP SECTION THAT THE POINT IS IN. EXAMPLES: 05, 01, 15, 32.
(NOTE: PLEASE ADD THE ZERO (0) BEFORE A ONE DIGIT NUMBER).

ITEM: Survey_no

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION:
UNIQUE CODE FOR A PARTICULAR SURVEY OR HYDRO UPDATE MAP.
(EXAMPLES: HU12, SW23, WT23).

ITEM: Pt_id

FORMAT: TYPE: NUMERICAL, LENGTH 4

DESCRIPTION: USER-DEFINED POINT IDENTIFICATION NUMBER; WE SUGGEST THAT THE USER NUMBER THE POINTS INCREMENTALLY WITHIN A SPECIFIC SURVEY, SURVEY FORM OR HYDRO UPATE FORM.

ITEMS: SPONSOR

FORMAT: TYPE: CHARACTER, LENGTH: 16

DESCRIPTION: THE NAME OF AGENCY, GROUP, TRIBE OR COMPANY THAT IS CONDUCTING THE SURVEY. (EXAMPLES: WEYCO; DNR; WATROUT; WF&W; ETC.)

ITEMS: Date

FORMAT: TYPE: DATE: YYYYMMDD, LENGTH: 8

DESCRIPTION: DATE THE SURVEY WAS CONDUCTED.

Note: spreadsheets and info may use a different date format.
Please check and make sure any arcview conversions conform to above format.

THE FOLLOWING ITEMS (FIELDS) HAVE CODES AND CODE DESCRIPTIONS

ITEM: Protocol

FORMAT: TYPE: CHARACTER, LENGTH 4

DESCRIPTION: PROTOCOL OF FISH SURVEY

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID
PRE	PRE-EMERGENCY RULE PROTOCOLS
UNK	UNKNOWN

ITEM: Pt_type

FORMAT: TYPE: CHARACTER, LENGTH: 4

DESCRIPTION: THE TYPE OF POINT REPRESENTED UNDER THE SPECIFIED PROTOCOL.

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID

ITEM: Bnd_type

FORMAT: TYPE: CHARACTER, LENGTH: 2

DESCRIPTION: PHYSICAL PLACEMENT OF POINT (NEEDED FOR MODELING PURPOSES).

CODE	CODE DESCRIPTION
A	MID-CHANNEL END OF HABITAT
B	CONFLUENCE POINT (NON-FISH-BEARING STREAM LATERALLHY INTERSECTING A FISH-BEARING STREAM)
C	TRIBUTARY JUNCTION (TWO OR MORE NON FISH-BEARING STREAMS JOIN TO FORM A FISH-BEARING STREAM

ITEM: End_type
TITLE: END TYPE OF FISH POINT

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: THE REASON FOR THE PLACEMENT OF END POINT.

CODE CODE DESCRIPTION

1	NATURAL END (BND_TYPE B,C OR SIZE RELATED, (WIDTH/BASIN SIZE)
2	GRADIENT RELATED (e.g., WATER FALLS)
3	LARGE WOODY DEBRIS (LWD)
4	ROAD CULVERT
5	MASS WASTING EVENT (LANDSLIDE)
6	BEAVER DAM or other NON-PERMANENT DAM
7	OTHER DAM (PERMANENT)
8	WATER QUALITY LIMITER
9	NONE
10	UNKNOWN

ITEM: Det_met

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: METHOD USED TO DETECT POINT

CODE	CODE DESCRIPTION
1	ELECTRO-SHOCKING
2	DAY SNORKELING
3	NIGHT SNORKELING
4	VISUAL OBSERVATION

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION5)

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION

5) Where is the electronic copy being kept?

On Washington Trout's Document Server.

Curriculum Vitae

Stephen C. Conroy, Ph.D

Address: 10624 165th St.
Renton WA 98055

Telephone: (425) 277 7868 (home)
(425) 788 1167 (work)

email: watrout@eskimo.com

Undergraduate Degree: B.Sc. with Honours, 1980. University of Aberdeen, Scotland, U.K. Major: Biochemistry

Graduate Degree: Ph.D. 1984. University of Aberdeen, Scotland, U.K. Field of study: Enzymology

Employment History:

University of Aberdeen, Scotland, U.K.	Research Assistant.	1980-1984
University of Colorado, Denver, CO.	Research Fellow.	1984-1985
Case Western Reserve University, Cleveland, OH.	Research Associate.	1985-1987
University of Washington, Seattle, WA.	Senior Fellow.	1987-1992
Fred Hutchinson Cancer Research Center, Seattle, WA.	Staff Scientist.	1992-1995
Washington Trout, Duvall WA.	Science/Research Director	1996-present

Editorial Positions

Manuscript reviewer, "The Journal of Biological Chemistry" 1985-1987.
Manuscript reviewer, "Biochemistry" 1987-1994.
Manuscript reviewer, "Washington Trout Report" 1996-present

Grant Awards

Weiss Creek Restoration and Deer Creek Stream Typing. $300,000 from Washington Jobs For The Environment Program (JFE 9809)

North Fork Stillaguamish Engineered Log Jam Project. $160, 127 from Washington Department of Fish & Wildlife.

Griffin Creek Restoration. $49,600 from National Fish and Wildlife Foundation.

Skykomish Culvert Inventory & Analysis. $44,500 from Washington Department of Transportation.

Weiss Creek Demonstration Project. $40,000 from Snohomish Watershed Basin Work Group.

Salmonid habitat identification/stream typing project. $33,200 from King County Water Quality Block Grant.

Stream Typing and Culvert Analysis. $30,000 from the Bullitt Foundation.

Stream Typing and Culvert Analysis. $10,000 from the General Services Foundation.

Stream Typing and Culvert Analysis. $10,000 from the Horizons Foundation.

Stream Typing and Culvert Analysis. $5,000 from The Trout and Salmon Foundation.

Cherry Creek Riparian Restoration. $3,000 from Stilly-Snohomish Regional Fisheries Enhancement Group.

Tolt steelhead molecular genetics project. $250 from Puget Sound Flyfishers

Tolt summer steelhead monitoring project. $250 from Puget Sound Flyfishers

Typical Responsibilities

Supervised up to eight field biologists performing stream typing across the Western Cascades and in the Lower Columbia. Obtained grants and contracts for stream typing and in-stream restoration projects, published technical reports, supervised budgetary requirements, participated in TFW technical committees. Taught stream typing courses to TFW partners and consultants. Participated in snorkel surveys and electrofishing surveys. Experienced in non-lethal tissue sampling from fish for DNA analysis.
Coordinated culvert inventory and analysis projects, analyzed data, maintained databases and prioritized projects for restoration. Participated in formal training courses regarding culvert assessments and helped refine class materials and content.
Project manager for in-stream restoration in Weiss Creek and Griffin Creek. Projects involve permit acquisition, channel construction, LWD placement, riparian planting and fencing, and public outreach and education. Delivered oral and written reports to grantors and agencies.

Published Essays (Fisheries/Ecology)

Conroy, S.C. "Genetic Diversity in *Salmonidae*" The Osprey, 12: 5 (1991).

Conroy, S.C. Habitat Lost and Found; Part 1. Washington Trout Report (1996)

Conroy, S.C. Molecular Biology Comes to the Tolt. Washington Trout Report (1996)

Conroy, S.C. Habitat Lost and Found; Part 2. Washington Trout Report (1997)

Conroy, S.C. Stream Typing. Northwest Fishing Holes, (1996)

Conroy, S.C. Atlantic Salmon; Friend or Foe? Northwest Fishing Holes, (1997)

Conroy, S.C. Genetic Diversity in Salmon. Washington Wildlife Magazine, volume I, number II, 1997

Conroy, S.C. Habitat Identification and Development: The Need For Streamside Buffer Zones. Washington Trout Technical Report TR-98-1 (1998).

Scientific Publications (Peer Reviewed)

Conroy, S.C.; Adams, B.; Pain, R.H.; Fothergill, L.A. "3-Phosphoglycerate Kinase Purified by Affinity Elution has Tightly Bound 3-Phosphoglycerate." FEBS Letts. 128 353-355 (1981).

Dobson, M.J.; Tuite, M.F.; Roberts, N.A.; Kingsman, A.J.; Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A. "Conservation of High Efficiency Promoter Sites in *Saccharomyces cerevissiae*." Nucleic Acids Research 10 2625-2637 (1982).

Watson, H.C.; Walker, N.; Shaw, P.J.; Bryant, T.N.; Wendell, P.; Fothergill, L.A.; Perkins, R.E.; Conroy, S.C.; Dobson, M.J.; Tuite, M.F.; Kingsman, A.J.; Kingsman, S.M. "Sequence and Structure of Yeast 3-Phosphoglycerate Kinase." EMBO 1 1635-1640 (1982)

Conroy, S.C. "Sequence, Structure and Activity of Yeast 3-Phosphoglycerate Kinase" Ph.D Thesis, University of Aberdeen, Scotland, U.K. (1983).

Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A.; Tuite, M.F.; Dobson, M.J.; Kingsman, S.M.; Kingsman, A.J. "The Complete Amino Acid Sequence of Yeast 3-Phosphoglycerate Kinase" Biochemical J. 211 199-218 (1983).

Conroy, S.C.; Dever, T.E.; Owens, C.L.; and Merrick, W.C. "Characterization of the 46,000-Dalton Subunit of eIF-4F." Arch. Biochem. Biophys. 282 363-371 (1990)

Merrick, W.C.; Dever, T.E.; Kinzy, T.G.; Conroy, S.C.; Cavallius, J.; Owens, C.L. "Characterization of Protein Synthesis Factors from Rabbit Reticuloctyes." Biochimica et Biophysica Acta 1050 235-240 (1990).

Hagen, F.S.; Arguelles, C.; Sui, L.; Zhang, W.; Seidel, P.R.; Conroy, S.C.; Petra, P.H. "Construction of a Full-Length cDNA for the Sex Steroid Binding Protein of Human Plasma or Androgen Binding Protein of Human Testis (SBP/ABP or SHBG/ABP). Expression and Preliminary Characterization of the Recombinant Protein." FEBS Letts. 299 23-27 (1992).

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Conroy, S.C., Morales, T.H., Stuart, K. "Partial Purification and Characterization of a Terminal Uridyl Transferase from *Leishmania tarantolae*." Manuscript in preparation.

Bonin, L, Tedford, K., Perez-Reyes, N., McDougall, J.K. & Conroy, S.C. "Gene expression in extended life-span human smooth muscle cells derived from atherosclerotic plaque." In press.

Contributed Papers

Conroy, S.C. "Binding of Substrate to 3-Phosphoglycerate Kinase." Scottish Protein Society, Aberdeen, Scotland. 1982.

Conroy,S.C. "Sequence, structure and Activity of 3-Phosphoglycerate Kinase" Scottish Protein Society, Stirling, Scotland. 1983.

Merrick, W.C.; Conroy, S.C.; Dever, T.E.; Brabanec, A.M.; and Owens, C.L. "Protein Synthesis Factors That Interact With RNA And Nucleotides." FASEB J 1988, Washington, D.C.

Perez-Reyes, N., Conroy, S.C., Halpert, C.L., Smith, P.P., Benditt, E.P., McDougall, J.K. "Immortalization of Primary Human Smooth Muscle Cells." FASEB J 6:A1032, 1992.

Conroy, S.C., Hart, C.E., Perez-Reyes, N., McDougall, J.K. "Phenotypic Characterization of Immortalized Vascular Smooth Muscle Cells." FASEB J 7:A758, 1993.

Scatena, M., Conroy, S.C., Tedford, K. & McDougall, J.K. "Increased ubiquitin expression in human atherosclerotic plaque-derived smooth muscle cells." FASEB J. 1996.

Conroy, S.C. "Habitat Lost and Found" 1st Annual Wildlife Congress. Washington Department of Fish and Wildlife. January 1997.

Mary Lou White
2905 Birchwood
Bellingham, WA 98225
(360) 671-8839

Experience:

1994-Present

Field Biologist/Project Manager
Washington Trout • Duvall, Washington

- Crew leader and field biologist for fish habitat assessments, stream typing, scientific data collection, culvert assessments, riparian planting and monitoring, 1994-present.

- Project manager for culvert replacement, stream channel restoration, road abandonment, and riparian revegetation grant projects completed in 1996 & 1997; combined worth of grants over $500,000. Supervised 30 people, including five contractors working simultaneously on six road abandonment and three restoration projects.

- Additional responsibilities include the following: (1) documenting and entering data; (2) preparing contracts; (3) obtaining permits; (4) writing quarterly and final reports; (5) instructing restoration and culvert assessment workshops.

1992-Present

Owner/Hydrologic Technician & Environmental Consultant • Bellingham, Washington

Representative clients: Washington Trout, Water Resource Consulting, Puget Power, Joanne Greenberg (N-SEA).

Assist hydrologic consultants in gathering, documenting and presenting information for impending watershed projects.

- Determine flow line estimates for application in determining time-of concentration.

- Research private landowner water rights.

- Using S.C.S. method, time-of-concentration and curve number assignments, calculate runoff flow from an urban watershed.

- Utilize aerial photos to determine land use activities.

- Measure lateral movement of channels based on aerial photo interpretation.

- Planimeter or digitize basins and sub-basins.

- Use maps, Quattro Pro, Excel, WordPerfect, Microsoft Word, or R-base, to document data or assemble reports.

- Conducted Wellhead Protection Program for Everson, WA.

1991-1992 • **Fisheries Technician** • Center for Streamside Studies • University of Washington, Seattle, Washington.

- Timber/Fish/Wildlife ambient monitoring; collected data on stream discharge, bankfull width and depth, gradient, fish habitat, mass wasting, valley bottom and riparian characteristics.
- Established photo points for long-term monitoring of stream channel changes.
- Used scantron for data documentation.

1989-1990 **Hydrologic Technician** • U.S.F.S. Mount Baker Ranger District • Sedro Woolley, WA.

- Assisted in layout and preparation of watershed/fisheries habitat improvement projects; monitored completed projects by recording graphics and establishing photo points.
- Created a stream file monitoring guide.
- Assisted in spotted owl surveys.

1984-1989 **Forestry Technician** • U.S.F.S. Fernan Ranger District • Coeur d'Alene, Idaho.

- Project supervisor - Fish habitat improvement structure installations; watershed inventories; coring and embeddedness surveys.
- Inventoried system and non-system roads; updated drainage map with culvert and road erosion site locations; documented problems and prescribed solutions.
- Arranged and assembled district watershed atlas for 62 stream drainages.
- Collected water samples and stream flow measurements; electrofished and snorkeled.
- Created a Future Fish Habitat Improvement Guide.
- Conducted field studies and documented data for fish habitat, elk browse, piliated woodpecker range management and watershed inventories.
- Assembled historical information for G.I.S. input.
- Served on initial attack crew for wild fire suppression.

Skills:

- **Computer**: Microsoft Word, WordPerfect, Excel, Quattro Pro and Quicken.
- **Habitat Assessments**: All modules of TFW methodology, or Hankin & Reeves. TFW quality assurance qualified.
- **Stream typing**: DNR certified.
- **Surveying**: Stream profiles (longitudinal or cross section), culvert assessments, or road abandonment.
- **Aerial Photo Interpretation.**
- **Equipment**: Compass, clinometer, planimeter, McNeil sampler, electroshocker, increment borer, flow meter.

Training:

- Timber Fish Wildlife Ambient Monitoring Workshops 1994-97
- Stream Typing Emergency Ruling workshop, DNR 1997
- 319 Grant Request Workshop, 1997
- Culvert College, Washington Trout, 1995
- CPR, 1993, 1994
- Effective management, U.S.F.S. 1988
- Defensive Driving - U.S.F.S. 1984-89
- Baci to Basics - Compass & First Aid Training, 1989
- Fire Suppression & Saw Training, 1984, 1985.

Awards:

- Recognized for significant contribution to the success of the Mt. Baker Ranger District Fisheries & Watershed Program during the 1989 field season.
- Awarded Certificate of Merit and Cash Award for extra effort and positive attitude in data base input and maintenance of fisheries, habitat database on Fernan District and for outstanding effort and high quality road condition inventories and work on the watershed road inventory database.

Education:

June 1994	**Bachelor of Science** Western Washington Univeristy, Bellingham, WA Major: Watershed Studies; Minor: Biology.
May 1979	**Associate of Arts** Lincoln Land Community College, Springfield, IL.
	Relevant courses: Water resources, soils, stream ecology, hydrology, water quality, fluvial geomorphology, ichthyology, watershed management, limnology, entomology, botany, biometrics and biology.

References:

Kurt Beardslee, Executive Director
Washington Trout, Duvall, WA (425) 788-1167

Steve Conroy, Ph.D. Science/Research Director
Washington Trout, Duvall, WA (425) 78-1167

Karen F. Welch, M.S., or Peter Willing, Ph.D., Hydrologist
Water Resource Consultants
1903 Broadway, Bellingham, WA (360) 734-1445

Robin Sanders, Hydrologist
Olympic National Forest, 1835 Black Lake Blvd. SW, Olympia, WA (360) 956-2433

Ed Lider, Fisheries Biologist
Fernan Ranger District, Coeur d'Alene, Idaho (208) 752-1221, 664-2318

Caroline Hidy, Fisheries Biologist
2695 Highway 200, Box 212
Trout Creek, MT 59874, (406) 599-2714.

David Crabb
17425 Turtle Lane
Bow, WA 98232
phone: (360) 724-4902

Education:	Master of Science in Geography with Planning Western Washington University, Bellingham, Washington 1985.
	Secondary Teacher Certification (Social Studies) Western Washington University, 1982
	Fifth Year History, San Diego State University, San Diego CA, 1973
	Bachelor of Arts in History, Grove City College, Grove City PA, 1971
Teaching Experience	Graduate Teaching Assistant in Physical and Human Geography, Western Washington University, Bellingham, WA 1984-1985
	Substitute Teacher grades 7-12 in Sedro-Wooley, Burlington-Edison, Mt. Vernon and Arlington school districts 1982-83
Work History	1994-present: Washington Trout, Cuvall, WA. Watershed analysis water typing, fish habitat restoration, riparian protection and revegetation.
	1976-present: Forest Contractor, providing tree planting and inventory survey skills for reforestation, forest management plans.
	1977-1978: Scott Paper Company, Hamilton, WA . Reforestation, pre-commercial thinning.
	1974: Whatcom Falls Park Fish Hatchery, Bellingham, WA. Hatchery maintenance, landscaping and rockeries.
Skills	All aspects of reforestation, crew leadeership and training, culvert analysis, stream typing, rockeries.

Training	Culvert assessment, water typing methodology, electrofishing, habitat surveying, spawning surveys, riparian revegetation, salmonid identification.
Personal Data	Born 1949, married, two children, health excellent, take pleasure in all family-oriented activities, especially backpacking and camping, gardening and basketball. Interested in reading and stewardship of the environment.

Bill McMillan

Perhaps best known as an author and master of fishing for steelhead trout using dry lines, Bill McMillan has devoted the greater part of a lifetime to fishing Northwestern rivers and sharing the enchantment of the experience through the written word and public speaking.

McMillan has authored numerous articles in *Salmon Trout Steelheader* magazine, *Wild Steelhead and Atlantic Salmon* magazine, and many others. His book *Dry Line Steelhead* has been described as "a graduate course in steelhead fly fishing." Most recently, McMillan spent two seasons on Russia's Kamchatka Peninsula as resident camp director for the joint Russian/American scientific expedition coordinated by the Wild Salmon Foundation.

For 40 years, McMillan's attention has been focused on the plight of wild salmonids, particularly regarding competition with hatchery-raised fish and the decline of their habitat's quality and availability. Concerns he raised decades ago regarding threats to wild salmonids have all been substantiated and vindicated. His extensive and precise field journals have filled a gap in statistics that the Washington State Department of Fish & Wildlife never kept, and he is widely quoted in academic fisheries papers.

An internationally esteemed author on conservation, fish, flyfishing and nature topics, he served on the Gifford Pinchot Forest's Spotted Owl Citizen's Advisory Board from 1989-1990 and on the Washington Department of Wildlife's Fishery Policy Task Force from 1990-1993.

McMillan, a founding board member and past President who has served on Washington Trout's board for all but two years, studied fisheries, English and philosophy at Clark College, University of Washington, Portland State and Central Washington. He co-founded the Clark-Skamania Flyfishers in 1975 and initiated spawning surveys in 1979 and snorkel surveys in 1983 on several rivers in Southwest Washington. An early and ardent conservationist, he has spent a lifetime advocating for the wild fish.

JOHN E. MEANS
2710 114th Way S.W.
Olympia, Washington 98512

RESUME OF QUALIFICATIONS

(206)-956-9103

OBJECTIVE — WATERSHED ANALYSIS TECHNICIAN

EDUCATION:

CULVERT ANALYSIS TRAINING
Washington Trout, Duvall , WA 1994

COLLEGE COURSE WORK
South Sound Commmunity College
Olympia, WA 1994

Everett Community College, Everett , WA 1983

HIGH SCHOOL
Juanita High School, Kirkland, WA 1977

EXPERIENCE:....

- Field Service, research and data collection,
- Computer applications and hardware support
- Installation management, procurement, layout
- Provide liaison between customers and company, follow up, solve problems and ensure customer satisfaction. Customer training and support.
- Performance of a wide variety of mechanical electrical and construction skills.

EMPLOYMENT HISTORY

June 1988 to present

Washington State Dept of Fisheries.
Wild Salmon Production and Survival Evaluation Program.
This program has measured wild coho smolt production, harvest and escapement through trapping and coded wire tagging of juveniles in various river systems. During the 1993 and 1994 coho smolt migration periods I was stationed at the Bingham Creek (Satsop River) trap facility and the Skagit River trap in 1992. Specific duties were, 24 hour trap operation, species identification (vertebrate and invertebrate) and enumeration, recording of catch and tagging data, coded wire tagging, length frequencies of salmonids, specimen preservation and physical measurements of stream conditions, ie. Lux, stream height, TSS sampling, Imhoff cone and temperature. I was also responsible for establishing the protocol for safe and efficient fish handling procedures. During this time I was also a member of the NATURES team and provided the same services to this WDF and NMFS research project. Being stationed at this location allowed me the opportunity to observe and study the stream ecosystem which was of great personal interest.

WDF. Harvest Management, Soft Data Unit.
From 1990 thru 1993 during the commercial fishing season (July to Jan) I was responsible for monitoring commercial salmon catch data, ensuring accurate principle data sources, summarization and processing data for the Auxilary Fish Catch Record System that is used for in-season harvest management. I was also responsible for biological and catch corrections in processed data in the Prime computer system files. The job required a thorough knowledge of the commercial fishing industry, salmon stock composition and run timing. Our unit was also responsible for PC hardware and software support for the harvest management division. At this time I also participated in Puget Sound purse seine test fishing, in which I performed GSI, fecundity, scale and catch composition sampling. During slow periods of commercial fishing I was charged with finding and sampling little known sport fisheries on the beaches and estuary's of South Puget Sound and Hood Canal.

WDF.Puget Sound Sport Emphasis Sampling.
As a Sport Sampler in 1989 and 1990 I conducted interviews with sport salmon anglers on Puget Sound and the Straight of Juan de Fuca, recording angler catch, effort and biological data. Scale sampling and coded wire tag recovery were also performed.

Related volunteer experience.:
South Sound Fly Fishers, Director.
The following is a list of activities and accomplishments which I have been involved with that are combined efforts of the So. Sound Fly Fishers and Washington Dept of Fish and Wildlife.

I was lead person for a cooperative project with WDFW doing a creel census on the South Fork Toutle River during the Feb-March wild winter steelhead fishery in 1993 and 1994.

I am the SSFF representative on the citizen advisory committee to WDFW's Wild Salmonid Policy meetings.

Conducted electro-fishing projects on the North Fork Toutle and Green River tributaries in cooperation with WDFW for five consecutive years, establishing base line data of juvenile wild salmonid populations and stream habitat analysis.

Began work on a Sea-run Cutthroat Trout Bibliographic Database. This work has received wide support from conservation, sport, and government organizations. It is expected to be a 3 year project.

Participated in snorkel survey's in the Tolt, Washougal and Wind rivers in conjunction with Clark-Skamania Fly Fishers and Washington Trout. These surveys are to continue baseline data of wild summer steelhead populations in these rivers.

Dec. 1982 to June 88 — Cutting Edge Floor Covering

As part owner of Cutting Edge Floorcovering I had many responsibility's in the operation of a small business. Contract commercial floorcovering of large office buildings such as the Columbia Center, Century Tower, etc. provided the business base. My specific duties included, sales, small business management, blueprint takeoffs, materials estimations, procurement and layout. A thorough understanding of floor covering technologies and building construction techniques were also required. Coordination of workspace, material transport and time scheduling between the prime contractor, sub-contractor's and my crew was done on a daily basis to achieve timely completion of the job and assure customer satisfaction.

Jan. 82 to Dec. 82 — Design Interiors

Floorcovering installation apprentice. Assisted and installed all types of commercial floorcoverings in new construction and renovation of large office buildings in downtown Seattle

eb. 79 to Dec.81 — Seattle Industrial Controlled Heat

Seattle Industrial Controlled Heat was a company that specialized in the manufacture of portable industrial heat treating and stress relieving equipment. My position with them was essentially two fold. As a shop electrician/mechanic my duties involved welding, fitting, and mechanical fabrication of the equipment. I also participated in the schematic drafting and design and the subsequent electrical wiring and installation of the equipment. We also provided a nationwide heat treating and stress relieving service of industrial apparatus in oil refinery's, shipyards, nuclear plants, etc. As a field service technician I would travel with the equipment to the site for installation which included wiring and any training required by the customer.

During this time I held a limited industrial electricians license.

Personal Data: Married, 3 children, excellent health.
Hobby: Fly fishing for salmon and steelhead.

Personal and professional references are available on request

LOCATED [illegible]

[illegible]

E Dale Russell

RESS 6330-A CADY Rd.

[illegible] 290-1006

Forest Worker

TITLE III - ASSESSMENT INFORMATION

List previous paid jobs. Please answer the following ques... starting with your most recent job and working backward in ... show your employment for the last three years.

a. Employer Absolute Cleaning Services
MailingAddress 4403 Russell Rd #116
City Mukilteo State WA ZipCode 9
Phone Number 745-6909 Dates Worked 5/2/93 to 6/3
Job Title Operation Manager Supervisor Sid McWhir
Duties Scheduling customer ... safety program ..., employee discipline, training, ...
Please list equipment or tools operated on a regular basis as a ... this job. Network computer, phones, calculators, ...press, chop saw, trucks, etc
PayRate $10-/hr
How did you get this job? Refer to apply by old Supervisor
Reason for leaving lay off

b. Employer Boeing
MailingAddress
City Everett State WA
Phone Number ... Dates Worked 3/6/89
JobTitle Factory Clerk C Supervisor Brad Martin
Duties Receiving and shipping parts and material ... into work station, locate hot jobs, expedite parts ...
Please list equipment or tools operated on a regular basis of this job ... tools, ... fueling propane ...
PayRate $15.53/hr
How did you get this job [redacted] applied
Reason for leaving layoff

Employer ... Corp
Mailing ...
City Oak Harbor State WA
Ph... Dates Worked 10/ /88
... Supervisor Shane ...

pallet jacks.

PayRate 5.25/hr

How did you get this job Applied.

Reason for leaving Take job at Boeing.

d. Employer Northwest Taxidermy

MailingAddress [illegible] Parker Rd

City [illegible] Coupeville State WA ZipCode

Phone Number N/A Dates Worked 10/[illegible]/86 to 10/

JobTitle Owner/Operator Supervisor

Duties Receive items for work, bookkeeping, sales, marketing advertising, inventory control, [illegible] items, painting [illegible]

Please list equipment or tools operated on a regular basis as part of this job paint guns & air brush, band saw, hand tools, pe[illegible] carpentry tools, pneumatic tools, etc.

Pay Rate piece work

How did you get this job? Started it with partner

Reason for leaving Dissolved partnership

e. Employer Alaska Dept of Fish & Game, Comm. Fish.

MailingAddress P.O. Box 87

City [illegible] State [illegible] ZipCode [illegible]

Phone Number 907 822 [illegible] Dates Worked [illegible]

Job Title Fisheries Tech/Biologist Supervisor [illegible]

Duties Construction of camps, research facilities, Data collection, analysis, recording, research writing, sampling, [illegible]

Please list equipment or tools operated on a regular basis as part of this job Computer, calculator, boats, ATV, [illegible] sonar counters, power carpentry tools, radios, etc.

Pay Rate $13.83/hr

How did you get this job? Applied

Reason for leaving Because married, did not want to be away for more than 3 months a year

f. Employer

MailingAddress

City State ZipCode

Phone Number Dates Worked to

Job Title

Duties

Please list equipment or tools operated on a regular basis

ADDITIONAL OCCUPATIONAL SKILLS

You may have marketable skills which you have developed outsi[de] employment. Please review your education, hobbies, interest[s] everyday activities. Include any machinery, equipment or tools you [u]sed. Also, list any special licenses you possess or work processes yo[u are] fam[ili]ar with. You need only include those skills not listed on the [work h]istory section of this application.

SKILL INVENTORY

[S]kills acquired on the job: (other than previously listed)
landscaping, customer service, [redacted] typing, ten key, [illegible], [illegible] fishing, trolling and gillnetting, forklift operations, delivery truck d[riving] [illegible] [illegible]ing, stone sheetmetal work.

[Skil]ls acquired through classroom training:
[illegible]ing, optic measuring, Quality assurance, blueprint reading, CPR [illegible] [illegible] tools.

[Ski]lls acquired through hobbies, interests and life experiences:
[illegible]ing, carpentery, fitness

[List] any tools, machines, equipment you can operate [illegible] [illegible] pneumatic tools, forklift, 34,000 lb gross axle wt. truck with [illegible] paint gun & air brush, chain saw, [illegible], [illegible] calculator, general office equipment [illegible], mowers, [illegible]

[Spe]cial licenses Propane fueling permit, CPR & First Aid Cert.

P[AGE] [illegible]

DENNIS O. BROWN
15309.5 PORTLAND AVE. SW
TACOMA, WASHINGTON 98498
(206) 588-1794

April 2, 1996

TO WHOM IT MAY IT CONCERN:

This is a work history of Dennis O. Brown.

WORK HISTORY

Sept. 6, 1995 to Feb. 20, 1996	Bates Technical College Long-Haul Trucking Program South Campus 2201 South 78th Street Tacoma, Washington 98409-5847 (206) 596-1753 (Sharon Wade)	(GPA 95%)
Nov. 93 to Aug. 95	Witcraft & Swope Contract Cutters 7901 Holiday Valley Ct. NW Olympia, Washington 98504 (360) 866-9110 (Steve or Marti Witcraft)	Timber Faller $30.00 per. hr.
Mar. 88 to Nov. 93	#208 Shake & Shingle Griffiths Inc. PO Box 208 Moclips, Washington 98562 (360) 276-4640 (Annette Griffiths)	Everything From Truck Driver to Millwright
Feb. 85 to Mar. 88	Pearson Forest Products Molips, Washington 98562 (Out of business/no phone)	Everything From Truck Driver to Millwright

DENNIS O. BROWN
15309.5 PORTLAND AVE. SW
TACOMA, WASHINGTON 98498
(206) 588-1794

April 2, 1996

SKILLS

TRUCKS DRIVEN

Straight Trucks, Tandum and Single Axles, Hydraulic or Air Brakes.

Flatbeds, Dump Trucks, GI Duce and a Half, Geophysical Vibrators (6 x 6 on and off road), Buses.

Tractor Trailer: Semi-dumps, Flatbeds, Vans, and Doubles.

EQUIPMENT OPERATED

Most types and brands of Forklifts, Front-end Loaders, Loggstackers, Cats, and Lumber Carriers.

RELATED WORK

Maintenance Mechanic on equipment operated, (Trucks and Loaders, etc...)

Industrial Millwright, including Welding and Maintenance Mechanic for Shake and Shingle mills, Sawmills, and other production type sites.

Electrician: Commercial, Industrial, and Residential.

I have also been superintendent, manager, and foreman for companies that I have worked for in the past.

Frank Staller
16 Malone Hill Branch Road
Elma, Washington 98541
(360) 482-2960

Education & Training

St. Benedict's High School, Chicago, Illinois, 1974 diploma.

DeVry Institute of Technology, Chicago, Illinois, Electronics Technician degree, 1976.

Grays Harbor College, Aberdeen, Washington, Environmental Services Contracting Certificate 1996.

Northwest Indian Fisheries Commission, TFW Monitoring Training Workshop, 1997.

Department of Natural Resources & Quinault Nation: DNR Stream Typing Updated Rulings & Electroshocking Workshop, 1997.

Specialized Training

Power Squadron boating course; U.S. Forest Service forest fire training; defensive driving certificate; First Aid and CPR; Hazmat Awareness Level; Swiftwater First Responder; Swiftwater Boat Rescue; Wilderness Survival; Wilderness First Aid; Helicopter I evacuation, safety and man-tracking, and culvert analysis.

Streamtyping Experience

Washington Trout, P.O. Box 402, Duvall, WA 98019
Scientific Field Technician: Three years of stream surveying, using maps and compass to report on condition of streams related to fish presence, barriers and condition for re-typing classification. I submitted reports and upgraded maps after streamtyping. I also did culvert analysis on Type 3 waters. I worked on road closure and culvert replacement projects, operated pumps, assisted in surveying and stream monitoring.

Washington Department of Fish & Wildlife, Montesano:
Stream surveyor using maps and compass to collect information on streams related to fish presence and barriers for stream type verification.

Self-employed timber salvage contractor: Eight years subcontracting cedar salvage through Weyerhaeuser and other private landowners to salvage down and dead cedar logs for roofing material. I ran chainsaw, graded blocks and partook in helicopter logging operations. We cut down dead fir logs into cants with portable chainsaw mill and flew them out with helicopter assistance.

Timber Faller: For six months I felled and bucked timber for private landowners for partial and clear-cut operations.

Forestry technician for USDA Forest Service, Quinault, WA for four nine-month seasons: set up logging areas by traversing boundaries, surveyed for new roads, prepared profile surveys, assisted in cruise plots and marked trees, plus assisted in transient

survey of national forest boundaries, placing section corner markers and marking bearing trees.

Other work has included two seasons as a fire crewman, three years in horticulture/landscaping, experience planting and thinning trees, building and maintaining the Quinault trail system plus two years as electronic technician.

Volunteer Activities

Grays Harbor Search & Rescue, Chehalis Valley Restoration wood Duck Project, Washington Department of Fish & Wildlife elk relocation project plus oak habitat mapping.

Gregory Ericksen
2832 Pacific
Hoquiam, Washington 98550
360-533-2058

General Summary

20 years' experience in positions requiring coordinated mental and physical skills to ensure productivity and safety.

Work equally well in a teaming environment or with minimal supervision. My varied work experiences indicate willingness and ability to learn.

Streamtyping Experience

Washington Trout, Duvall, WA.: I have taught stream typing to crews and TFW partners and participated in restoration projects including road closures, culvert surveys and replacement, and collected scientific data for Washington Trout and for Thomas Travis Young, Olympia (consultant).

I have performed streamtyping for the Washington Department of Natural Resources, Olympic Peninsula Office, Aberdeen, WA, the Department of Fish & Wildlife at Montesano, WA and stream typing plus tree planting for Weyerhaeuser. I have more than three years' experience in streamtyping.

Other Experience

Heavy equipment operator
Rigging operator
Mechanic
Carpenter
Landscaping
Supervisory
Watershed Restoration

Education

Washington State University survey class, Adopt-A-Stream, Everett WA.

Grays Harbor College, Aberdeen, Washington: Watershed analysis/data collection.

Department of Natural Resources wetland verification class, Forks, WA.

Hoquiam High School, Hoquiam, Washington.

References

Available upon request.

I TT Rayonier Pulp Mill 1977-1982
Yard Crew Run Equipment Fork lifts all sizes, Front End-loader, Back Hoe, Bob Cats, Riggin Slinger for lifting + Replacing Equipment Motor's, Pumps, Steam lines ect. Basically Anything in mill. Leadman for Crews + Work Alone. Take care of all safety equipm in the entire mill + Order + Replace.

2 Earley tire Co. 1983-1988
Auto Mech. Certified in Diagnostic Scope, Brake's, Air Cond. Tune-ups + Brakeman + Service A/C systems was work Done Schooling to Be Certified for all Area's.

3 Weyco. 1989-90 Plant trees for them + contract Work for them in tree planting Area of Work and Some Cedar Block cutting for them contract cutting

4 Work for Quality Homes const. Clark + Son + Locke Const. Building houses from ground up + foundation's also with Clark + Son was all commercial Building's from 89-1994

5 Washington Dept. Fish + Wildlife 1995
Stream Retyping + Mapping of Stream's + Restoration Work

Greg Ericksen

ROGER R. KRINGEN
Box 866
Elma, WA 98541
Phone: (360) 482-4042

POSITION DESIRED   Stream Survey Technician

WORK EXPERIENCE

QUINAULT DEPT. OF ENVIRONMENTAL PROTECTION

Stream Type Technician

Quinault Indian Nation Taholah, WA. November 1995 to present. Duties include:

-Acquiring and organizing the road and field maps required to perform surveys on type 4 and 5 streams on a township-by-township basis across the Olympic Peninsula.

-Utilizing forest practice base maps and hydro maps in coordination with road maps from timber companies, Forest Service, USGS, and other sources to locate streams in the field.

-Employing electroshocker or visual methods to determine if salmonids are present in streams. If salmonid presence is verified, survey is continued upstream until practical fish passage limit is reached and flagged as end of type 3 water. Position is noted on map by orientating with side-tributaries, topographic irregularities or other physical features. Stream characteristics such as substrate, wetted width, ordinary high water mark, large woody debris, canopy and gradient are noted as well as any observance of salamanders, frogs or other riparian species. Mass-wasting, debris flows or other geologic events are noted and mapped.

-At office, survey results and pertinent information are transferred to data cards, and stream type changes or verifications are color-coded on file copies of forest practice base maps. High culverts or other man-made blockages are documented on fish passage forms.

-Review and on-site inspection of forest practice applications.

MUCKLESHOOT FISHERIES DEPARTMENT

Stream Type Technician

Muckleshoot Indian Tribe Auburn, WA. Seasonal employment from June 1996 to October 1996. Duties: Similar to those with QIN, but additional emphasis was placed on initiating development of a data bank documenting the maximum gradient limits of salmonid occurrence in the Washington Cascades. Job required backpacking in and camping overnight in Clearwater Wilderness and other remote areas.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Stream Typing Field Supervisor

Montesano, WA June 1994 to July 1995.
Duties: Supervision of 6-man stream typing crew included interviewing job applicants, crew-member training, directing work activities, maintaining time sheets, scheduling equipment maintenance, monitoring incoming field data and contacting private landowners to acquire permission to enter their properties.

ADDITIONAL WORK EXPERIENCE

-Contracted for Weyerhaeuser Corporation to collect riparian zone shade data during Little North River-Vesta Creek Watershed Analysis.

-Two years experience as chain-man and rod-man for soil and water conservation district.

-Longtime logger with extensive experience as timber faller, chaser, chokerman and cat operator.

FORMAL TRAINING

-DNR Wetland Recognition and Designation
-Forest Practices Road Maintenance and Abandonment

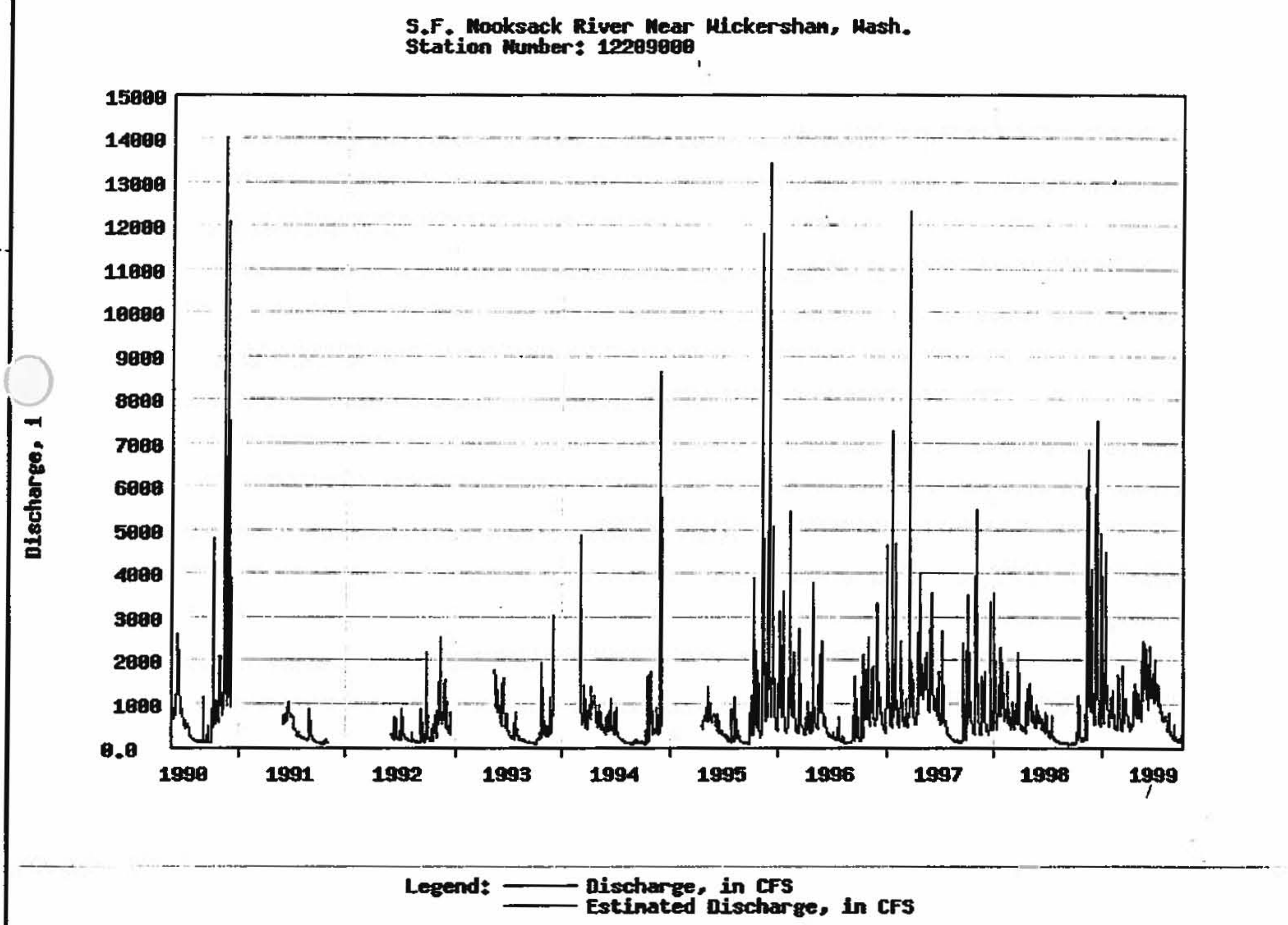
EDUCATION

Associate of Arts and Sciences Degree Grays Harbor Community College, Aberdeen, WA June 1994. Graduated #2 of 300 with 3.95 GPA.

References available upon request.

USGS science for a changing world

Historical Streamflow Daily Values Graph for S.F. Nooksack River Near Wickersham, Wash. (12209000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

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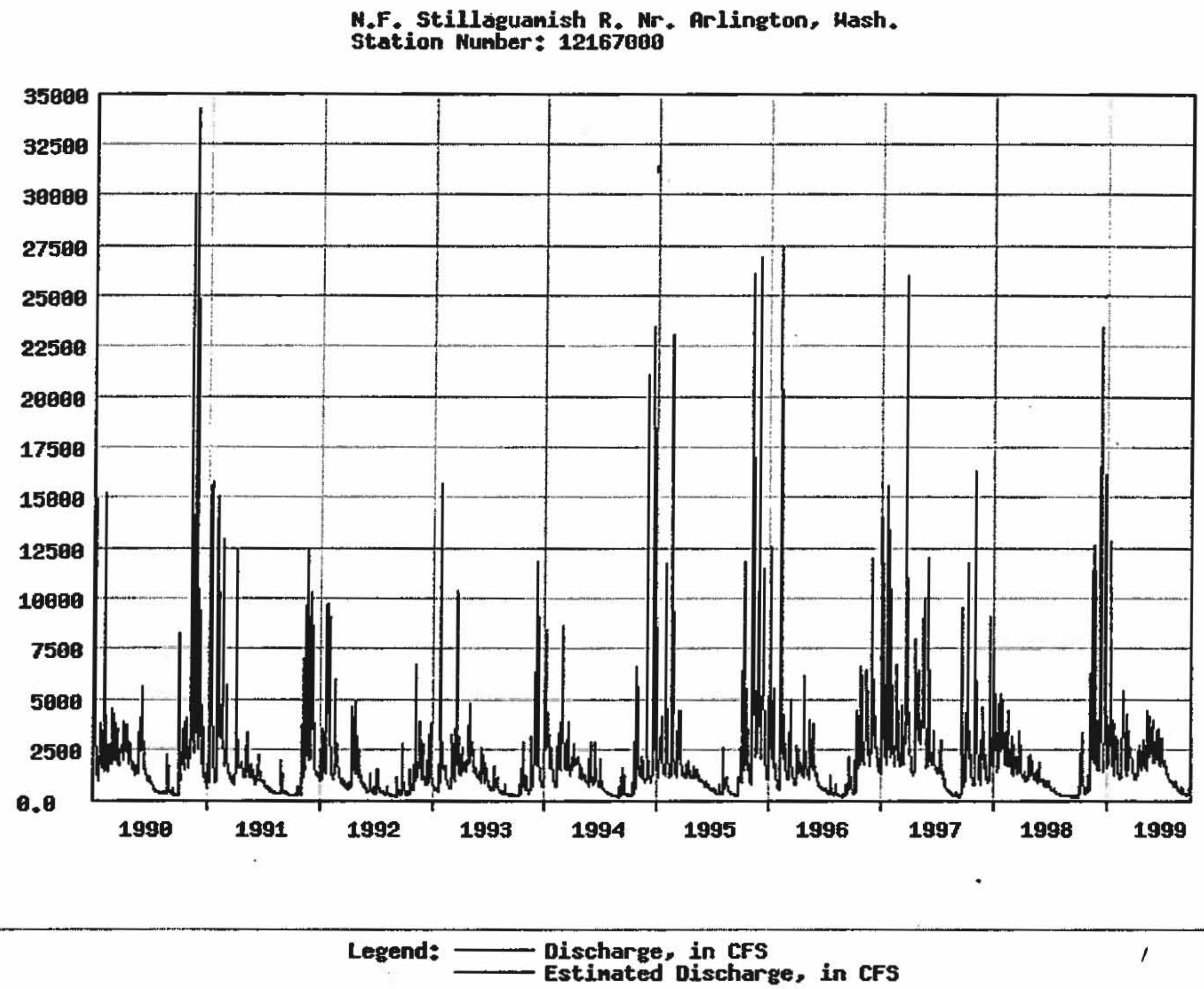
Historical Streamflow Daily Values Graph for N.F. Stillaguamish R. Nr. Arlington, Wash. (12167000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn? Why you might press this button

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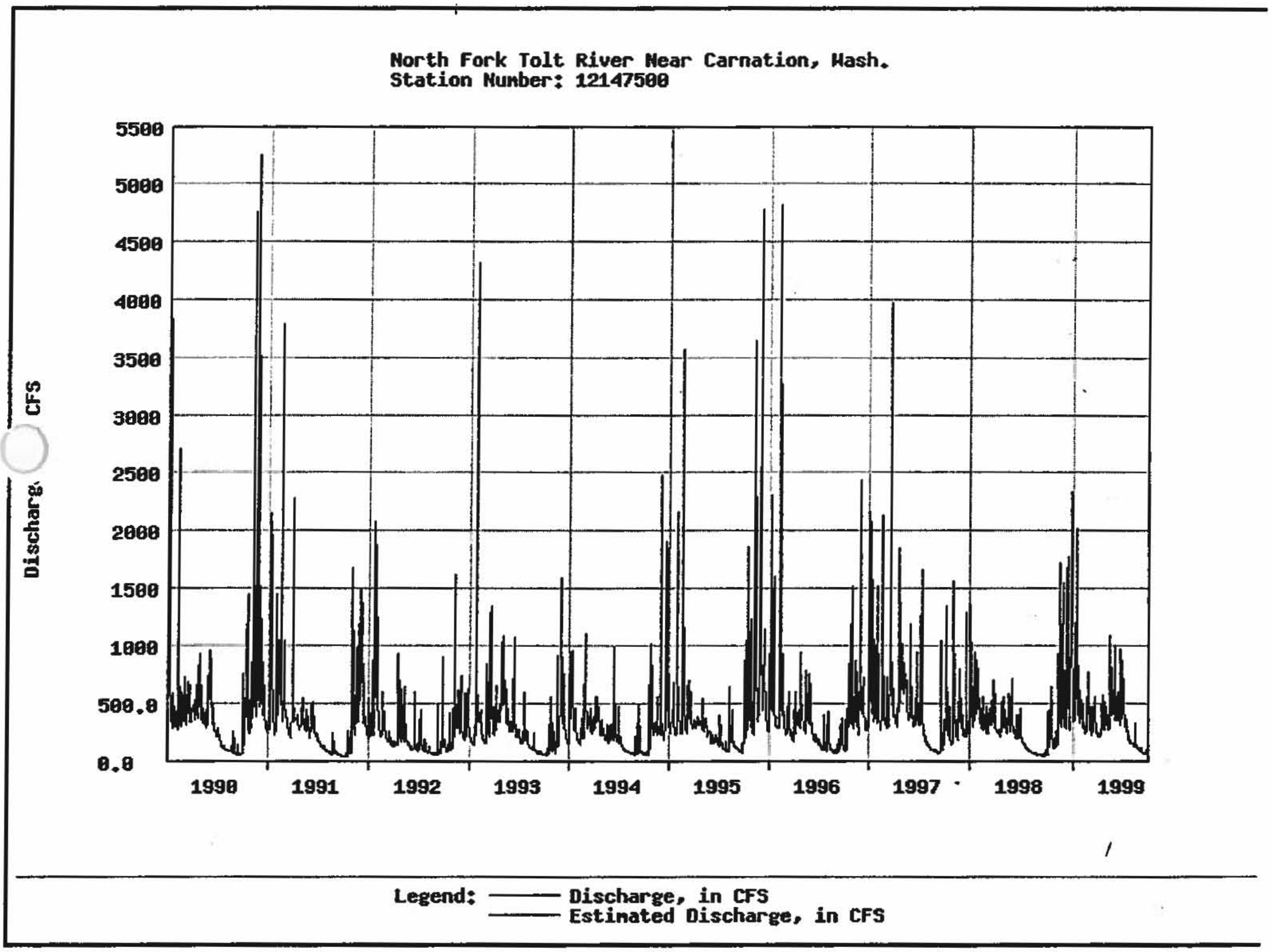
Historical Streamflow Daily Values Graph for North Fork Tolt River Near Carnation, Wash. (12147500)



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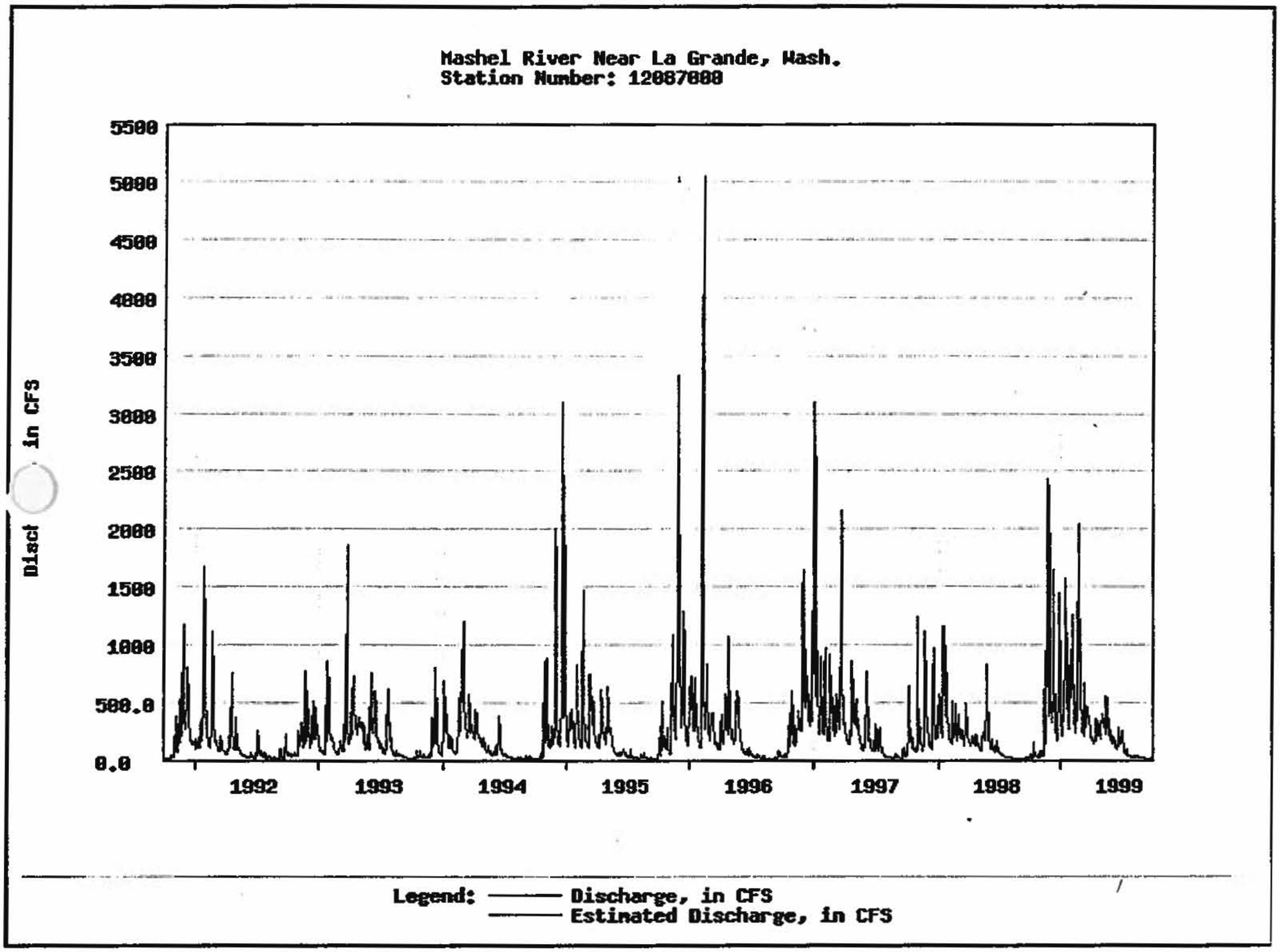
Historical Streamflow Daily Values Graph for Mashel River Near La Grande, Wash. (12087000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

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Why you might press this button

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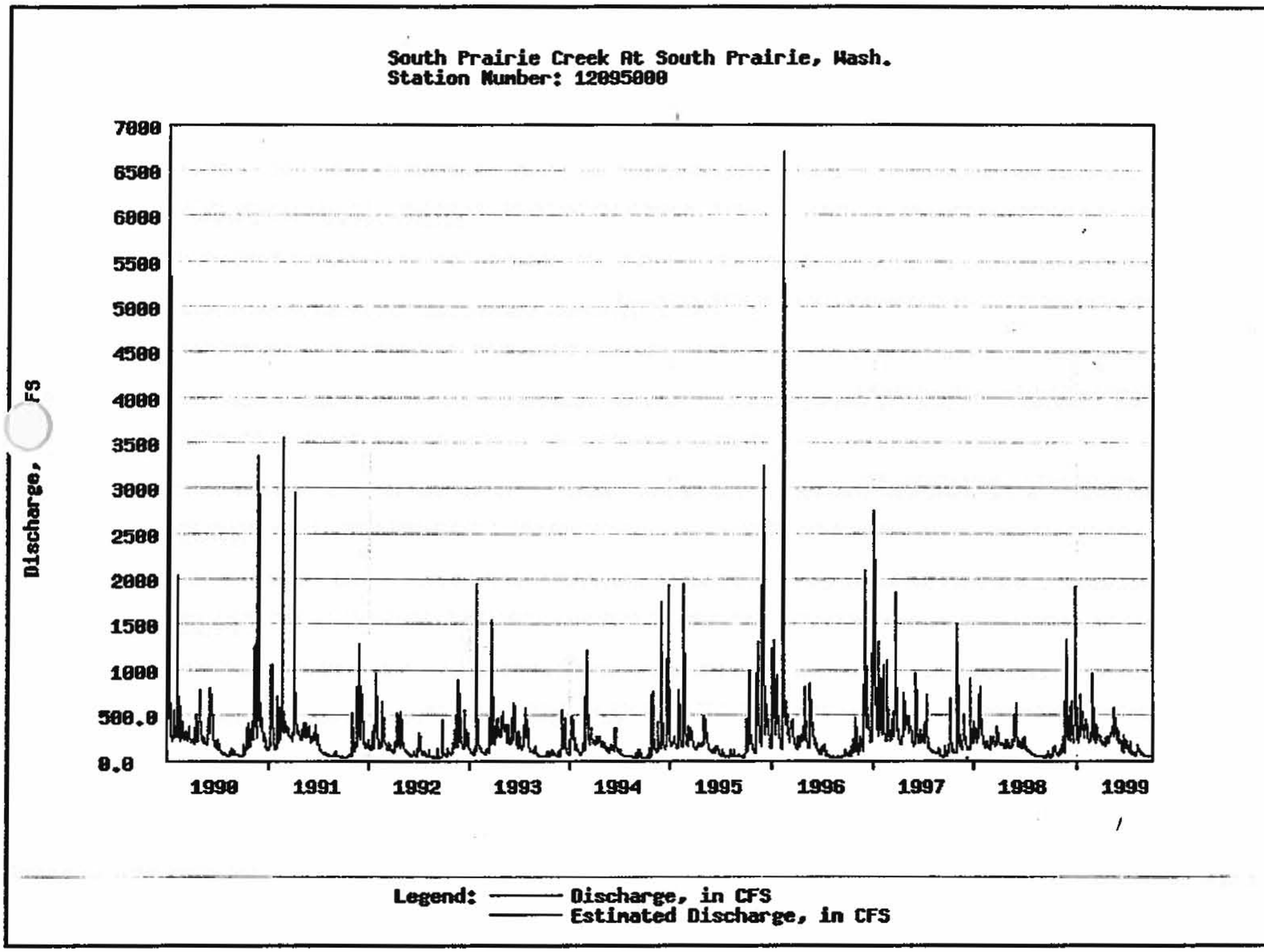
science for a changing world

Historical Streamflow Daily Values Graph for South Prairie Creek At South Prairie, Wash. (12095000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

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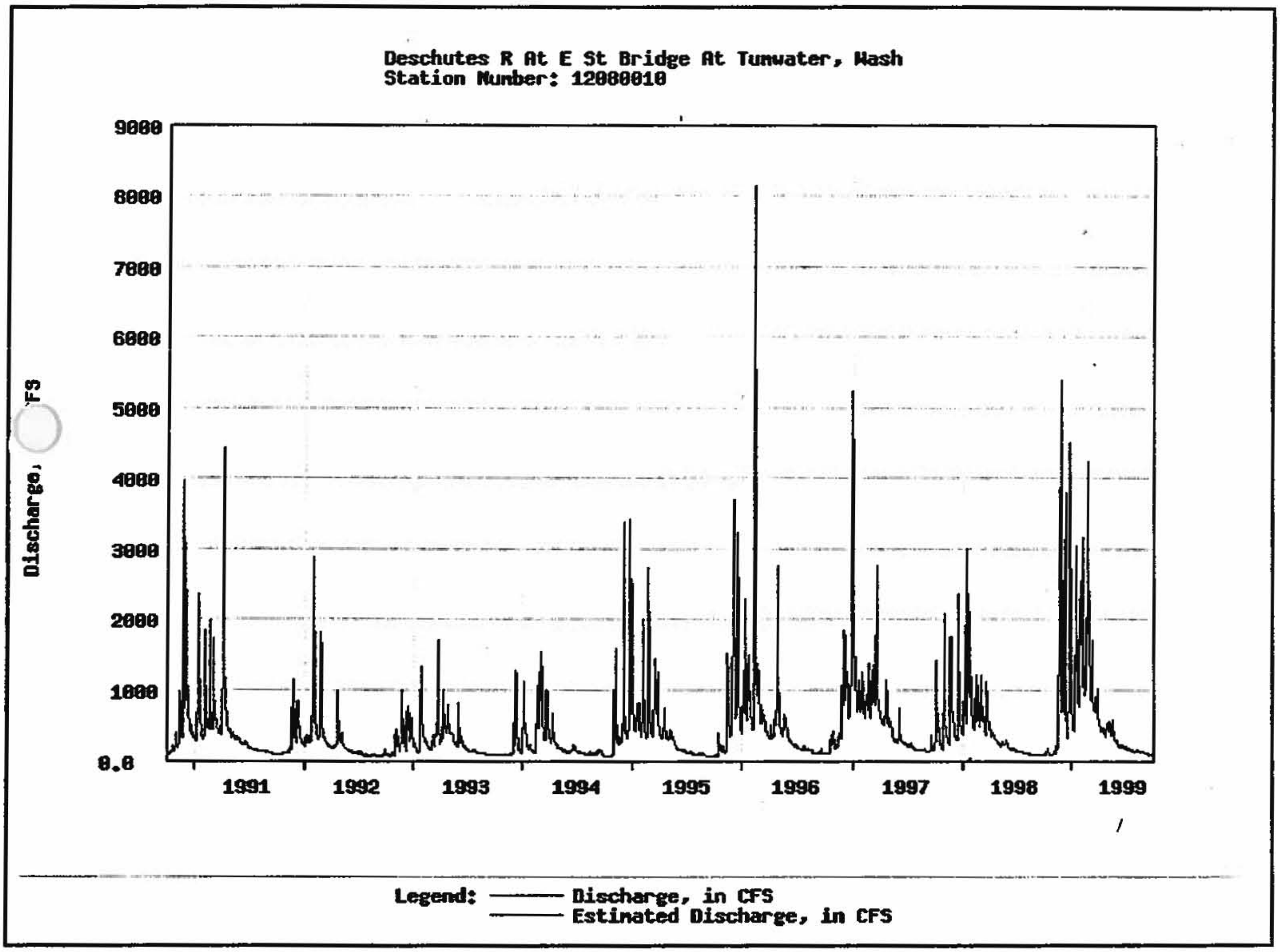
Historical Streamflow Daily Values Graph for Deschutes R At E St Bridge At Tumwater, Wash (12080010)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

SNOQUALMIE RIVER
Lower Mainstem

This drainage section includes the lower 12 miles of Snoqualmie River from a few miles above Duvall downstream to the confluence with the Skykomish River (R.M. 20.5). Eleven tributaries enter in this section, adding more than 83 total stream miles. Principal access in this northwest King-southwest Snohomish counties section is provided by State Highway 203 running south from Monroe.

Stream Description

From stream mile 12.0 the Snoqualmie River meanders northeast approximately five miles to Cherry Creek, then northwest to the confluence with the kykomish River. Principal tributaries include Tuck, Cherry, and Peoples creeks.

The flat valley floor is two miles wide and is cleared with only occasional strips or small thickets of deciduous trees and underbrush. The low, rolling hills bordering the valley are moderately steep-sloped with deciduous and some mixed conifer cover. Land use is almost exclusively agricultural pasture land. Recreation use is heavy, consisting of both fishing and hunting. The only community development is Duvall; however, there are a few widely scattered rural residences within this section. Some logging occurs in the upper Cherry Creek watershed.

Through this section, the Snoqualmie River is contained within a broad channel ranging from 30 to 45 yards during fall months. The gradient is gentle with a few nearly flat stretches. The channel meanders back and forth across the valley, forming oxbows. Stream flow is sluggish in many stretches, with numerous long, deep pools and slow-moving glides predominating. Stream bottom is primarily sand and silt, with only a few short, scattered gravel-riffle sections, generally heavily silted. Most banks are moderately high, sharply sloped earth cuts, with a few gently sloped sand-gravel beaches. Some bank protection work has taken place at certain locations within this stretch of river in the form of artificial contour and rock riprap, cabled logs, and discarded car bodies or other large debris to divert flow from easily eroded banks.

Bank cover is sparse to moderately dense, consisting almost entirely of intermittent strips or small thickets of deciduous trees and underbrush. In many areas this growth actually overhangs the banks, and with numerous logs and accumulated debris extending out from the shore, provides favorable protective cover for fish life.

Tributaries in this section exhibit gentle to moderate gradients over their lower reaches as they course across the valley floor. Their upper slopes, however, are quite steep and generally offer limited access to salmon. Through their accessible reaches, most of these streams contain good pool-riffle conditions within relatively narrow stream channels. Stream bottoms are predominantly gravel and sand over the lower reaches, with gravel and some rubble materials above. Tributary cover is usually moderate to dense growth of mainly deciduous trees and underbrush.

Salmon Utilization

This lower Snoqualmie River section provides transportation for all salmon utilizing the upper drainage. Chinook, coho, pink, and chum salmon inhabit these waters. Only limited spawning habitat is available in the Snoqualmie; however, tributaries, including Cherry, Peoples, and Tuck creeks, support good to excellent spawning populations. These tributaries as well as this section of mainstem river provide important rearing habitat for juvenile salmon.

Limiting Factors

One factor limiting salmon production is low summer stream flow in some of the smaller tributaries. This restricts rearing potential and, when continuing into the fall months, can inhibit adult salmon access. One activity which could potentially limit production is clear-cut logging over some reaches of upper tributary drainages. Such logging can influence the productive capacity of streams emerging from such areas, as well as affect production in their drainagesbelow. Another potential limiting condition involves water quality throughout the lower mainstem Snoqualmie. The slow-moving water lacks cover and is more easily warmed, and offers the potential for concentrating pollutants that could severely affect the natural production capabilities. Occasionally, heavy poaching activity occurs on adult salmon in some of the smaller tributaries.

Beneficial Developments

No facilities or programs have been undertaken in this drainage section to specifically benefit salmon production. Occasionally, stream maintenance activities involving removal of minor jams are undertaken on small streams.

Habitat Needs

The major requirement to maintain salmon production potential in this section is to protect the natural conditions that presently exist, i.e. natural stream cover, pool-riffle character, quantity and quality of stream gravel, good water quality, etc. Restoration of natural stream cover where it has already been eliminated is highly desirable, particularly on the tributary drainages.

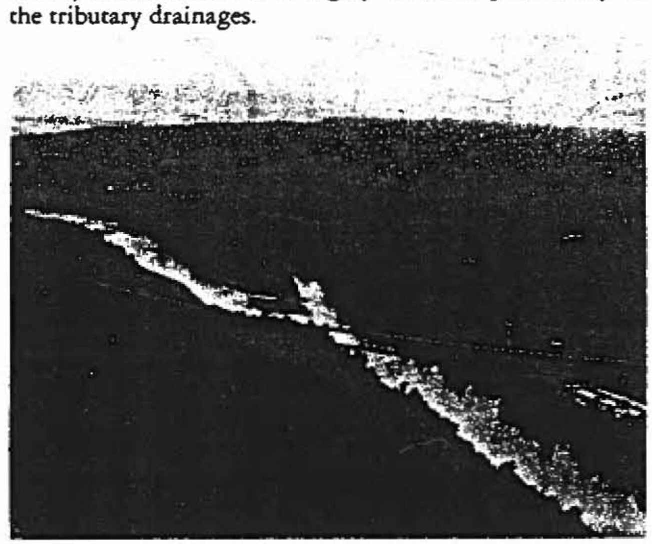
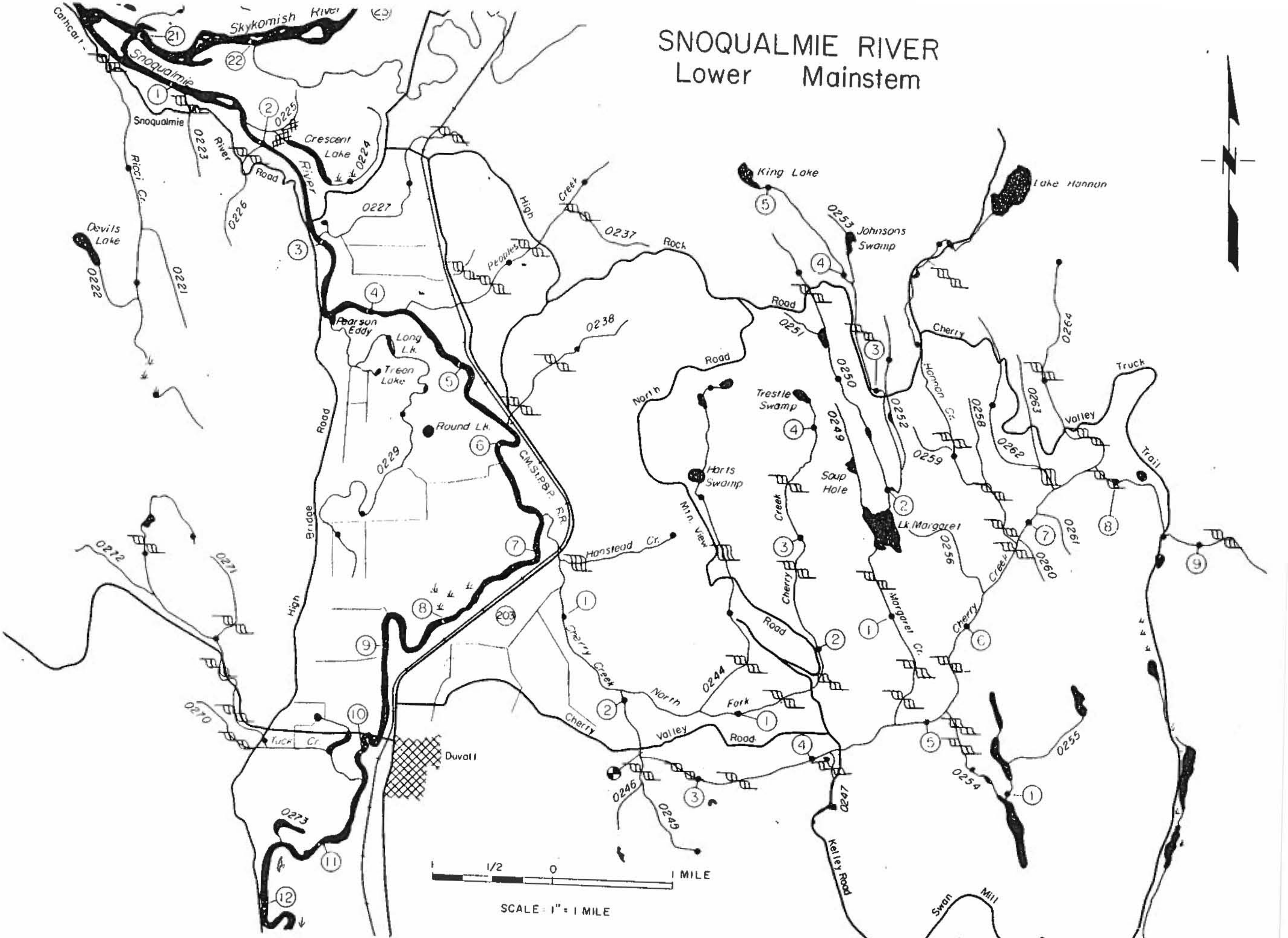


PHOTO 07-19. Confluence of the Skykomish and Snoqualmie Rivers.

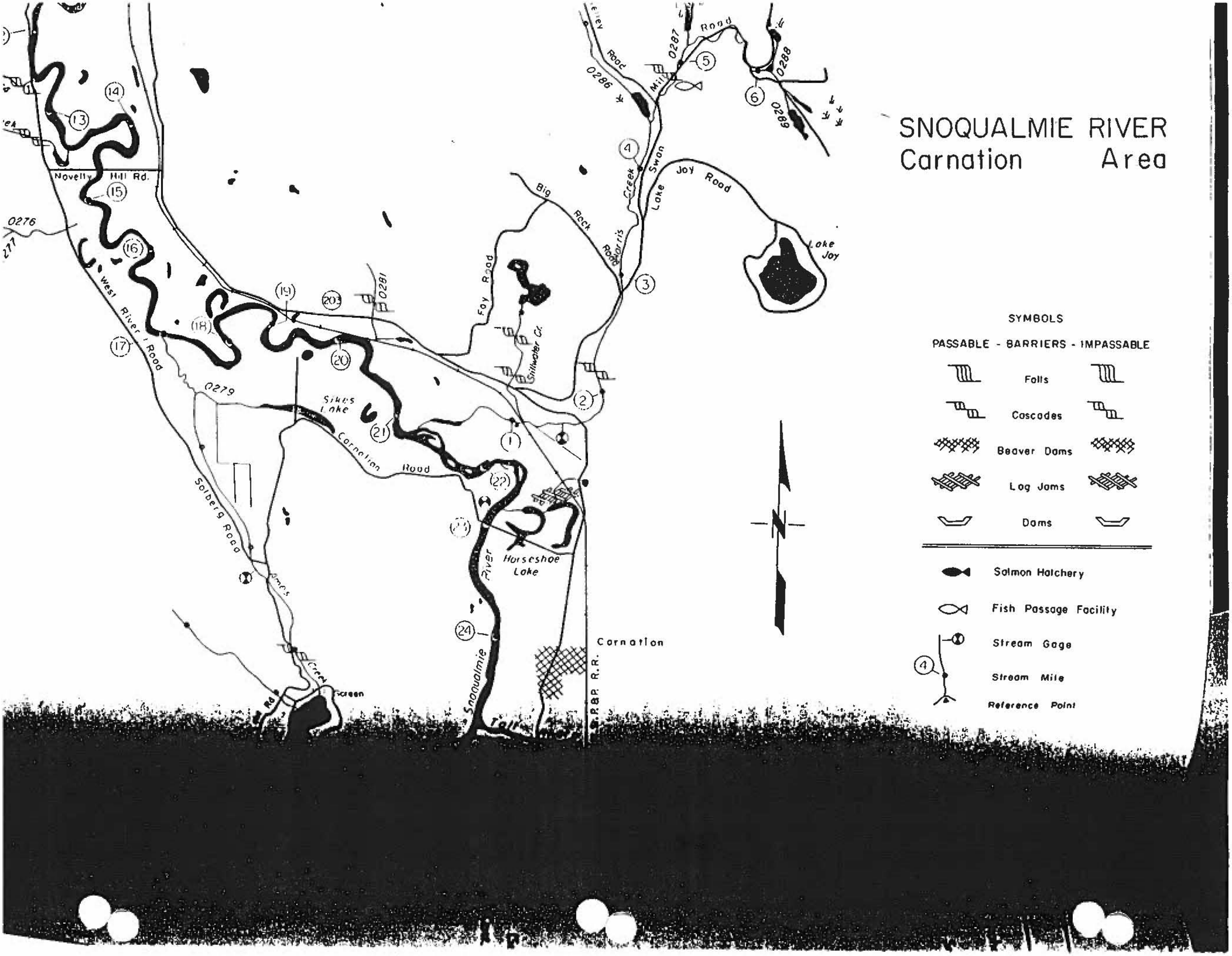
SNOQUALMIE RIVER
Lower Mainstem



SNOQUALMIE RIVER — LOWER MAINSTEM
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho Pink, Chum
0219	Snoqualmie River	LB-20.5	84.55	693.0	Chin., Coho, Pink, Chum
0220	Ricci Creek	LB-0.4	3.5	—	(Coho)
0224	Unnamed	RB-1.7	1.7	—	Unknown
	Crescent Lake	Outlet-0.35	—	—	
0227	Unnamed	RB-2.9	1.9	—	(Coho)
	Drainage Ditch	LB-0.2	~ 2.1	—	Unknown
0229	Pearson Eddy Creek	LB-3.6	4.35	—	Unknown
	Long Lake	Outlet-1.0	—	—	
0233	Drainage Ditch	RB-3.85	~ 1.3	—	Unknown
0236	Peoples Creek	RB-4.3	2.3	—	Coho
0238	Unnamed (Duvall Cr)	RB-5.7	1.5	—	(Coho)
0240	Cherry Creek	RB-6.7	9.9	—	Chin., Coho, Pink, (Chum)
0241	Hanstead Creek	RB-0.5	1.0	—	Unknown
0242	Drainage Ditch	LB-0.75	~ 3.5	—	Unknown
0243	N. Fk. Cherry Cr.	RB-1.9	4.2	—	Coho, (Pink), (Chum)
0244	Unnamed	RB-0.7	3.1	—	(Coho)
	Harts Swamp	Outlet-2.15	—	—	
	Unnamed Lk.	Outlet-2.8	—	—	
	Unnamed Lk.	Outlet-3.1	—	—	
	Trestle Swamp	Outlet-4.2		—	
0245	Unnamed	LB-2.5	1.0	—	Unknown
0248	Margaret Creek	RB-4.7	5.1	—	(Coho)
	Margaret Lk.	Outlet-1.55	—	—	
0250	Unnamed	RB-2.0	2.4	—	None
	Roth's Sw.	Outlet-0.45	—	—	
	Unnamed Lk.	Outlet-1.35	—	—	
0252	Unnamed	LB-2.2	1.3	—	
	King Lake	Outlet-5.1	—	—	
0254	Unnamed	LB-5.2	1.6	—	Unknown
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-0.85	—	—	
	Unnamed Lk.	Outlet-1.15	—	—	
	Unnamed Lk.	Outlet-1.6	—	—	
0257	Hannan Cr.	RB-6.8	3.55	—	(Coho)

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
	Unnamed Lk.	Outlet-2.65	—	—	
	Lake Hannan	Outlet-3.55	—	—	
0262	Unnamed	RB-7.4	1.9	—	None
0264	Unnamed	RB-7.8	2.0	—	(Coho)
	Cherry Lake	Outlet-9.9	—	—	
0267	Tuck Creek	LB-10.3	4.05	—	Coho, (Chum)
0268	Drainage Ditch	LB-0.4	~ 1.1	—	Unknown
	Unnamed Lake	Outlet-3.25	—	—	
	(Cont. Snohomish 703)				


SNOQUALMIE RIVER
Carnation Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Novelty Hill Rd.
West River Road
Carnation Road
Sikes Lake
Horseshoe Lake
Snoqualmie River
Fay Road
Big Rock Road
Lake Joy Road
Lake Joy
Stillwater Cr.
Carnation
0276
0279
0281
0286
0287
0288
Solberg Road
Screen

SNOQUALMIE RIVER — CARNATION AREA
Snohomish River Basin — WRIA 07

Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
Snohomish River				Chin., Coho, Pink, Chum
Snoqualmie River				Chin., Coho, Pink, Chum
Adair Creek	LB-13.35	1.65	—	Unknown
Unnamed	LB-15.1	1.05	—	Unknown
Ames Creek	LB-17.0	5.2	—	Coho, (Chum)
Unnamed	RB-0.55	0.7	—	Unknown
Drain. Ditch	LB-0.25	~ 1.6	—	Unknown
Sikes Lake	Outlet-0.7			
Ames Lake	Outlet-3.5	—	—	
Harris Creek	RB-21.3	6.45	—	Coho, (Chum)
Unnamed Lake	Outlet-0.2	—	—	
Stillwater Cr.	RB-1.11	1.1	—	Coho
Unnamed	RB-4.45	1.1	—	Coho
Unnamed Lake	Outlet-6.1	—	—	
Unnamed Lake	Outlet-6.45	—	—	
Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)

(See Snohomish 803)
(See Snohomish 1003)

This section includes the lower 9.0 miles of Tolt River with nine tributaries, excluding the South Fork, providing an additional 13.2 stream miles. The Tolt River originates in the range of mountains including Mt. Index, Red Mountain, and Mt. Phelps east of the Snoqualmie River, then flows southwest to its confluence with the Snoqualmie (R.M. 24.9) near the town of Carnation. The entire watershed lies within King County and road access to the lower river is provided by the Tolt River Road along the north bank, upstream from about six miles, and by the Bunker Road on the south bank from the mouth to river mile 1.8. Stossel Creek is the principal tributary and is accessible from the Tolt Truck Trail. The upper watershed will be discussed with Map 901.

Stream Description

The lower Tolt River includes the 9.0 miles below the confluence of the North and South forks. Flows are controlled by the spillway releases from the Seattle Water Supply Reservoir on the South Fork. The peaks of the upper watershed mountain range extend to 5,000-foot elevation and drop rapidly from steep canyon boulder zones to the 450-foot elevation near the forks. The Tolt River Valley broadens below this point and becomes predominantly of floodway character. Stream width varies from 45 to 75 feet above river mile 5.0 and extends to 90 feet in the lower river. Channel splitting and overflow side channels occur below river mile 4.0. Above river mile 5.0 the streambed is comprised mostly of rubble and boulders with few patch gravel areas. Flows are mostly of fast riffle character with a few rapids. Below river mile 5.0 the bottom composition changes, with the streambed exhibiting rubble and gravel with a few boulder-strewn sections. Proceeding downstream from R.M. 5.0 there are increasing sections of gravel riffles and generally good pool-riffle balance.

Land use is confined to a few permanent small rural farms in the lower 2 miles, with heavy recreational use up to river mile 6.0 at the end of the Tolt River Road. Some logging occurs in the upper section near the forks. Stossel Creek is the principal tributary providing 4.45 miles of accessible stream. This tributary contains several reaches of beaver ponds. There are 8 short tributaries that also provide considerable drainage runoff to this system. These contain good shade cover and some sections suitable for salmon production.

Salmon Utilization

Chinook, coho, chum and pink inhabit the lower Tolt River with chinook and coho ascending this entire section and chum and pink utilizing the lower 4.0 miles, particularly the channel splits and overflow channels. Coho ascend all of the accessible portions of the tributaries, particularly Stossel Creek and Langlois Creek.

Limiting Factors

Steep gradients, cascades and falls restrict some fish use in the smaller unnamed tributaries. Gravel removal, particularly in the lower river, has altered the streambed conditions. Riprapping and other flood control measures below river mile 4.0 has tended to eliminate natural overflow channels and construct the main channel in some cases. Cleared logged-off slopes in the upper watershed contribute to the flash flooding and silting in the basin. Large boulders in the streambed limit the spawning areas. The Seattle-Tolt Water Reservoir controls the flows from the South Fork, reducing summer rearing capacity.

Beneficial Developments

A U.S.G.S. gaging station, located about 0.5 mile downstream of the confluence of the South Fork, has continuously recorded stream flow measurements from the Seattle Water Reservoir since 1952. Another U.S.G.S. gaging station, with records dating back to 1928, is located near the mouth of Stossel Creek. Negotiations for minimum flow releases for fish use were initiated in 1957 but have never been consummated into a formal agreement. Based on average flows of 200 cfs from September 15 to June 1, and 125 cfs from June 1 to September 15, as measured below Stossel Creek, releases from the Seattle Storage Dam would amount to 38 cfs in the winter period and 24.5 cfs in the summer period. In critical water years, which occur one out of ten, the reduction of 30% in these quantities would be made in the monthly release schedule.

Habitat Needs

A firm minimum flow agreement should be negotiated through the Department of Ecology with Seattle Water Department for Tolt River Reservoir releases for fish use. Gravel removal operations in the lower Tolt River should be prohibited as recruitment of gravel is minimal in this river.

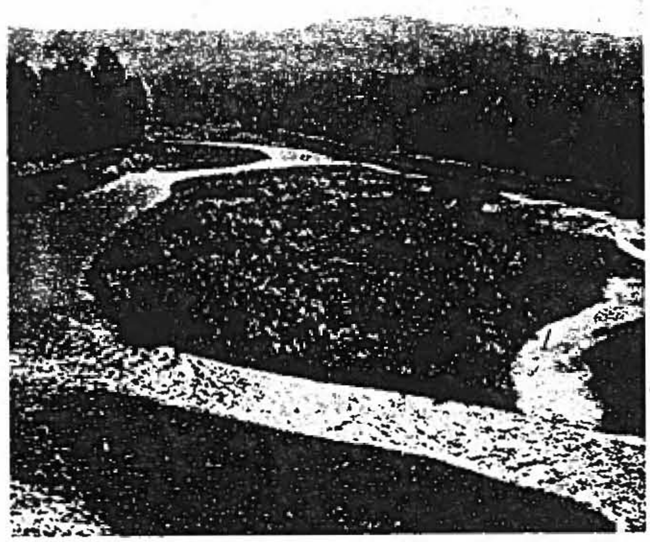
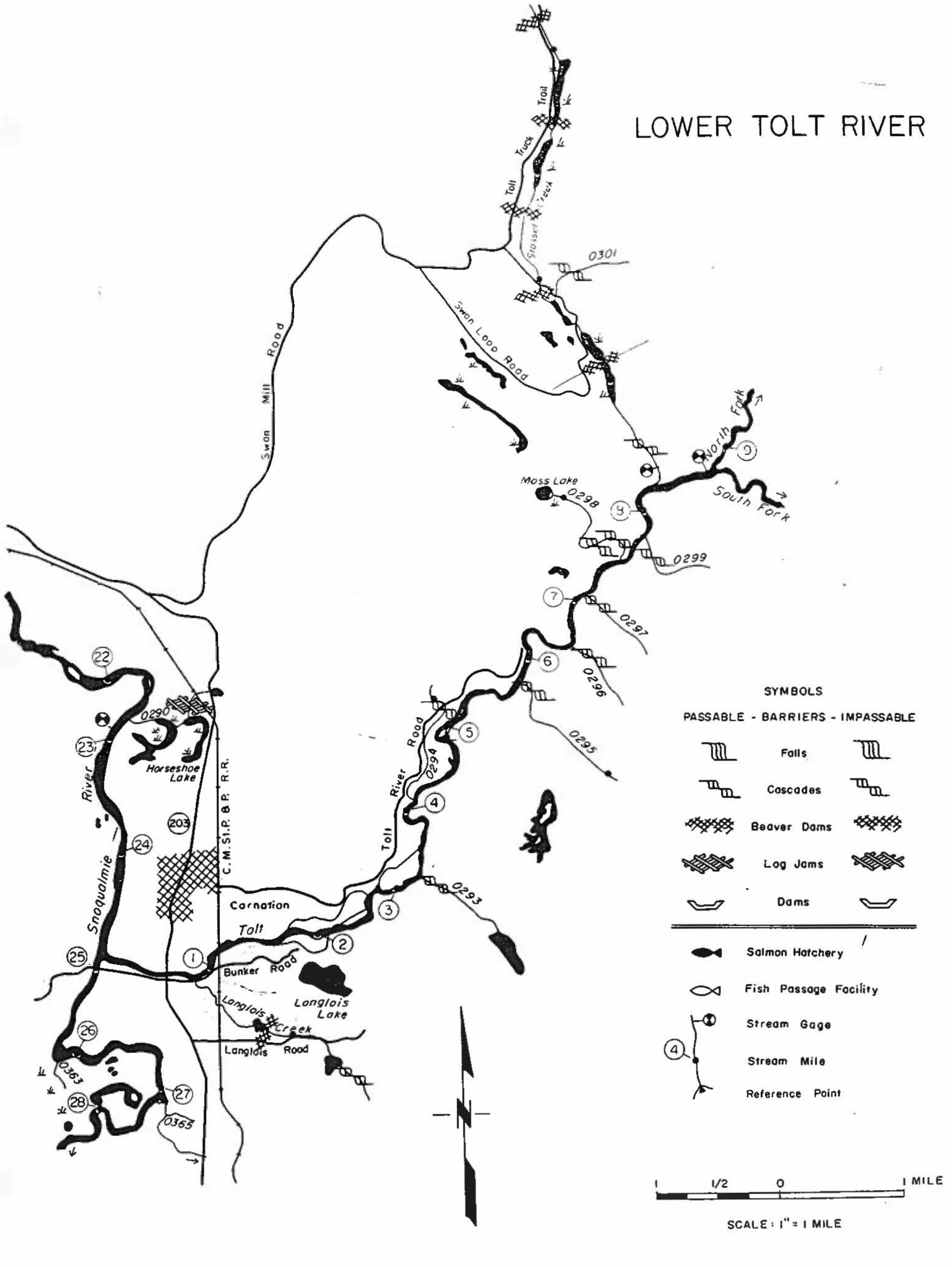


PHOTO 07-21. Set back levees on lower Tolt River allows the river to meander.

LOWER TOLT RIVER



LOWER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)
0292	Langlois Creek	LB-0.85	1.85	—	Coho
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-1.4	—	—	
0294	Unnamed	RB-4.1	1.1	—	(Chin), Coho
0295	Unnamed	LB-5.8	1.1	—	Unknown
0298	Unnamed	RB-7.5	1.15	—	(Coho)
0300	Stossel Cr.	RB-8.3	4.45	—	Coho
	Unnamed Lk.	Outlet-0.8	—	—	
	Unnamed Lk.	Outlet-1.2	—	—	
	Unnamed Lk.	Outlet-1.56	—	—	
	Unnamed Lk.	Outlet-2.9	—	—	
	Unnamed Lk.	Outlet-3.4	—	—	
	Unnamed Lk.	Outlet-4.45	—	—	
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
	(See Snohomish 903)				
	Tolt R. cont. as	(@ mi. 8.81)	—	—	
	No. Fk. Tolt R.				
	(Cont. Snohomish 903)				

This section covers the upper Tolt River basin. Above the South Fork (R.M. 8.8) it continues as North Fork more than 17 miles. Some 22 tributaries and 50 stream miles. The South Fork is also about 17 miles long, with 15 tributaries adding 30 stream miles. The area is located six miles east of Carnation, in north-central King County. Access is via logging roads from the town of Snoqualmie. The North Fork and tributaries above R.M. 18 are within Snoqualmie National Forest. Also, much of the area is managed as watershed by the City of Seattle.

Stream Description

From the northwest slopes of Red Mountain the North Fork flows first northwest, then west about eight miles, then southwest nine miles to the South Fork confluence. The only large tributary other than the South Fork is North Fork Creek.

Over its upper 6-7 miles the North Fork cuts through a narrow, steep-sloped valley. The upper three or so miles hold dense conifer forest; the lower slopes mostly clear-cut. Downstream from Titicaca Creek (R.M. 20.6) the valley shallows and broadens for six miles, showing many clear-cuts and various stages of reforestation. The lower six miles cut through deep ravine-canyon terrain, where most side slopes are thickly forested. Similar mountain terrain exists over the South Fork; however, most slopes here hold dense forest cover. Little development has occurred in the upper drainage. Principal activity is logging, with some recreation.

The North Fork's upper six miles are mostly steep, the stream's narrow channel holding some falls, numerous cascades, a few short pool-riffle stretches. Widths range 2-6 yards, the bottom mainly boulder and rubble, little gravel.

The gradient over the next six miles is mostly moderate. Fall widths range 5-10 yards, with some channel splitting. There are a number of good pool-riffle stretches, with the bottom being mainly rubble and gravel, and a few boulder areas. Banks are mostly low earth or rock cuts, with a few gravel-rubble beaches. Cover consists of patches or strips of mainly deciduous growth and some mixed conifer.

Over the next 3-4 miles, the ravine-canyon area presents mostly steep gradient, with numerous falls, cascades, and rapids, and only a few deep pools and short riffles. One large falls, exceeding 25 feet, is located about R.M. 10.8. Stream widths above the falls range from 4 to 9 yards. The bottom is mostly large rock and boulders, with some bedrock and a few rubble-patch gravel stretches.

The lower two miles of the reach present moderately steep gradient. The channel remains confined, ranging 5-12 yards in width in the fall, exhibiting numerous cascades and rapids, and occasional pools and short riffles. The bottom is boulder and rubble, with some patch gravel. Banks are steep -sloped, maintaining moderate to dense deciduous/conifer cover where logging has not occurred.

The South Fork's upper three miles is steep gradient stream, with conditions much the same as in the upper North Fork. For the next three miles, the gradient is moderately steep, with the stream presenting mostly fast riffles, a few cascades, and some short pool-riffle stretches. Here, fall widths range 3-5 yards, with the bottom composed mostly of rubble and scattered boulders, and some patch gravel areas. Cover is mostly conifer timber, with some mixed deciduous growth. Seattle's South Fork Tolt Reservoir encompasses the next 3.5 miles (R.M. 8.5-12.0). A large falls is located just downstream from the dam. Over the remaining eight or so miles the South Fork presents moderately steep to steep gradient, with mostly fast riffles and some cascades, particularly in a short canyon (R.M. 2.5-3.5). Stream widths range from 5 to 14 yards. Some deep pools, with a few short riffles, exist along this lower stretch. The bottom is mainly rubble and boulders, with a few short gravel riffles and patch gravel strips. The South Fork banks are generally sharp earth or rock cuts holding dense cover, except for the lower river stretches where clear-cut logging has occurred.

Nearly all smaller tributaries exhibit steep mountain stream character, with numerous cascades and rapids, and mostly boulder and rubble bottoms.

Salmon Utilization

This section receives limited salmon use, some chinook and coho ascending the North Fork about a mile, the South Fork as far as eight miles. Chinook juveniles rear for a short time in these waters, coho having year-round habitation.

Limiting Factors

Natural salmon production limitations include the North Fork and South Fork falls, plus the steep gradient restricting spawning habitat within accessible stream reaches. Additional factors include low flows during critical dry seasons, and occasional heavy siltation from a South Fork slide.

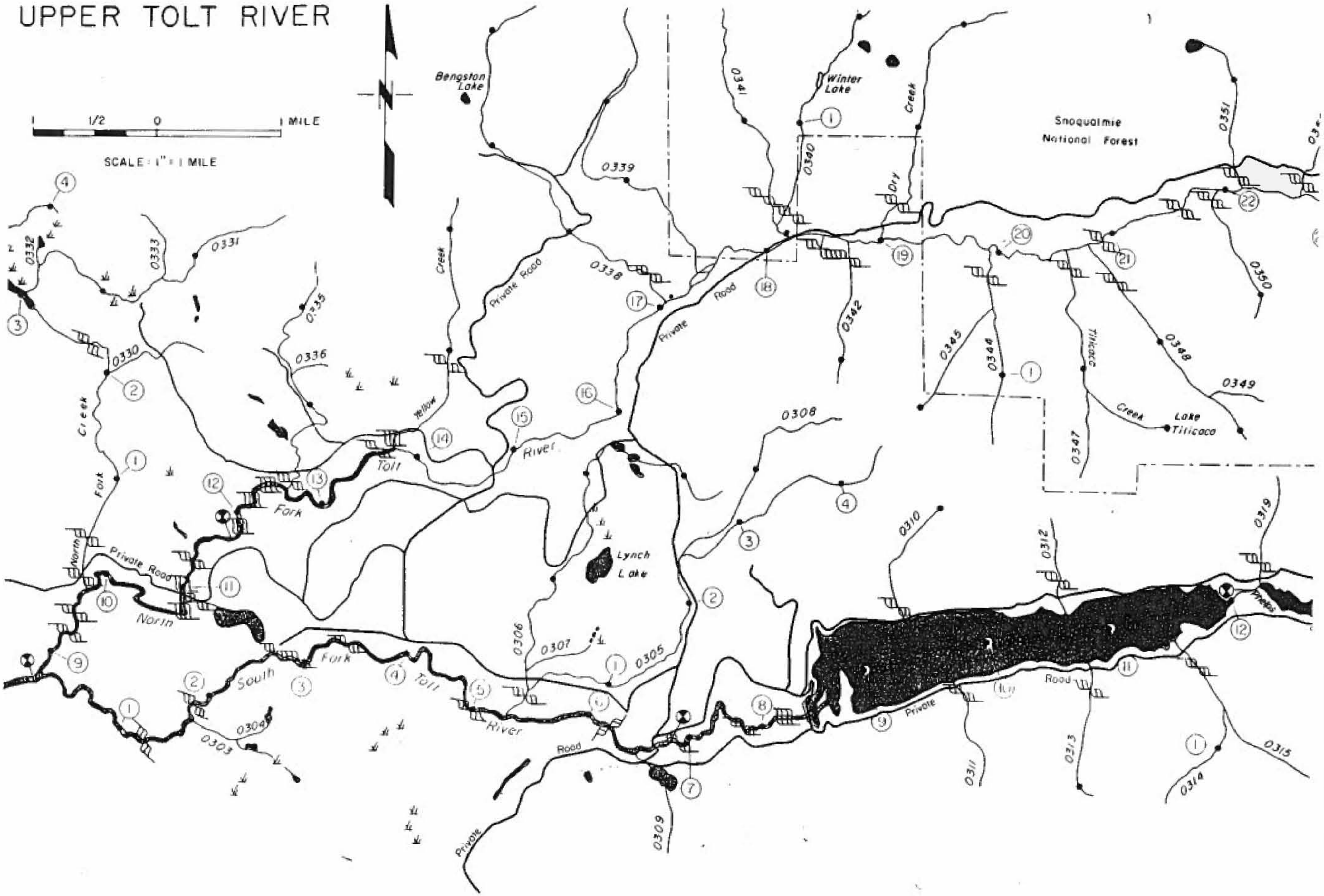
Beneficial Developments

The only programs to benefit salmon production is a minimum flow agreement with the City of Seattle to insure against severe flow reductions.

Habitat Needs

Requirements to maintain production habitat include preserving stream side cover, and maintaining stream conditions in a near natural state. Containment of the South Fork slide would benefit the more productive areas downstream.

UPPER TOLT RIVER



UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River				Chin., Coho, Pink, (Chum)
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
0305	Unnamed	RB-5.3	4.5	—	Unknown
0306	Unnamed	RB-0.3	3.4	—	None
	Unnamed Lake	Outlet-2.3	—	—	
	Unnamed Lake	Outlet-2.5	—	—	
0308	Unnamed	RB-2.45	1.9	—	None
	Tolt-Seattle Water Sup. Res.	Outlet-8.4	—	—	
0310	Unnamed	RB-9.4	1.0	—	None
0313	Unnamed	LB-10.8	1.1	—	None
1314	Unnamed	LB-11.5	1.6	—	None
0315	Unnamed	RB-0.7	1.0	—	None
0316	Phelps Cr.	LB-12.3	2.2	—	None
0320	Unnamed	RB-12.9	1.0	—	None
0323	Unnamed	RB-14.5	1.0	—	None
	Tolt R. cont. as N. F. Tolt R.	@ mi. 8.81	—	49.3	
0329	N. Fork Creek	RB-9.7	4.1	7.53	Unknown
	Unnamed Lake	Outlet-2.85	—	—	
0331	Unnamed	LB-3.0	2.8	—	None
	Unnamed Lake	Outlet-3.55	—	—	
0335	Unnamed	RB-12.6	2.5	—	None
0337	Yellow Creek	RB-13.8	2.2	—	None
0338	Unnamed	RB-17.05	3.7	—	None
0339	Unnamed	RB-17.4	2.9	—	None
0340	Unnamed	RB-18.25	3.0	—	None
0341	Unnamed	RB-0.15	2.7	—	None
	Winter Lake	Outlet-1.35	—	—	
0342	Unnamed	LB-18.7	1.2	—	None
0343	Dry Creek	RB-19.0	2.4	—	None
0344	Unnamed	LB-19.9	1.6	—	None
0345	Unnamed	LB-0.5	1.0	—	None

UPPER TOLT RIVER

Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0346	Titacaca Creek	LB-20.6	1.9	—	None
	Lk. Titicaca	Outlet-1.9	—	—	
0348	Unnamed	LB-20.8	2.1	—	None
0350	Unnamed	LB-21.9	1.2	—	None
0351	Unnamed	RB-22.1	1.4	—	None
0352	Unnamed	RB-22.6	1.1	—	None
0353	Unnamed	RB-23.1	1.2	—	None
0354	Unnamed	RB-23.39	1.4	—	None
0355	Titicaed Cr.	LB-23.4	1.65	—	None
	Titicaed Lk.	Outlet-1.65	—	—	
0358	Unnamed	RB-23.55	1.1	—	None

SNOQUALMIE RIVER
Tolt Area

Thirteen miles of main Snoqualmie River are covered in this section from Tolt River upstream to Tokul Creek, plus fourteen tributaries exclusive of the Raging River, providing an additional 51.0 stream miles. The principal town in this valley section is Fall City located near the confluence of the Raging River with the Snoqualmie River at mile 36.0. Access along this stretch of river is by the Fall City to Monroe State Highway 203 on the east valley, and by the west valley road which connects to the Redmond-Fall City State Highway 522 two miles northwest of Fall City. This portion of the Snoqualmie River lies within King County. The Raging River will be presented in Map 1101.

Stream Description

This section of the Snoqualmie River from river mile 25.0 at the mouth of the Tolt River upstream to river mile 39.3 near Tokul Creek, about a mile below Snoqualmie Falls, provides the floodway for the extensive mountainous headwaters of this watershed above the falls. The Snoqualmie River winds in shallow bends downstream to river mile 33.5, below which it forms extensive oxbows and zigzags across the valley floor in serpentine fashion downstream to the town of Carnation. The valley averages about 1.5 miles in width with hillsides rising to the 400-foot elevation, forming valley walls on either side. Many large side sloughs formed by overflow waters are located in this stretch, with the largest group located on the east valley side between river mile 36.0 and 33.0 below Fall City. The mainstem Snoqualmie varies in width from 150 to 400 feet, averaging about 250 feet over much of the distance. Gradient is extremely shallow, descending from 100-foot elevation to 55-foot elevation within this 13.8 mile distance, with only a five-foot drop in the lower 6 miles. Below river mile 33.0 the river becomes a slow, deep slough, confined within diked banks with heavy mud and silt bottoms. Few patch gravel shoreline bars are present even on inside curves. Long gravel riffles with goo gravel composition occur between river mile 34.0 and 35.0. Above this point, the river again becomes deep and slow moving. Good tree cover with brush-covered banks occurs throughout this section. Land use is essentially agricultural and pastural. Due to annual flooding in the valley, there are only scattered rural homes.

Griffin Creek is a major tributary providing some 13 stream miles of drainage. The creek ranges from 10 to 25 feet in width with fair gravel composition. The average flow from 20 years of record is 42.3 cfs. Many beaver dams and swamps occur above stream mile 5.0 and much of the upper watershed has been logged off. Many summer homes are located on the lower stream.

Patterson Creek is 9.25 miles in length with an additional 9.7 miles of tributaries. It is a typical lowland-type stream with fair to good gravel, good pool-riffle balance and excellent shade and cover. Average discharge for 19 years of record is 32.2 cfs.

Salmon Utilization

Chinook, coho, chum and pink salmon utilize the mainstem Snoqualmie within this section for transportation, spawning and rearing. Chinook spawning is intense between river mile 34.0 and 35.0 with some chum and pink utilizing this same area as well as the mouth of the Raging River. Below R.M. 33.5 there is minimal spawning area with only a few shoreline gravel sections. Coho utilize mainly the tributaries; especially Griffin Creek, Patterson Creek, Skunk Creek, and the lower accessible portions of the other small unnamed tributaries. In Griffin Creek the main coho spawning occurs between R.M. 3.0 and 5.1 at the outlet of the lower swamp lake.

Limiting Factors

Heavy snowmelts and runoffs from above Snoqualmie Falls create heavy flooding in the valley. The I-90 road construction on Snoqualmie Pass Highway causes heavy silt loads in the lower river. Heavy deposits of silt and mud are found throughout the deep, slow oxbows of the lower river. Logging in the headwaters of Griffin Creek creates heavy runoff and gravel bed shifting in this stream. Steep gradients and cascades of the small independent tributaries reduce the streams to minimum salmon usage.

Beneficial Developments

No facilities or programs have been undertaken in this section to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production habitat in this section include: developing zoning laws preventing construction of permanent buildings within the flood plain; coordinating flood control activities with King County Flood Control; and the development of a good watershed management plan to preserve the environment.

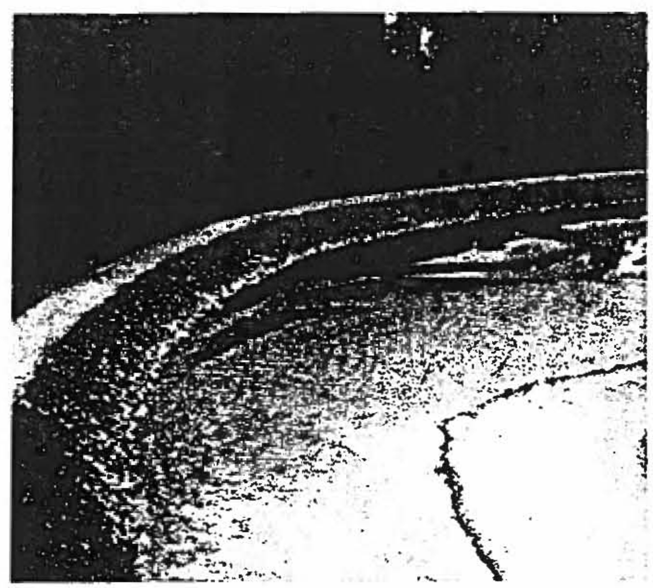
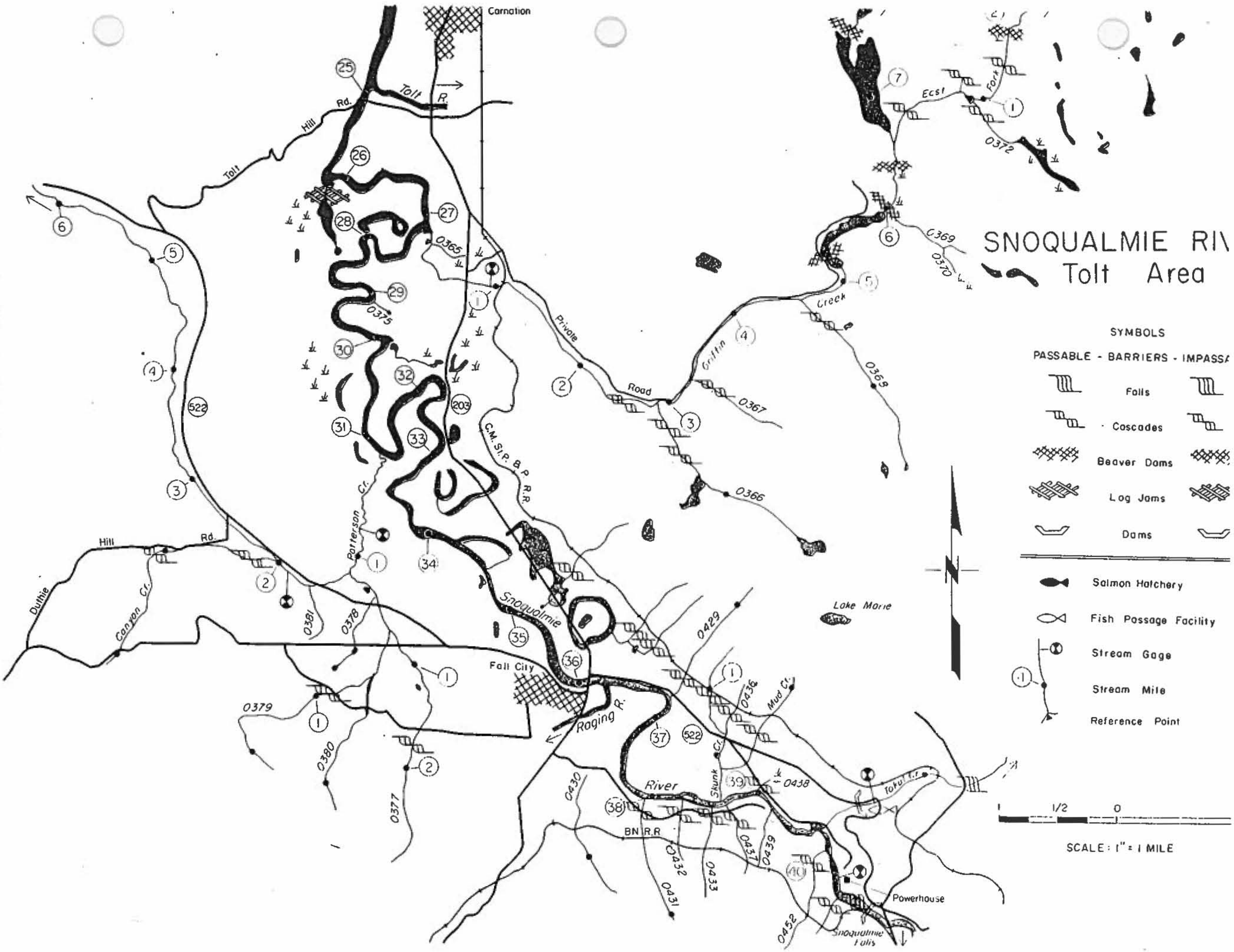


PHOTO 07-22. Good chinook riffles on Snoqualmie River.


SNOQUALMIE RI\
Tolt Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSA
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
SCALE: 1" = 1 MILE
Carnation
Tolt R.
Tolt Hill Rd.
Private Road
Griffin Creek
East Fork
C.M. St.P. & P. R.R.
Snoqualmie
Patterson Cr.
Canyon Cr.
Duthie Hill Rd.
Fall City
Raging R.
River
Skunk Cr.
Mud Cr.
Tokul Cr.
BN R.R.
Lake Marie
Powerhouse
Snoqualmie Falls
0365
0366
0367
0368
0369
0370
0372
0375
0377
0378
0379
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0429
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0433
0436
0437
0438
0439
0452
522
203

SNOQUALMIE RIVER — TOLT AREA
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River			—	Chin., Coho, Pink, Chum
0219	Snoqualmie River	LB-20.5		—	Chin., Coho, Pink, Chum
0364	Griffin Creek	RB-27.2	11.4	—	Chin., Coho, Pink, (Chum)
0366	Unnamed	LB-2.9	1.75	—	(Coho)
	Unnamed Lk.	Outlet-0.75	—	—	
	Unnamed Lk.	Outlet-1.75		—	—
0368	Unnamed	LB-4.6	1.7	—	(Coho)
	Unnamed Lk.	Outlet-5.1	—	—	
0371	East Fork	LB-6.6	3.3	—	Coho
	Unnamed Lk.	Outlet-0.9	—	—	
	Unnamed Lk.	Outlet-2.6	—	—	
	Hull Lake	Outlet-3.05	—	—	
	Unnamed Lk.	Outlet-3.3	—	—	
	Unnamed Lk.	Outlet-6.75	—	—	
	Unnamed Lk.	Outlet-7.8	—	—	
	Unnamed Lk.	Outlet-8.9	—	—	
	Unnamed Lk.	Outlet-11.0	—	—	
0376	Patterson Creek	LB-31.2	9.25	—	Coho
0377	Unnamed	RB-1.2	2.9	—	Coho
0379	Unnamed	LB-0.6	2.2	—	Unknown
0380	Unnamed	RB-0.55	1.2	—	Unknown
0382	Canyon Creek	RB-2.0	2.1	—	(Coho)
0383	Unnamed	RB-6.5	1.3	—	Unknown
	Unnamed Lake	Outlet-9.25	—	—	
0384	Raging River	LB-36.2	15.2	—	Chin., Coho, Pink, (Chum)
	(See Snohomish 1103)				
0429	Unnamed	RB-36.8	1.2	—	Unknown
0430	Unnamed	LB-37.65	1.4	—	Unknown
0431	Unnamed	LB-37.95	1.0	—	Unknown
0434	Skunk Creek	RB-38.64	1.4	—	Coho
0435	Mud Creek	LB-0.3	1.1	—	(Coho)
	(Cont. Snohomish 1303)				

UPPER SOUTH PRAIRIE CREEK

This drainage section covers the upper South Prairie Creek above R.M. 12.0. The headwaters lie in the Snoqualmie National Forest near Old Baldy Mountain, Burnt Mountain, and the Three Sisters Mountain near the northwest corner of Mount Rainier National Park in Pierce County. From here the stream generally courses northwesterly towards the town of Buckley. Within this ten-mile section of upper South Prairie Creek, three major tributaries plus eight smaller tributaries provide an additional 34.65 stream miles.

Stream Description

The headwaters of the South Fork and East Fork originate near the Burnt Mountain and Old Baldy Mountain range at the 4,000-foot elevation. The upper headwaters of Beaver Creek and New Pond Creek flow from the Three Sisters Mountain range, several miles north, at the 3,200-foot elevation. They flow generally westward to their confluence with South Prairie Creek. The entire upper South Prairie Creek watershed lies in densely forested mountainous terrain above any major towns or communities. Logging is the principal activity throughout this area, with selective clear-cut sections. Much of the upper watersheds above the forks and along the creek bottoms have been extensively logged in years past. Some mining activity occurs in the mountain peak areas along the Carbon Ridge. Many small mountain lakes, which attract recreational use, also are found throughout this range.

The only access to the upper watershed is out of the town of Wilkeson by two logging roads, the Littlejohn Road and the East Prairie Road. Jeep trails branching off these roads are the only other accesses to the tributaries of the upper watershed.

Above R.M. 14.5 the upper South Prairie Creek and its tributaries course through steep-sloped high mountain terrain containing moderately steep gradients with numerous cascades and rapids and few pools or riffles. Bottom composition is primarily of boulder and rubble with some patch gravel areas. The mainstem stream banks and streambeds below New Pond Creek are quite stable with only a few natural earth-cut exposed areas. Except for the logged-off portions along the upper stream sections, there is good stream cover and shade from dense conifer timber stands.

Salmon Utilization

Salmon use within this area is restricted below R.M. 15.0 where steep cascade sections are located. A diversion dam at stream mile 15.7 provides a total block to salmon migration. Chinook, coho, and pink salmon utilize the stream below. Beaver Creek is inhabited by chinook, pink, and coho in the lower portion and coho in the upper portion, while only coho salmon utilize New Pond Creek. Juvenile chinook and coho rear in the lower three miles between R.M. 12 and 15 of this section.

Limiting Factors

The steep terrain, swift velocities, and many falls and cascades above stream mile 15.0 offer little potential for anadromous production. No fish passage facilities are associated with the diversion dam at R.M. 15.7. Heavy flood runoff waters associated with the steep mountainous terrain have scoured away much of the spawning gravel through the deep ravines and cascade sections of the upper watershed. Boulders, logs, and debris jams also limit the available areas for fish use. Logging and road construction in the upper watersheds have caused considerable silting in lower South Prairie Creek.

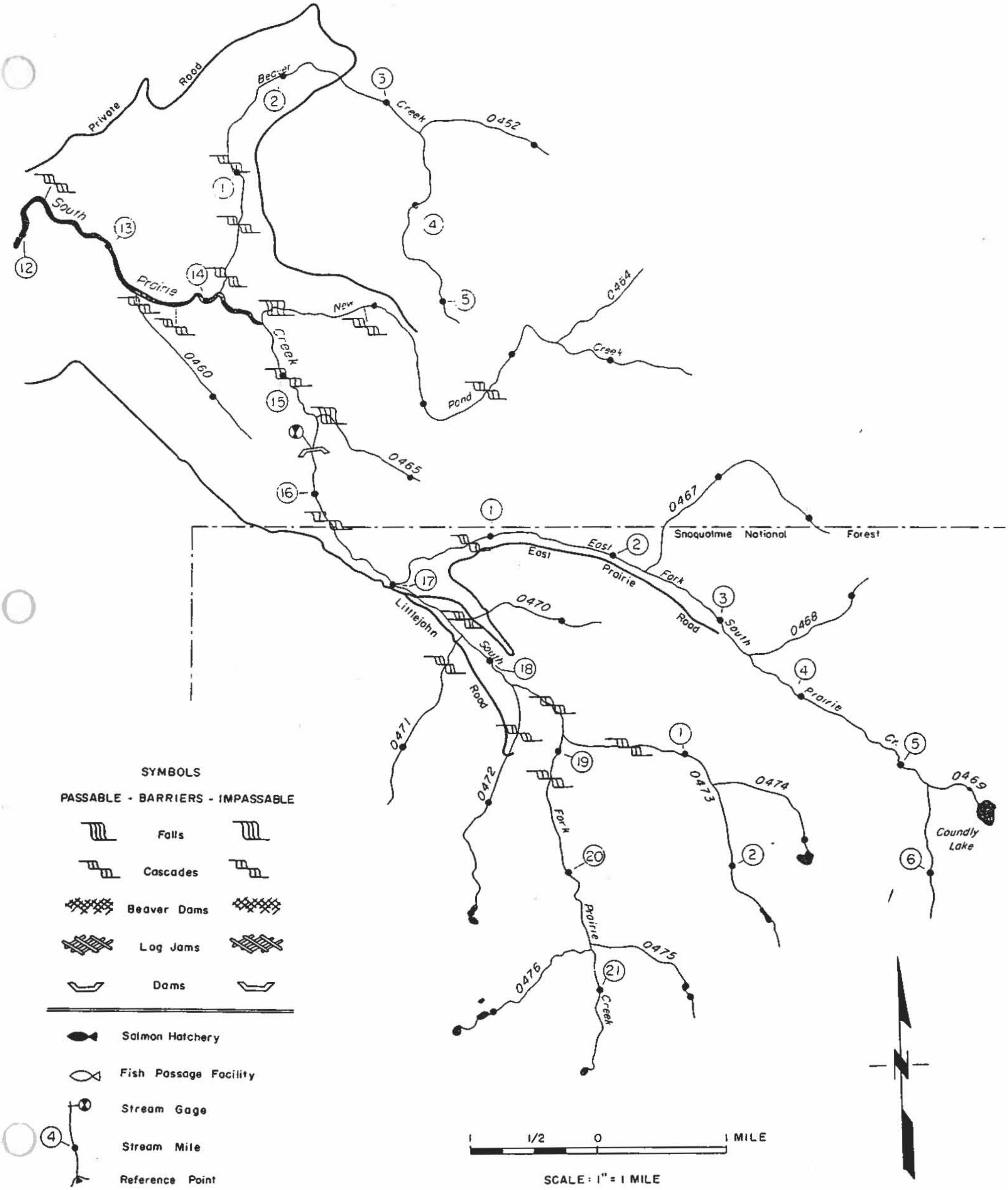
Beneficial Developments

No projects have been undertaken within this section to benefit salmon production.

Habitat Needs

This entire watershed, except for logged areas, remains essentially in its natural pristine state. Logging and road building operations throughout the upper watershed should conform to practices that will maintain clean, free-flowing streams. Buffer strips should be left in the logging areas near the upper watershed streams. Reforestation is mandatory and should be carried out as soon as possible after logging operations have ceased.

UPPER SOUTH PRAIRIE CREEK



UPPER SOUTH PRAIRIE CREEK

Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0413	Carbon River				Chin., Coho, Pink, Chum
0429	S. Prairie Cr.				Chin., Coho, Pink, Chum
0460	Unnamed	LB-13.4	1.5	—	Unknown
0461	Beaver Creek	RB-14.1	5.25	—	(Chin.), Coho, (Chum)
0462	Unnamed	RB-3.35	1.15	—	None
0463	New Pond Creek	RB-14.55	4.65	—	(Coho)
0465	Unnamed	RB-15.4	1.05	—	Unknown
0466	East Fork S. Prairie Cr.	RB-17.0	6.4	—	None
0467	Unnamed	RB-2.3	2.2	—	None
0468	Unnamed	RB-3.4	1.2	—	None
	S. Prairie Cr. cont. as S.Fk. Prairie Cr.	@ mi. 17.01		—	
0470	Unnamed	RB-17.5	1.3	—	None
0471	Unnamed	LB-17.7	1.5	—	None
0472	Unnamed	LB-18.25	2.0	—	None
0473	Unnamed	RB-18.85	2.85	—	None
0474	Unnamed	RB-1.3	1.1	—	None
0475	Unnamed	RB-20.6	1.2	—	None
0476	Unnamed	LB-20.65	1.3	—	None

This section includes the lower 12 miles of South Prairie Creek above its confluence with the Carbon River on the right bank at R.M. 5.9 immediately below the State Highway 162 bridge. Wilkeson Creek is a major tributary along with eight smaller tributaries having a total of 41.9 linear stream miles. The watershed is located near the communities of Wilkeson, Burnett, and South Prairie in Pierce County. Access to this area is by State Highway 162 and by the Spiketon-Wilkeson Road.

Stream Description

From R.M. 12.0 South Prairie Creek generally zigzags for 7 miles to the town of South Prairie where it then turns and flows southwest to its confluence with the Carbon River at R.M. 5.9. Within the upper 4 miles of this section the creek cuts through steep ravine-type terrain, with a confined stream channel. At R.M. 8.0 near the community of Burnett, the hillsides give way to more gently sloping terrain and widening valley floor. From this point downstream the creek flows through well defined channels. The valley floor intermittently broadens and narrows downstream to the mouth. This lower section contains increasing amounts of open farmlands separated by intermittent stands or strips of deciduous trees and brush. Land use is agricultural in the lower valley and logging and mining in the upper watershed.

South Prairie Creek exhibits a moderate gradient throughout the valley floor. The stream contains good shade and cover with overhanging banks and has an average discharge of 250 cfs at the gage at South Prairie. Stream widths vary from 10 to 70 yards. The valley hillsides rise from 500 to 700-foot elevation and are covered with mixed deciduous and coniferous forests. Most of these 12 miles contain good pool-riffle proportions and excellent stream substrate.

Wilkeson Creek is the major tributary within this section and contains 12.3 miles of stream plus 5 smaller tributaries providing an additional 21.3 linear miles. The upper headwaters are formed from the South Fork Gail Creek and from West Fork Gail Creek which originate in the Gleason Hills. This drainage flows northerly through the town of Wilkeson to its confluence with South Prairie Creek at R.M. 6.7. The upper watershed originates in a rather pristine area of mountainous terrain with steep gradient, numerous cascades, and is heavily forested. A steep cascade at R.M. 6.8 is a total barrier to fish passage. The lower stream contains excellent pool-riffle balance and much good gravel substrate. The moderately steep gradient shallows in the lower 3 miles. This stream is well covered with deciduous trees and brush along the banks throughout the entire length.

Salmon Utilization

The lower 8 miles of South Prairie Creek provides the major spawning habitat within the system and this drainage is utilized by chinook, pink, chum, and coho. The lower 6.8 stream miles of Wilkeson Creek provide excellent spawning and rearing habitat, with heaviest usage by coho. Each of the accessible unnamed tributaries receives annual runs of coho and a few are utilized by chum in the lower reaches.

Limiting Factors

The major limiting factor within this drainage section is the natural occurrence of low summer flows that reduce the available rearing area throughout the stream. Flood control measures have been undertaken in the lower stream section including gravel removal, bank erosion controls, and channel changes. Heavy silting and gravel compaction have resulted from these types of operations. Coal waste from former mining operations in the upper Wilkeson watershed has settled in the lower stream. Poaching has always been a serious problem in this lower South Prairie Creek area.

Beneficial Developments

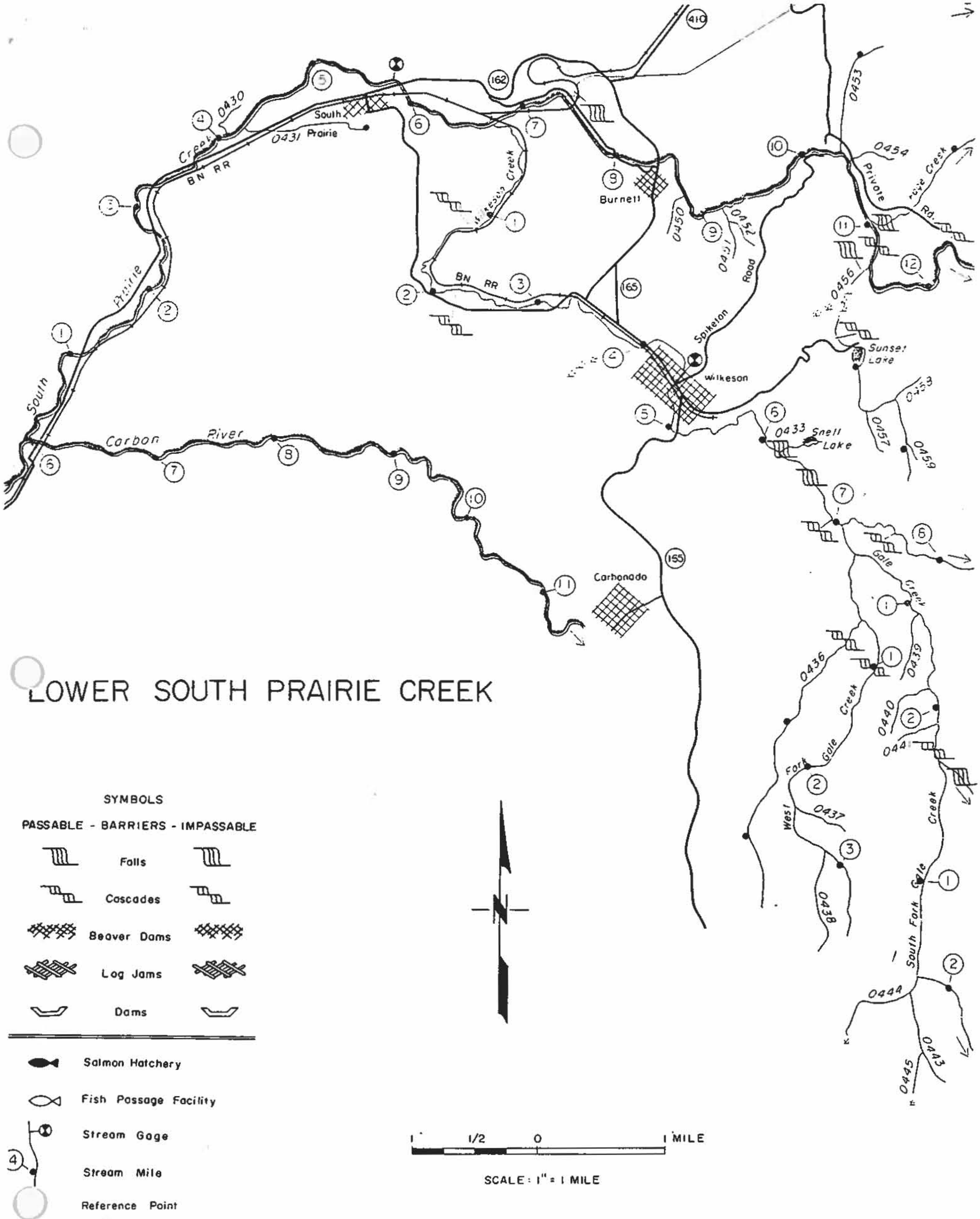
No facility developments or programs have been undertaken within this section to benefit salmon production.

Habitat Needs

A major requirement for maintaining salmon production potential within this drainage section is to preserve existing stream cover and the natural pool-riffle balance. Future mining operations in the upper watershed, particularly for coal, should be monitored closely to preserve the water quality of the area. A good watershed management plan should be developed under the Shorelines Management Act by the local communities to preserve this watershed in its natural state.

PHOTO 10-18. South Prairie Creek has a gentle gradient.

LOWER SOUTH PRAIRIE CREEK



LOWER SOUTH PRAIRIE CREEK
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0413	Carbon River				Chin., Coho, Pink, Chum
0429	S. Prairie Creek	RB-5.9	21.65	—	Chin., Coho, Pink, Chum
0431	Unnamed	LB-4.2	1.0	—	(Coho), (Chum)
0432	Wilkeson Creek	LB-6.7	12.3	—	Chin., Coho, Pink, (Chum)
0434	Gale Creek	LB-7.05	7.7	—	None
0435	West Fork Gale Creek	LB-0.3	3.6	—	None
0436	Unnamed	LB-0.5	2.6	—	None
0442	South Fork	LB-2.4	3.2	—	None
	Gale Creek	LB-2.4	3.2	—	None
0446	Unnamed	LB-5.5	1.4	—	None
0447	Unnamed	RB-5.8	2.0	—	None
0448	Unnamed	RB-8.6	2.6	—	None
0449	Drainage Ditch	RB-7.4	~ 4.15	—	Coho,Pink,(Chum)
0453	Unnamed	RB-10.2	1.1	—	Coho, (Chum)
0455	Page Creek	RB-11.0	2.25	—	Unknown
0456	Unnamed	LB-11.4	2.2	—	(Coho), (Chum)
	Sunset Lake	Outlet-0.85	—	—	
	(Cont. Puyallup 1103)				

WHITE RIVER
Clearwater Area

This section of the White River includes 10 miles of mainstem plus the entire Clearwater drainage and six tributaries to the White River, for a total of 84.35 stream miles. Access along this stretch of river is via the Chinook Pass Highway 410 which parallels the mainstem, and by private logging roads. This entire section of drainage all lies within King County.

Stream Description

The mainstem White River from R.M. 31 to 35 is inundated by the Mud Mountain Dam Reservoir which backs up to approximately R.M. 35.5 above the confluence of the Clearwater River. The stream above this point meanders to R.M. 42.0. There are six tributary streams draining into the White River plus 10.5 miles of Clearwater with some 14 moderate to small tributaries totalling more than 40.45 stream miles. The White River is a glacial stream and shows mountainous characteristics including heavy boulders, rubble, and large gravel, meandering with many channel splits and deep-cut banks. The Clearwater River originates from springs and natural runoff on Bear Head Mountain, and flows northerly 10.5 miles to the confluence with the White River at R.M. 35.3. Approximately a mile and a half downstream is Canyon Creek which originates from small lakes and groundwater runoff from the Three Sisters Mountain Range. It flows northerly 5.8 miles to its confluence with the White River at R.M. 33.8. The other tributary streams include Clay Creek, Cyclone Creek, West Twin, and East Twin creeks. These originate from the slopes of Grass Mountain north of the White River. They all contain steep cascade sections approximately 0.5 mile above their mouths.

The White River has a gradient of approximately 50 feet per mile and contains fast-moving flows. The main river and tributary creeks in the upper portion of this section all show the effects of heavy flood flows and runoffs. The hillside area between Clay Creek and East Twin Creek has been heavily logged in past years. Mostly deciduous trees and brush are found along the river banks and side slopes of the valley with some mixed conifer. Slash burns from logging have left the area barren.

The Clearwater River descends through a narrow, steep, heavily forested valley above R.M. 4.0. The lower valley gradually broadens and the gradient becomes moderate. Heavy rubble predominates in this section with considerable angular rock and gravel in the lower portions of the tributaries. Access is by a private logging road and jeep trail.

Land use is logging and recreation, with minimal development due to the precipitous terrain. Most of the land is owned by Weyerhaeuser Timber Company or other private logging interests. Gravel mining for road construction is also prevalent.

Salmon Utilization

Although salmon are transported and released 10 miles above the dam near Greenwater, the adult chinook and coho still manage to move downstream and into the Clearwater system. Both chinook and coho adults ascend Clearwater River beyond R.M. 5.0. Coho are also known to inhabit the lower 1.5 miles of Canyon Creek. Minimal spawning and rearing area is available within the main White River above the reservoir in this section. Coho can also utilize the lower tributary sections of streams entering the Clearwater River. Juvenile spring chinook and coho rear within the tributaries of this section of river the year around.

Limiting Factors

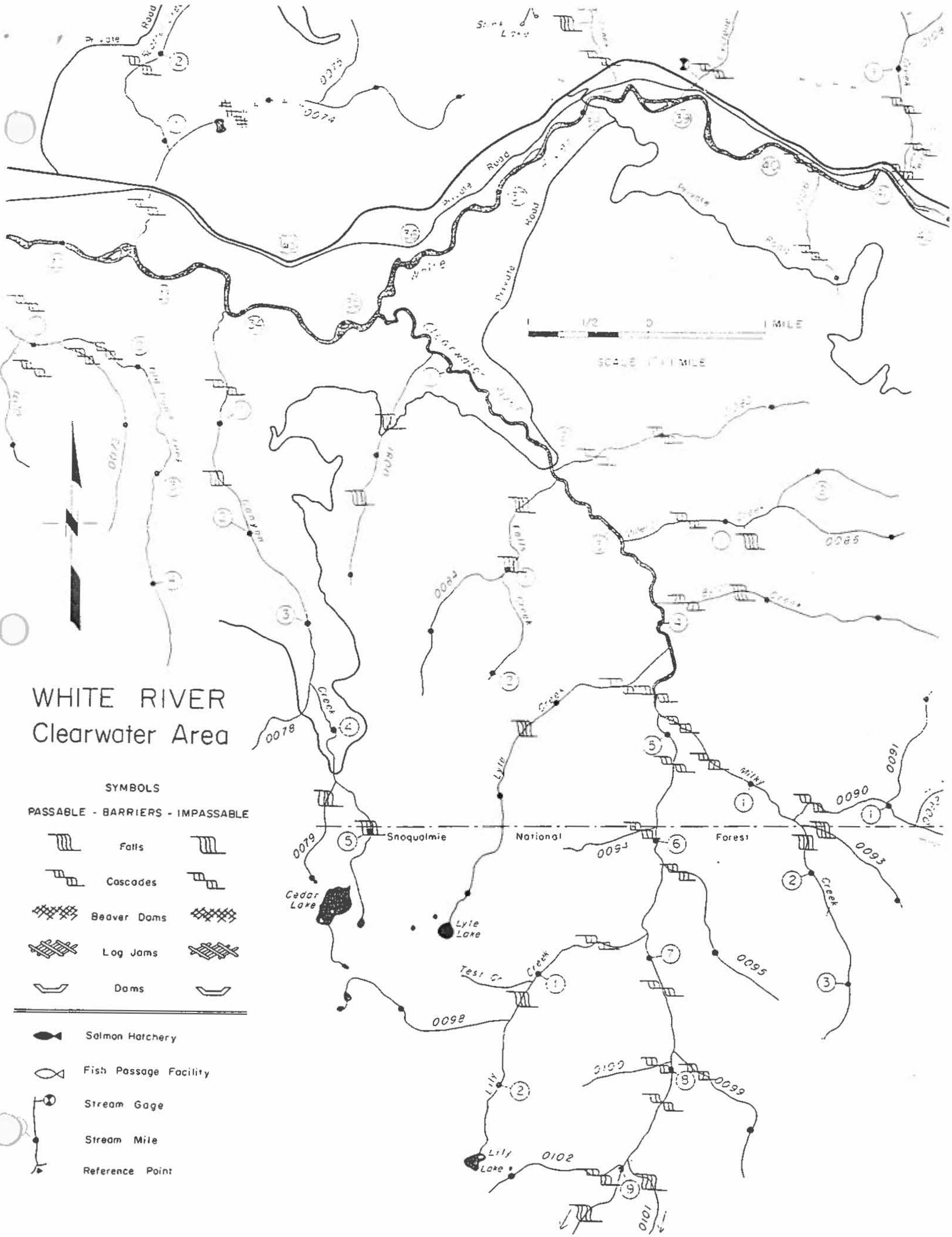
The major limiting factors curtailing salmon production include flooding from snow melt runoff, heavy silt loads from logging operations, large boulders and rubble material throughout the area, low summer flows restricting the available rearing area, limited food supply in glacial atersheds, and extreme cold water temperatures within the river and reservoir. Flash flooding and channel shifting are perhaps the most serious limiting factors impacting salmon production. Road construction and logging within the area have stripped much of nutrients from the land. Flood control measures along the Chinook Pass Highway have also been extensive.

Beneficial Developments

No specific fish facilities or programs have been undertaken within this section of river to benefit salmon production. Hatchery plants of chinook and coho are released into the system to supplement runs that are depleted due to environmental degradation.

Habitat Needs

Coordinated logging agreements between the Weyerhaeuser Timber Company and other private logging companies with the fisheries agencies should be encouraged in order to protect the natural stream habitat within the area. Rehabilitation of streams that have suffered from poor logging practices should be addressed in this agreement. Barren area fry plants into the upper watershed would also be beneficial. Establishment of streambed controls within the mainstem of the White river through this section should be evaluated.


WHITE RIVER
Clearwater Area
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Clearwater
Canyon
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Snoqualmie
National
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Cedar Lake
Lyle Lake
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WHITE RIVER — CLEARWATER AREA
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0031	White River				Chin., Coho, Pink, Chum
0073	Scatter Creek	RB-32.7	5.1	—	Coho
0074	Unnamed	LB-0.9	3.05	—	None
	Unnamed Lake	Outlet-0.5	—	—	
0076	Unnamed	LB-3.85	1.5	—	None
0077	Canyon Creek	LB-33.85	5.8	6.05	Coho
0079	Unnamed	LB-4.45	1.0	—	None
	Unnamed Lake	Outlet-5.8	—	—	
0080	Clearwater River	LB-35.3	10.5	37.8	Chin., Coho
0081	Unnamed	LB-0.75	2.1	—	Coho
0082	Unnamed	RB-2.31	2.35	—	(Coho)
0083	Falls Creek	LB-2.4	2.05	—	(Coho)
0084	Unnamed	LB-1.1	1.5	—	None
0085	Mineral Creek	RB-3.15	2.7	—	(Coho)
0086	Unnamed	LB-1.5	1.15	—	None
0087	Byron Creek	RB-3.8	2.5	—	(Coho)
0088	Lyle Creek	LB-4.2	3.35	—	(Coho)
0089	Milky Creek	RB-4.8	3.55	6.99	(Chin.), (Coho)
0090	Unnamed	RB-1.5	2.8	—	None
0091	Unnamed	RB-0.85	1.1	—	None
0092	Unnamed	RB-1.2	1.1	—	None
0093	Unnamed	RB-1.6	1.1	—	None
0095	Unnamed	RB-6.2	1.7	—	Unknown
0096	Lily Creek	LB-6.8	2.7	—	(Coho)
0098	Unnamed	LB-1.5	1.6	—	None
	Lily Lake	Outlet-2.7	—	—	
0099	Unnamed	RB-7.85	1.5	—	Unknown
0101	Unnamed	RB-8.9	2.2	—	None
0102	Unnamed	LB-8.95	1.2	—	None
0103	Clay Creek	RB-38.2	1.7	—	None
0105	Cyclone Creek	RB-38.95	2.1	—	None
0106	Unnamed	LB-40.6	1.2	—	None
0107	W. Twin Creek	RB-41.4	2.7	—	None
0108	Unnamed	LB-1.3	1.8	—	None
0109	E. Twin Creek	RB-41.5	2.65	—	None

WHITE RIVER — CLEARWATER AREA
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0110	Unnamed	LB-1.0	1.3	—	None
0111	Unnamed	LB-1.9	1.0	—	None
	(Cont. Puyallup 503)				

MASHEL RIVER DRAINAGE

This section includes the entire Mashel River drainage with over 20 miles of mainstem plus seven tributaries providing another 67 linear stream miles. The majority of this drainage is located east of Eatonville in southern Pierce County. Access is via the Mount Rainier National Park Highway, and various county and private roads out of Eatonville.

Stream Description

From mountain slopes about ten miles east of Eatonville, the Mashel winds its way more than 20 miles west and southwest to enter the Nisqually River (R.M. 39.6) northwest of La Grande. Principal tributaries are Busy Wild and Beaver creeks in the upper drainage, and the Little Mashel River in the lower reaches.

Through the majority of its drainage the Mashel cuts through a shallow, relatively narrow, steep-sloped, forested valley. A number of short, canyon-ravine stretches are encountered. Only in the Eatonville vicinity does the valley broaden to any extent, and this extends for only about a mile. Cover is mainly mixed deciduous and coniferous growth over the upper drainage, and predominantly deciduous trees and brush below. Principal land use is timber production with some agriculture and recreation. Development is sparse with a few scattered rural residences, generally downstream from the town of Eatonville.

From its headwaters downstream about six miles to Busy Wild Creek (R.M. 14.5) the Mashel has a fairly steep gradient, with a few falls, and numerous cascades. These are interspersed with some fast riffles and a few pools. In its narrowly confined channel the bottom is largely boulder and rubble, some bedrock, and only occasional gravel-rubble riffles. Its banks are fairly steep-sided earth or rock cuts, maintaining little cover and much of this upper area has been clear-cut.

Below Busy Wild Creek for approximately 9 miles, the river's gradient is moderately steep. The channel remains quite confined, with fall season flows covering 6 to 12 yards. It is mostly a fast riffle stretch with some cascades and a few relatively large pools. Stream-side cover is dense deciduous trees and underbrush.

In the two miles below Eatonville, the river has a moderate gradient with relatively good pool-riffle stream conditions. The channel is fairly stable with some braiding. Fall season flows range from 8 to 15 yards in width. Here, the bottom is predominantly rubble and gravel, with a few scattered boulders. The banks are low earth cuts or gravel-rubble side beaches. Cover consists of moderate stands or strips of mostly deciduous growth.

Through the lower 4 miles, the Mashel cuts through a narrow, shallow valley, with alternating moderate to moderately steep gradients. The confined channel width ranges from 6 to 12 yards during the fall. The bottom is composed mostly of rubble and gravel, with some bedrock and a few boulder-strewn sections. This area contains fast riffle-type character with occasional good quality pool-riffle stretches, particularly over the lower half-mile. Stream banks are usually natural earth or rock cuts, and a few relatively narrow rubble-gravel beaches. Cover is mainly thick deciduous growth.

Busy Wild Creek has a moderate gradient for nearly 5 miles, with relatively good pool-riffle balance and predominantly gravel-rubble bottom. Its cover is moderate growths of deciduous and low coniferous trees. Beaver Creek and the

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Busy Wild Creek has a moderate gradient for nearly 5 miles, with relatively good pool-riffle balance and predominantly gravel-rubble bottom. Its cover is moderate growths of deciduous and low coniferous trees. Beaver Creek and the Little Mashel River each have falls very near their mouths. The areas above the falls contain moderate gradient stream character for most of their upper stream courses. Most smaller tributaries to the Mashel exhibit steeper mountain-type stream character over much of their lengths, with little access or favorable salmon habitat.

Salmon Utilization

The accessible reaches of the Mashel drainage are utilized primarily by chinook and coho, with pink extending to the Eatonville vicinity. Chum are confined primarily to lower river stretches. Chinook spawn principally in the main river with coho extending into accessible tributaries. Juvenile salmon rearing takes place throughout the accessible stream reaches, with coho having year around habitation.

Limiting Factors

The canyon above Eatonville creates fish passage delays, particularly during low flow periods. This is sometimes compounded by the buildup of logging debris in the stream. Also, flash flooding and unusually heavy siltation are considered problems. Poaching is sometimes prevalent in the lower half-mile.

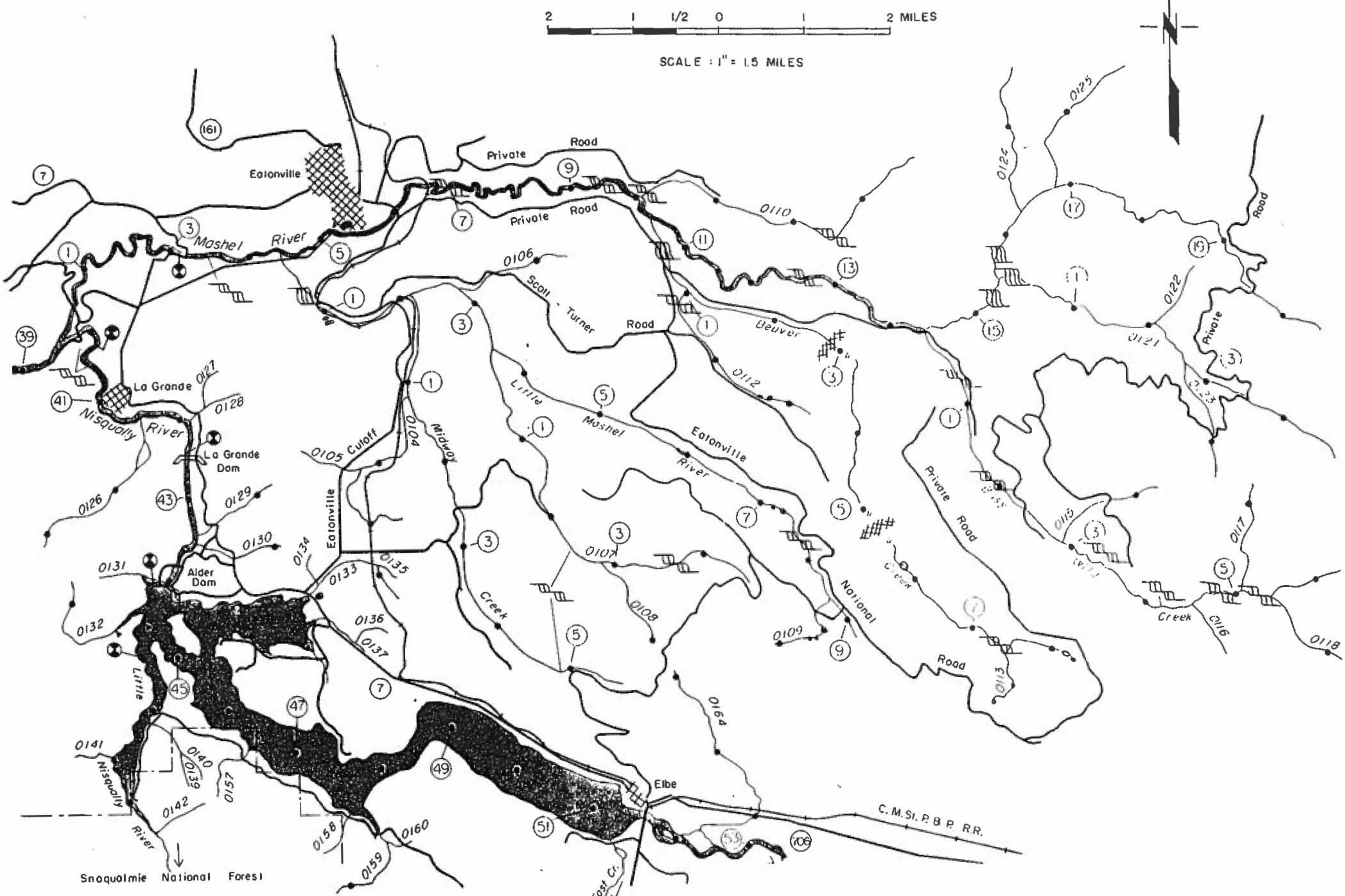
Beneficial Developments

Log jam removal and planting of hatchery-reared fish are the only projects that are performed benefiting salmon production in this section.

Habitat Needs

The principal requirement is to maintain stream and streambed conditions in as near natural state as possible.

MASHEL RIVER DRAINAGE



Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0008	Nisqually River				
0101	Mashel River	RB-39.6	20.5	83.5	Chin., Coho, Pink, (Chum)
0102	Little Mashel R.	LB-4.35	9.2	—	Coho
0103	Midway Creek	LB-2.1	5.6	7.24	None
0104	Unnamed	LB-1.2	2.4	—	None
0106	Unnamed	RB-2.8	1.3	—	None
0107	Unnamed	LB-3.6	4.7	—	None
0108	Unnamed	LB-2.9	1.1	—	None
0109	Unnamed	LB-8.6	1.0	—	None
0110	Unnamed	RB-10.1	3.75	—	Unknown
0111	Beaver Creek	LB-10.4	8.3	—	(Coho)
0112	Unnamed	LB-0.95	2.35	—	None
0114	Busy Wild Creek	LB-14.5	7.8	—	(Chin.), (Coho)
0115	Unnamed	RB-2.9	1.3	—	Unknown
0117	Unnamed	RB-5.1	1.15	—	None
0118	Unnamed	LB-5.45	2.7	—	None
0119	Unnamed	RB-6.4	1.4	—	None
0121	Unnamed	LB-15.6	4.75	—	None
0123	Unnamed	LB-2.7	1.4	—	None
0124	Unnamed	RB-16.4	1.7	—	None
0125	Unnamed	RB-16.85	1.9	—	None

DESCHUTES RIVER
Tumwater Area

This segment covers the lower 19 miles of the Deschutes River, plus 6 tributaries totalling nearly 24 linear miles of stream drainage. The area extends from the Olympia-Tumwater vicinity southeast toward the town of Rainier in central Thurston County, and is accessible via county roads.

Stream Description

From the vicinity of the Military Road crossing (R.M. 19.5), about 2.5 miles west of Rainier, the Deschutes River meanders in a northwest direction more than 17.5 miles to Tumwater Falls, from there into Capitol Lake, then north for about 1.5 miles to salt water at the southern tip of Budd Inlet. Six tributaries enter the Deschutes before it reaches Capitol Lake, the principal one being Spurgeon Creek. Percival Creek enters directly into Capitol Lake (see Deschutes-101).

The Deschutes River, plus a majority of its tributaries, flows over moderate to gently sloped terrain. Adjacent land is primarily agricultural, with scattered residential development. Intermittent sections have been cleared for grazing or annual crop production. Considerable land remains in second or third growth forest consisting of mixed deciduous and conifer growth. Increasing numbers of rural and suburban dwellings, plus a large golf course are encountered as a stream moves toward more heavily populated Tumwater and Olympia. Suburban development, particularly of summer and recreational housing, is increasing along the upper portion of this section. Considerable recreation use is also made of this area.

The Deschutes River meanders a great deal, offering a moderate gradient with a good to excellent pool-riffle balance. Channel widths range from 6 to over 20 yards, with numerous broad, clean gravel riffles. Bottom composition is mainly gravel and rubble, and is generally quite stable. Shorelines consist mainly of broad, gently sloping gravel beaches and low, steep slope earth banks. A few higher, steep, unprotected earth banks are found along this stretch. Along some stream sections, the bank has been contoured and riprapped for protection, particularly over the lower 4-5 miles. Stream-side cover consists of intermittent stands or strips of deciduous growth, interspersed by cleared farm or recreational use of land.

Capitol Lake is a shallow, 300 acre impoundment approximately 1.5 miles in length. The lake is situated in a relatively shallow basin, its shoreline consisting of riprap along the roads or steep slope, heavily wooded, sparsely developed hillsides.

Salmon Utilization

The lower Deschutes River, including Capitol Lake, is the major transportation reach for salmon using this system. The river in this section provides the main spawning habitat for chinook salmon in the entire Deschutes drainage. Coho also spawn here, as well as in each of the accessible tributaries. Juvenile chinook salmon rear through the spring and summer within these waters, while juvenile coho maintain year around residence. In addition to the natural fish production, highly significant numbers and pounds of chinook are reared in Capitol Lake by feeding artificial diets.

Limiting Factors

The major factors limiting salmon production in this section include warm summer temperatures, siltation in Capitol Lake and the lower 2-3 miles of river, low summer-fall flows in the Deschutes and its tributaries, plus streambed and bank alterations associated with land development and erosion control.

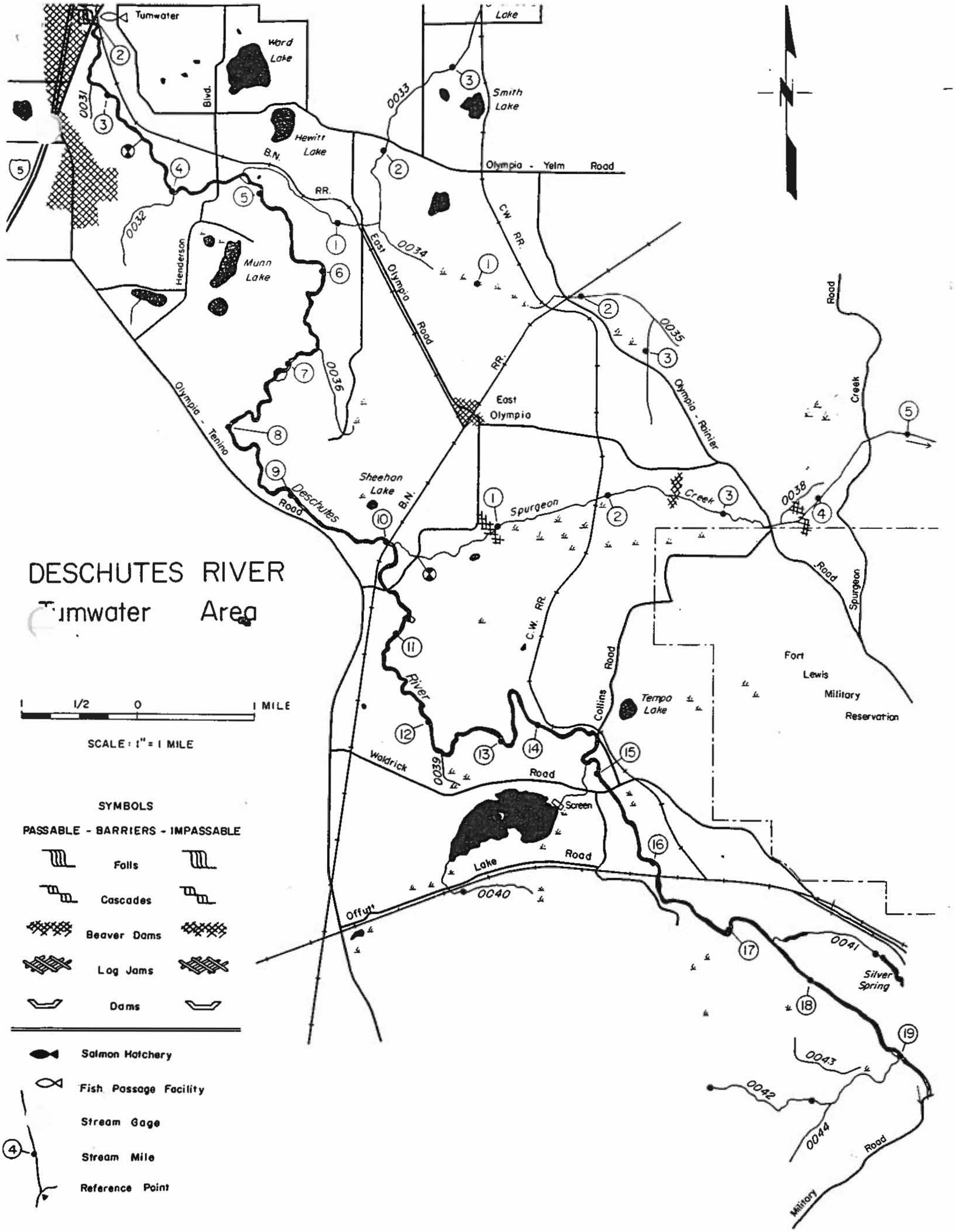
Beneficial Development

This section of the Deschutes River has two fish passage facilities. One is located at the dam impounding Capitol Lake, providing passage from salt to fresh water. The other is at Tumwater Falls consisting of three ladder facilities providing access to the upper river. Trapping facilities are available at the upper Tumwater ladder where chinook eggs are taken for artificial production. Hatchery produced juvenile chinook are planted into Capitol Lake, many of which are fed artificial diets and other that utilize the lake's natural productivity.

Habitat Needs

Any alterations of the existing environment in this section must be compatible to fish requirements. Capitol Lake should be reclaimed by selective dredging and future sedimentation or land fills carefully controlled to maintain present and future production.

PHOTO 13-11. Typical river section above Tumwater Falls.



DESCHUTES RIVER
Tumwater Area
1 1/2 0 1 MILE
SCALE: 1" = 1 MILE
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Tumwater
Ward Lake
Lake
Smith Lake
Hewitt Lake
Blvd.
B.N. RR.
Olympia - Yelm Road
CW RR.
Munn Lake
Henderson
East Olympia Road
East Olympia
Olympia - Tenino Road
Olympia - Rainier
Sheehan Lake
Deschutes River
Spurgeon Creek
Road
Creek
Spurgeon Road
C.W. RR.
Collins Road
Tempo Lake
Fort Lewis Military Reservation
Waldrick Road
Screen
Lake Road
Offutt
Silver Spring
Military Road
0031
0032
0033
0034
0035
0036
0038
0039
0040
0041
0042
0043
0044

DESCHUTES RIVER — TUMWATER AREA
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River			—	Chin., Coho, (Chum)
0033	Unnamed	RB-4.7	4.15	—	Coho
0034	Unnamed	LB-1.4	3.6	—	Unknown
	Little Chambers Lake	Outlet-3.65	—	—	
	Chambers Lake	Outlet-4.15	—	—	
0037	Spurgeon Creek	RB-10.01	5.8	—	(Chin.), Coho
0040	Unnamed	LB-14.8	2.6	—	Coho
	Offutt Lake	Outlet-0.5	—	—	
0041	Unnamed (Silver Springs-local name)	RB-17.5	1.0	—	Coho
0042	Unnamed	LB-18.9	2.0	—	Coho

(Cont. Deschutes 303)

DESCHUTES RIVER
Lake Lawrence Area

This section covers approximately 12 miles of the main-stem Deschutes River, plus 4 smaller tributaries providing more than 17 additional stream miles. The area is located just a few miles south of the town of Rainier in southeastern Thurston County. Access is via Highway 507 out of Rainier, the Vail Loop Road, and private logging roads extending into the drainage.

Stream Description

From a point about a half-mile above Pipeline Creek (R.M. 31.0) the Deschutes River flows generally west-northwest for 12 miles, passing beneath the Rainier-Tenino Highway about 2.5 miles southwest of Rainier and Military Road immediately north of Lake McIntosh. Principal tributaries include Pipeline Creek, Lake Lawrence Outlet, Reichel Lake drainage, and one small unnamed spring feed stream (R.M. 20.9). Lake McIntosh does not provide a true surface connection with the Deschutes.

The Deschutes channel winds across a relatively broad, gently sloping valley floor through this section. The same is true with tributaries, except for the upper, steeper slope of Pipeline Creek and of one feeder tributary to the Reichel Lake drainage. The Deschutes skirts along the north rim of the valley bordered by mountainous terrain, and the steeper side slopes densely forested with mostly conifer timber. The valley floor has cleared farmland with intermittent stands of mixed deciduous and conifer growth. Aside from the small community of Vail, this section is developed mostly with rural-type residences and small summer home development along the river. Forested slopes on either side of the floor are managed principally for logging with numerous cleared sections, particularly over the upper drainage. Also, moderate to heavy recreation use is made of the area.

The Deschutes channel presents a moderate gradient through this section, with only occasional reaches showing steeper conditions. Stream widths range from 4 to 16 yards, averaging about 10 yards. A good pool-riffle balance exists and stream bank cover is generally dense, thus promoting exceptional rearing conditions through much of the area. The stream bottom is quite stable, comprised mainly of large rubble, with boulders and gravel interspersed across most riffles. Most pools are quite shallow and contain sand and fine gravel bottom material. Stream banks are generally quite low and stable and comprised of gently sloping gravel beaches with a few sharp earth cuts. Stream-side cover consists of moderate to dense stands or strips of deciduous trees and underbrush.

Salmon Utilization

This section of the Deschutes provides transportation for adult and juvenile salmon that utilize the upper drainage. Limited spawning area in this section is used largely by chinook and by some coho which also use the accessible tributaries. Juvenile chinook rear through the spring months in these waters with coho inhabiting the stream year around, particularly in stretches of dense stream-side cover.

Limiting Factors

Factors which limit salmon production in this section include low summer flows in the main channel as well as in the small feeder streams, stream bank clearing through logging or development projects, removal of streambed gravel, and poaching of adult salmon.

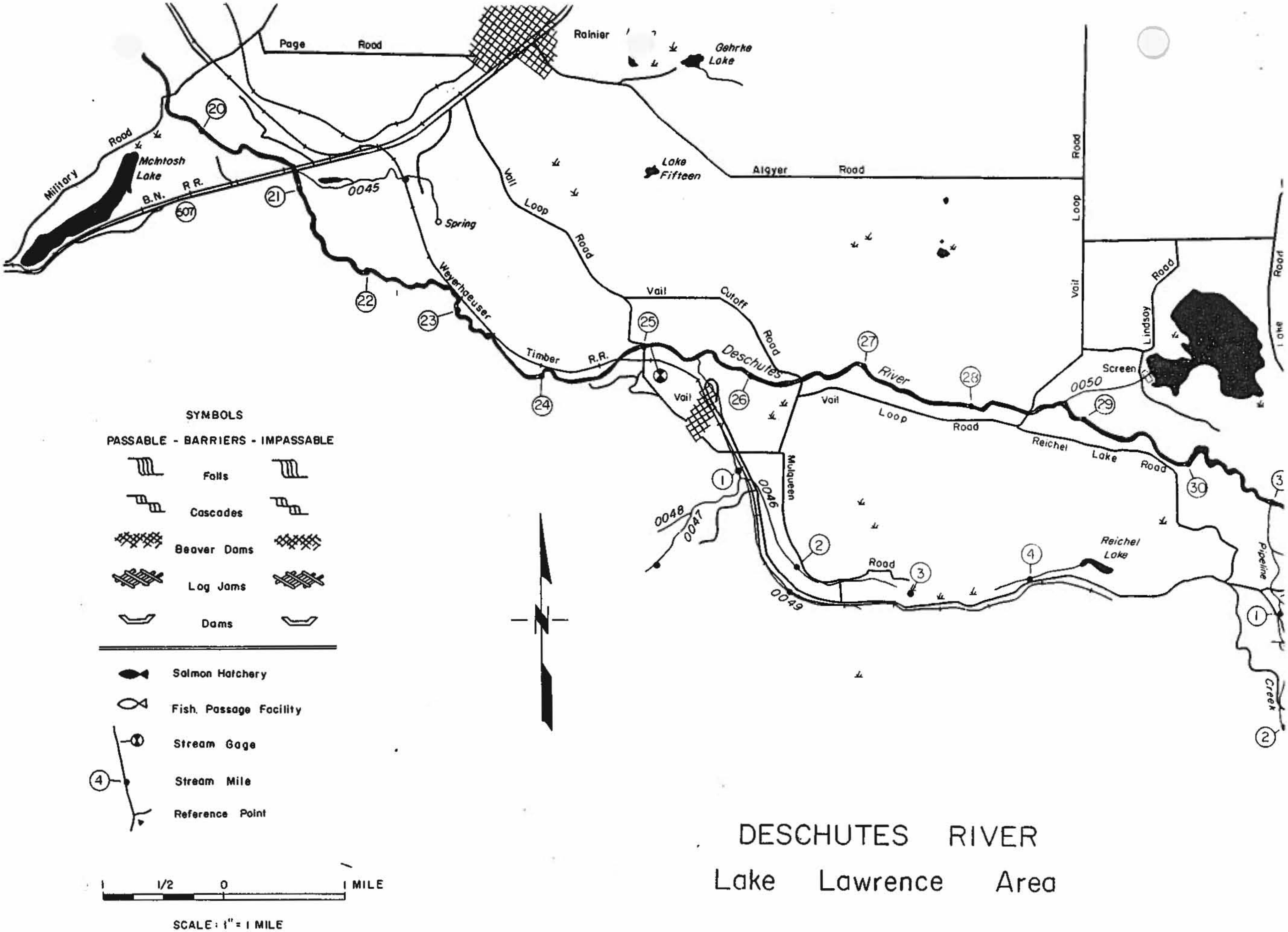
Beneficial Developments

No facilities or programs have been undertaken within this area to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production potential within this drainage section include preserving the existing stream bank cover, and curtailment of gravel removal projects. Logging plans and operations should be coordinated with Fisheries' needs to reduce the impact on the natural stream habitat.

PHOTO 13-12. Good pool riffle section in middle Deschutes River.



DESCHUTES RIVER
Lake Lawrence Area

DESCHUTES RIVER — LAKE LAWRENCE AREA
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River				Chin., Coho, (Chum)
0045	Unnamed	RB-20.85	1.6	—	Coho
0046	Unnamed	LB-25.5	4.5	—	Coho
0047	Unnamed	LB-1.1	1.1	—	Unknown
0049	Unnamed	LB-1.15	1.6	—	(Coho)
	Reichel Lake	Outlet-4.5	—	—	
0051	Pipeline Creek	LB-31.0	2.8	—	Coho
0052	Unnamed	RB-0.5	1.2	—	Coho
0053	Hull Creek	RB-0.9	2.0	—	(Coho)
	(Cont. Deschutes 403)				

DESCHUTES RIVER
Headwaters

This drainage section encompasses the entire upper Deschutes River including nearly 18 miles of mainstem, plus 21 tributaries adding nearly 92 stream miles. The area is located about six miles southwest of Alder Lake in eastern Thurston County. Access is available by private logging roads southeast of Rainier and the small community of Vail. The upper reaches of some tributaries, plus the upper main Deschutes, from just below Buck Creek, are within Snoqualmie National Forest.

Stream Description

From its mountain headwater southeast of Alder Lake, the Deschutes flows generally north for nearly seven miles to its major tributary, the Little Deschutes River (R.M. 42.5). From here it travels mainly west for more than six miles to the vicinity of Fall Creek (R.M. 35.3), then generally northwest toward Pipeline Creek (R.M. 31.0). In addition to the Little Deschutes River and Fall Creek, principal tributaries entering within this section include Lincoln, Thurston, Johnson, Huckleberry, and Mitchell creeks.

In this section, the Deschutes channel, as well as the majority of its tributaries, fall over mostly steep terrain with the streambeds confined by relatively narrow valleys. Adjacent slopes are quite steep and most are densely forested. Over the lower 3-4 miles of this section the Deschutes moves out onto a more gently sloping, wider valley floor. Here the adjacent hillsides are still densely forested, having mixed deciduous and conifer growth. Practically no development has taken place in the upper watershed, and only widely separated farms and a few recreational homes are located along the lower 5-6 miles.

The Deschutes River presents two slightly different environment types in this section. Above Deschutes Falls (R.M. 41.1), the gradient is moderately steep, in some sections presenting a series of short cascades. Stream widths range from 2 to 12 yards, averaging about seven yards. There are relatively high proportions of fast riffle and rapids sections. Pools, although somewhat scarce, are generally quite deep. The stream bottom is predominantly rubble and boulder with some lengthy sections of bedrock. Stream banks have moderate to dense conifer and deciduous growth, providing good to excellent cover for much of the area.

Below Deschutes Falls the channel gradient is mostly moderate, with only occasional rapid or cascade stretches. Stream widths range from 4 to over 17 yards, averaging near 10 yards. A good pool-riffle balance prevails, with most pools being quite deep and well shaded. The stream bottom is predominantly clean rubble and gravel, with only a few sections having a large proportion of boulders. Stream banks are mostly low and sharp cut, containing dense stands of mixed deciduous and conifer growth. The channel is well shaded and quite stable.

Virtually all tributaries entering the Deschutes in this section exhibit a swift-flowing character. Boulders and cascades predominate, with only the lower reaches of tributaries entering below Deschutes Falls offering relatively stable gravel and rubble bottoms, and fairly good pool-riffle conditions.

Salmon Utilization

Salmon use within this section is restricted to the mainstream river below Deschutes Falls, and to the lower reaches of tributaries entering just below the falls. The river receives scattered concentrations of chinook spawning, primarily in the lower 5 or 6 miles below Mitchell Creek. Some coho spawning takes place in the main channel up to the falls, as well as in the accessible portions of lower tributaries. Juvenile rearing occurs primarily in the main channel, and in those tributaries that maintain adequate summer flows. Juvenile chinook rear through the spring months, with coho inhabiting these waters year-round.

Limiting Factors

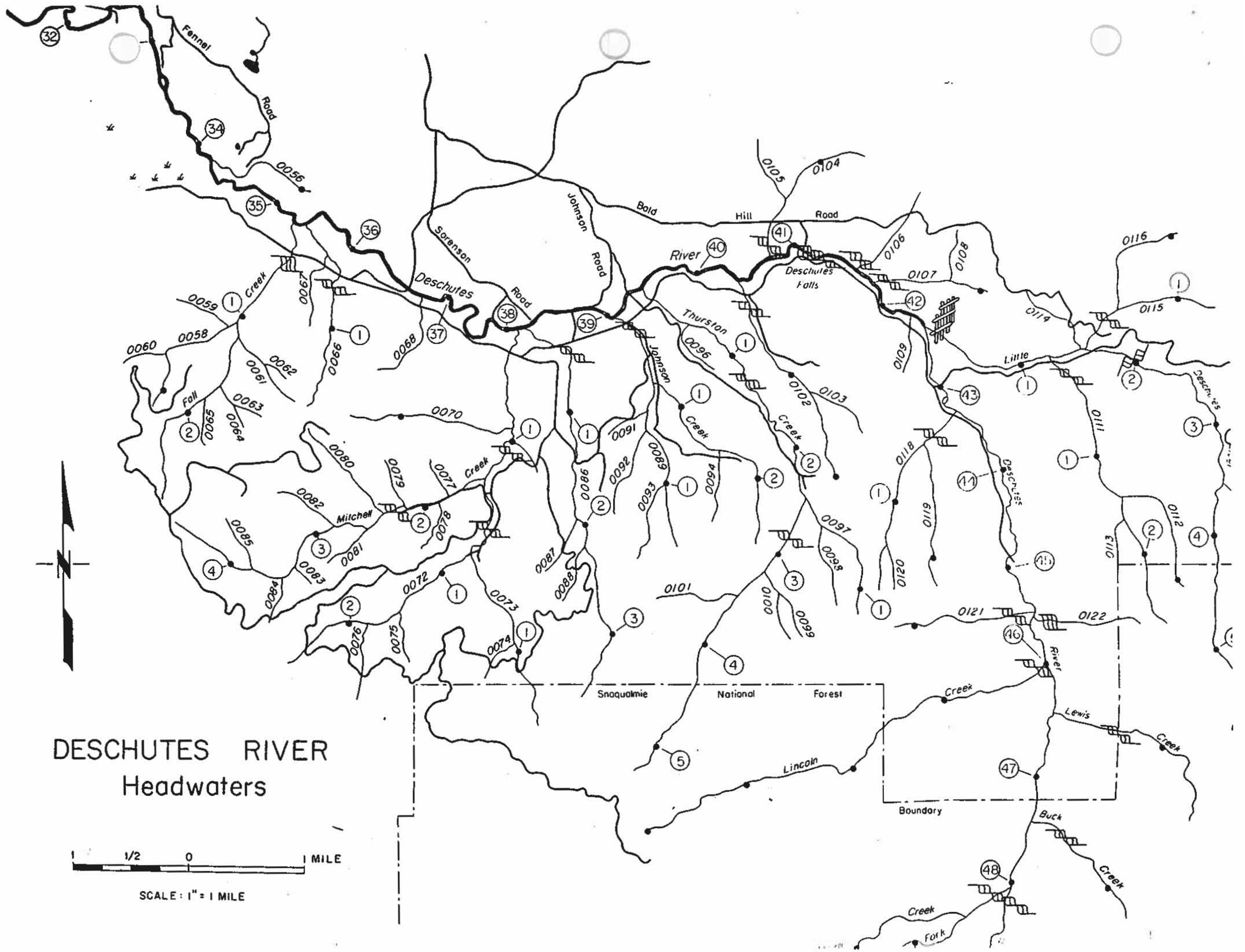
The principal factors limiting salmon production in this section include the total barrier at Deschutes Falls, and the occurrence of low summer flow conditions. Above Deschutes Falls additional cascades and falls, plus the general steep gradients, limit the salmon production potential. Clear-cut section logging and associated road building, along with occasional gravel removal operations, serve as further limitations to salmon production within this upper drainage.

Beneficial Developments

No other facilities, projects, or programs have been undertaken within this section to directly benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production potential of the upper Deschutes drainage include preserving existing streamnbank cover and curtailment of gravel removal and stream channel alterations. Replacement of stream-side cover along reaches already cleared would be highly desirable.



DESCHUTES RIVER
Headwaters

DESCHUTES RIVER — HEADWATERS
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River				Chin., Coho, (Chum)
0056	Unnamed	RB-34.2	1.1	—	Unknown
0057	Fall Creek	LB-35.3	2.9	—	Coho
0058	Unnamed	LB-1.1	1.2	—	None
0066	Unnamed	LB-35.4	1.7	—	Coho
0069	Mitchell Creek	LB-38.15	4.6	—	(Chin.), Coho
0070	Unnamed	LB-0.9	1.4	—	Unknown
0072	Unnamed	RB-1.4	2.8	—	None
0073	Unnamed	RB-0.75	1.7	—	None
0086	Unnamed (Huckleberry Cr.)	LB-38.2	3.6	—	(Chin.), Coho
0089	Johnson Creek	LB-39.1	2.6	—	(Coho)
0090	Unnamed	LB-0.7	1.7	—	None
0095	Thurston Creek	LB-39.4	5.3	—	(Chin.), Coho
0097	Unnamed	RB-2.5	1.2	—	None
0102	Unnamed	LB-40.4	2.0	—	(Coho)
0104	Unnamed	RB-40.7	1.4	—	Unknown
0107	Unnamed	RB-41.8	1.0	—	None
0110	Little Deschutes R.	RB-42.5	5.7	7.89	None
0111	Unnamed	LB-1.2	2.7	—	None
0112	Unnamed	RB-1.5	1.1	—	None
0115	Unnamed	RB-1.55	1.4	—	None
0116	Unnamed	RB-0.5	1.0	—	None
0117	Unnamed	RB-3.5	1.2	—	None
0118	Unnamed	LB-43.3	1.8	—	None
0119	Unnamed	RB-0.4	1.3	—	None
0121	Unnamed	LB-45.45	1.2	—	None
0123	Lincoln Creek	LB-46.0	4.0	—	None
0124	Lewis Creek	RB-46.5	1.7	—	None
0125	Buck Creek	RB-47.4	1.4	—	None
0126	W. Fk. Deschutes R.	LB-48.0	2.7	—	None
0127	Thorn Creek	LB-0.4	1.8	—	None
0128	Ware Creek	RB-48.6	1.0	—	None
0129	Hard Creek	RB-49.0	1.1	—	None
0130	Mine Creek	RB-49.6	1.1	—	None

BLACK RIVER

Black River originates in Black Lake southwest of Olympia. Its total drainage includes an estimated 136 square miles. There are 28.0 miles of mainstem channel and 15 tributaries providing an additional 84.0 miles of stream drainage.

Stream Description

Black River flows in a southwesterly direction out of Black Lake through the town of Littlerock. The course turns west near Rochester and continues in this direction to its confluence with the Chehalis River. A number of tributaries enter the Black River channel. These include Bloom's Ditch, Dempsey, Salmon, Waddell, Beaver, and Mima creeks, in addition to a few smaller unnamed streams.

The eastern portion of the Black River watershed is generally gentle hills and prairie land. Most of the prairie and some of the moderately sloping hills are presently utilized for agriculture. Some prairie farmlands also border the west side of Black River for a distance of up to 3 miles. The Black Hills, rising to over 2,500 feet, form the major portion of the westerly watershed. The Black Hills are forested with second -growth conifers. Some second-growth logging is underway.

Black Lake is heavily developed as a residential area as is Scott Lake on a Black River tributary. Other residential areas include Littlerock and Rochester. Numerous rural farm houses are located throughout the lowlands of the watershed.

Much of the Black River channel is almost entirely pool area. Pool-riffle areas are found near Littlerock and in the lower 7 miles. The channel width ranges from 5 to 30 yards. Bottom material is mostly gravel and rubble in the swifter flowing sections, and mud and sand in the long, quiet pool areas. Plant and algal growth is common in these reduced-velocity areas. Stream-side vegetation is mostly of deciduous brush and provides good stream bank cover.

Salmon Utilization

The Black River drainage has a significant run of coho and a small run of chinook. The watershed formerly supported large chum runs; however, recent surveys have indicated that this species may now be totally lacking. Black River provides transportation and rearing area for coho. Coho distribution in the watershed is nearly unlimited. A few barriers exist on the upper reaches of the tributaries, but for the most part do not block major production areas. Chinook spawning is known to occur in the river near Littlerock from mile 16.0 to 17.3 and likely occurs from mile 0.0 to 7.0. All of the mainstem Black River and at least 47.5 miles of tributaries are presently accessible for salmon production.

Limiting Factors

Chinook production in the mainstem of Black River is limited by a lack of good quality spawning area. Chinook spawning is not known to occur in any of the tributaries. Low summer flows influence coho production in several of the tributary streams. Low flow areas include Beaver, Salmon, and Dempsey creeks, and Bloom's Ditch. Low flows, particularly in Beaver Creek, are further diminished by irrigation diversions. Summer water temperatures in the lower reaches of Black River are quite high and have an adverse effect on juvenile rearing. The lower river also has a large population of predacious fishes which prey heavily on rearing juveniles and smolts. The upper reaches of Mima Creek and its tributaries are severely silted from past logging operations. Beaver dams on Beaver Creek and several Mima Creek tributaries prevent coho from utilizing minor potential production areas. A water diversion dam on Mima Creek may periodically delay adult coho and undoubtedly blocks chum.

Beneficial Developments

No hatchery facilities are maintained in this drainage. Streams periodically receive plants of coho fry and yearlings. A water diversion dam on Blooms' Ditch is equipped with a fishway.

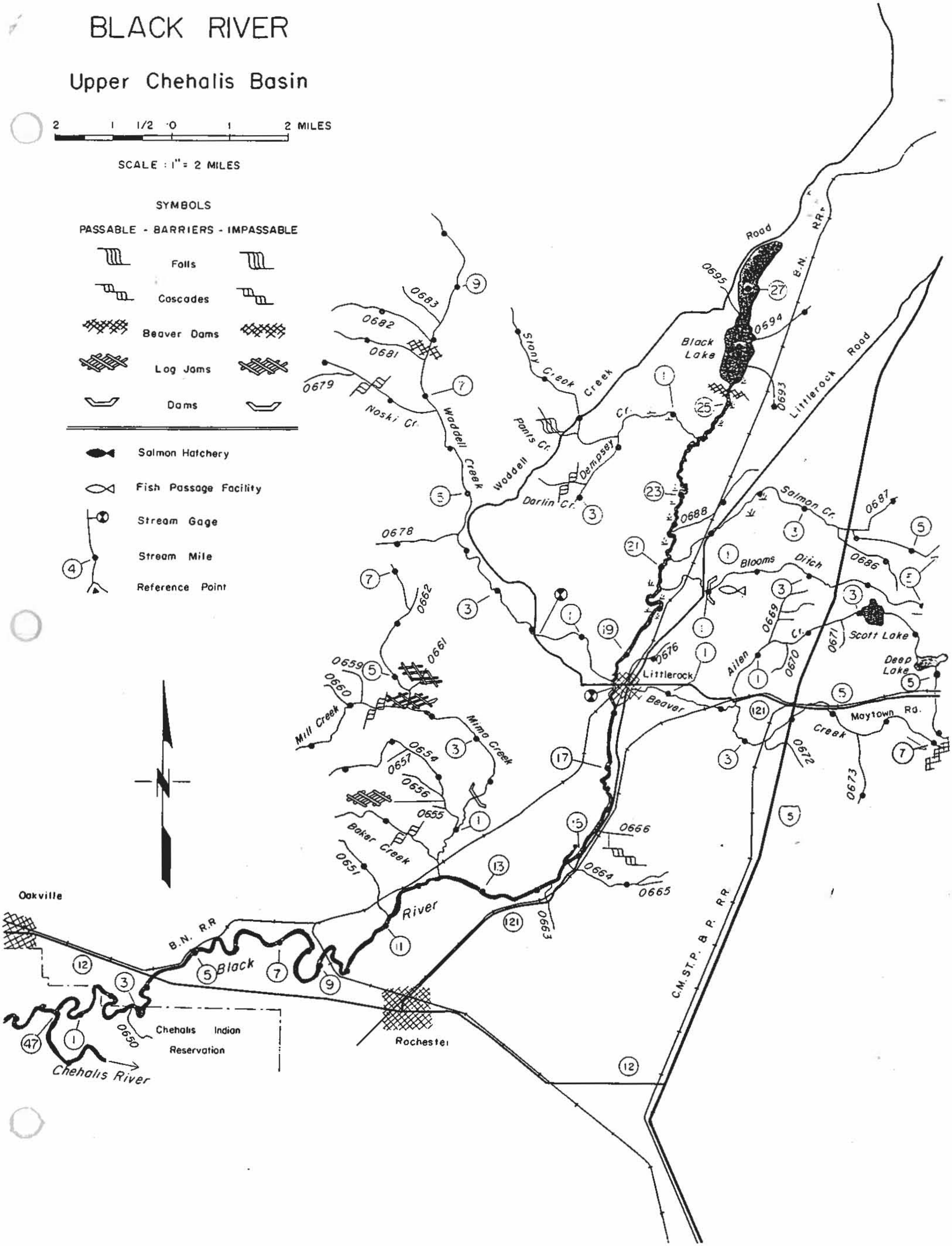
Habitat Needs

Maintenance of salmon runs in the Black River drainage will require strict controls on future development. Residential and summer-home development is likely to expand rapidly on the upper watershed, particularly on Beaver and Dempsey creeks. Logging of second-growth timber and associated road construction in the western half of the drainage could severely damage coho production if proper steps are not taken to prevent deterioration of water and streambed quality.

PHOTO 22-21. Fishway on Blooms Ditch diversion dam.

BLACK RIVER

Upper Chehalis Basin



BLACK RIVER
Chehalis Basin — WRIA 22 & 23

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0190	Chehalis River				
0649	Black River	RB-47.0	28.0	136.0	Coho,Chum,Chin.
0651	Unnamed	RB-11.15	1.75	—	Coho
0652	Mima Creek	RB-12.4	7.15	15.1	Coho
0653	Baker Creek	RB-0.3	1.9	—	Coho
0654	Unnamed	RB-1.0	3.3	—	Coho
0658	Mill Creek	RB-4.3	2.3	—	None
0664	Unnamed	LB-14.85	1.8	—	Coho
0667	Beaver Creek	LB-18.1	11.4	—	Coho
0668	Allen Creek	RB-2.3	6.3	—	Coho
0669	Drainage Ditch	RB-1.25	~ 2.1	—	
	Scott Lake	Outlet-3.0	—	—	
	Deep Lake	Outlet-4.5	—	—	
0673	Unnamed	LB-5.6	1.2	—	Coho
0674	Unnamed	LB-7.7	1.6	—	Coho
0675	Unnamed	LB-10.4	1.0	—	Coho
0676	Unnamed	LB-18.11	1.4	—	Unknown
0677	Waddell Creek	RB-18.5	10.4	18.2	Coho
0678	Unnamed	RB-4.3	1.4	—	Unknown
0679	Noski Creek	RB-6.7	2.0	—	Coho
0681	Unnamed	RB-7.6	1.6	—	Coho
0682	Unnamed	RB-8.0	1.85	—	Coho
0684	Bloom's Ditch	LB-20.6	8.5	—	Coho
	Pitman Lake	Outlet-6.5	—	—	
0685	Salmon Creek	LB-21.3	7.4	—	Coho
0686	Unnamed	LB-3.65	1.7	—	Coho
0687	Unnamed	RB-3.9	1.1	—	Unknown
0688	Unnamed	LB-21.8	1.8	—	Unknown
0689	Dempsey Creek	RB-24.2	3.05	—	Coho
0690	Stony Creek	LB-1.9	3.3	—	Coho
	Black Lake	Outlet-25.3	—	—	
0693	Unnamed	LS-25.6	1.1	—	Unknown
0694	Unnamed	LS-26.1	1.3	—	Unknown

Appendix BB

Quality Assurance Information Report Form

Please see cover letter for instructions. Answer as many of these questions as you can. This is not a test, and not all questions need to be answered affirmatively or in a certain way for a dataset to be included in the model. The Water Type Committee will review the information on a dataset-by-dataset basis.

A) Who collected the data?

1)Agency or company. Include address:

Washington Trout
PO Box 402
Duvall, Washington 98019

2)Principal investigator. Name, professional address, and short paragraph of qualifications and background.

Steve Conroy - Please see BB-1 in Appendix BB.

3) Field survey crews. Names, short paragraph of qualifications and training in last fish or last habitat field methodologies. Attach additional pages if necessary.
Please see BB-1 in Appendix BB.

B) When and Where was the data collected?

1) Year in which the data was collected. Please use one year per dataset.

1997 - Last Salmonid Protocal

2) Months in which the data were collected.
February, March, April, May, June, July, August, November, and December

i) Was the data collected in the sampling protocol window (March 15 through July 15)? 41 Last Salmonid, and 113 Last Habitat points were collected within the window.

ii) How would you characterize stream flow during the sampling period? (I.e., Higher than average flow conditions, Average, lower than average or mixed)

Average - Please see BB-2 in Appendix BB

3) What basins is the data from? (Use names, and WRIA codes).

Snoqualmie	- 070219
Puyallup (So. Prairie)	- 100429
Puyallup (White River)	- 100031
Nisqually (Mashel)	- 110101
Deschutes	- 130028
Chelhalis (Black river)	- 230649
Columbia	- ?

4) Describe the sampling area (basins, watersheds, ownerships, tribal U&As) in as much detail as possible.

Please see BB-3 in Appendix BB

C) Sampling Objectives and Design.

1) Was this data collection effort exclusively for the purpose of collecting last fish or last habitat data? **No.**

If YES, what was the sampling design?

i) Complete sampling of watersheds, or basins?

ii) Complete or partial ownership sampling? ....

iii) Random sampling? .....

iv) Other? (Explain with attachment)...............

2) Was this data collection effort part of a last fish assessment associated with an FPA or prospective timber harvest site? No, although water typing was done in collaboration with the timber industry on streams in So. Prairie. Additionally, some streams were typed

y request from Weyerhauser for validation.

If YES:
i) Did sampling extend beyond the boundary of the harvest site as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

ii) Did sampling consistently extend beyond the ownership boundary as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

If you answer 'no' to either question above, do not submit dataset.

3) Was sampling incidental to other research or assessment objectives? Yes

If YES:
i) Were there aspects of the sampling design that would be considered non-random or potentially biased for the purposes of last fish or last habitat determination? Please specify at end of questionaire.

ii) Did sampling target a specific species, elevation, ownership, etc.?

D) What Field Methodology was Used?

1) Which field sampling protocol was used?

Forest Practice Board Manual Protocal (Last Salmonid) was utilized with the following modifications: 1) streams were not methodically surveyed beyound the break for minimum of 12 pools or ¼ mile 2) Although Washington Trout crews typically utilize electroshockers in determining fish presence, visual determination of presence are also made without using electroshockers.

2) What field equipment was used to validate fish present or absence? Electroshocker? Snorkeling? Night-time snorkeling? Other?

Electroshocker, Visual identification, or visual, followed by Electroshocking in the absence of visual confirmation.

3) Was sampling for fish systematically carried a full 0.25 miles above the last fish or last habitat?

No

If you answer 'no', do not submit dataset.

4) How was the last fish or last habitat location marked in the field, i.e., monumented for future reference? Describe the appearance of the monuments, and where they were place. Last fish points were not routinely marked; when points were marked they were labeled with flagging, noting last fish. Occasionally, date, organization, and surveyors names were also noted on last fish flagging. Break points were marked with one Aluminum tag and flagging placed on a tree on both sides of the stream, Water Type Breaks, Date, Organization, and Surveyors names were noted on the flagging, only water type breaks were noted on the tags.

5) Were channels subjected to mass wasting in the past decade excluded from sampling or identified in the field data? If they were identified, how were they identified?

Channels subjected to mass wasting were not excluded from the sampling, however, Mass wasting is addressed in the field form and Last Fish/Last Habitat points within these drainages could be easily eliminated. It is possible that some drainages whose geomorphology has been changed over time may have been missed during the survey process.

6) In situations where surface flows ended, did samplers make a determination as to whether there was a break in channel gradient or other feature (headwater lake or wetland) that would cause surface flow to re-emerge up-stream?

Yes

7) In situations where last fish was determined to be below a culvert, how was this information recorded?

Culvert barriers were noted on the field form and in the database.

Where these situations discarded from the dataset?

No

Were these situations uniquely coded so that these data points could be easily pulled out of the dataset? These situations are not uniquely coded,however, this data can be extracted from the dataset in the database if a culvert barrier was identified.

Was the last habitat protocol applied above the culvert? Yes

E) Validation of Field Data.

1) Has the any of the data in this dataset been subjected to replicate sampling or verification, either within the same year or in a different year? If the replicate sample is in a different dataset, describe the location of this dataset. (Replicate sampling is not a requirement for dataset consideration.)

YES or NO__X__Yes_______

If yes, please explain how the duplicate samples can be found in the dataset, or where to find the replicate dataset if they are not included in this dataset.

Replicate samples where not systematically duplicated,however, occasional duplication occurred while conducting culvert assessments or upon request. The replicate dataset is attached or following the original dataset on the raw data forms.

If yes, Did comparisons with the replicate dataset raise any concerns? Please explain.

___Yes, as expected, habitat boundaries were extended on systems revisited after the emergency ruling was implemented. In addition, occasionally a last fish point was extending further up the system.

F) Data Management.

1) Attach sample of field data sheet.

2) Where is the raw (paper copy) data or paper map being kept?

At the Washington Trout Office

3) In what structure is the electronic data being kept (spreadsheet, tabular database, GIS)? Describe the software, including the version of the software. If none, write "none'.

Microsoft Access 2000 Table.

4) Attach details of data fields and data codes used in the electronic database.

DETAILED ITEM DEFINITION AND CODE EXPLANATION

ITEM: Twp

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION: TOWNSHIP AND RANGE THE POINT IS IN. EXAMPLES: T15R05W; T04R15E (NOTE: THE USE OF "N" (NORTH) IS NOT NECESSARY. THIS FORMAT COMPLIES WITH DNR DATA STANDARD FOR TOWNSHIP/RANGE). IF THE TOWNSHIP IS A "HALF TOWNSHIP, THEN PLACE THE "5" ON THE END (E.G., T39R41E5)

ITEM: Sect

FORMAT: TYPE: CHARACTER; LENGTH 2

DESCRIPTION:
THE TOWNSHIP SECTION THAT THE POINT IS IN. EXAMPLES: 05, 01, 15, 32.
(NOTE: PLEASE ADD THE ZERO (0) BEFORE A ONE DIGIT NUMBER).

ITEM: Survey_no

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION:
UNIQUE CODE FOR A PARTICULAR SURVEY OR HYDRO UPDATE MAP.
(EXAMPLES: HU12, SW23, WT23).

ITEM: Pt_id

FORMAT: TYPE: NUMERICAL, LENGTH 4

DESCRIPTION: USER-DEFINED POINT IDENTIFICATION NUMBER; WE SUGGEST THAT THE USER NUMBER THE POINTS INCREMENTALLY WITHIN A SPECIFIC SURVEY, SURVEY FORM OR HYDRO UPATE FORM.

ITEMS: SPONSOR

FORMAT: TYPE: CHARACTER, LENGTH: 16

DESCRIPTION: THE NAME OF AGENCY, GROUP, TRIBE OR COMPANY THAT IS CONDUCTING THE SURVEY. (EXAMPLES: WEYCO; DNR; WATROUT; WF&W; ETC.)

ITEMS: Date

FORMAT: TYPE: DATE: YYYYMMDD, LENGTH: 8

DESCRIPTION: DATE THE SURVEY WAS CONDUCTED.

Note: spreadsheets and info may use a different date format.
Please check and make sure any arcview conversions conform to above format.

THE FOLLOWING ITEMS (FIELDS) HAVE CODES AND CODE DESCRIPTIONS

ITEM: Protocol

FORMAT: TYPE: CHARACTER, LENGTH 4

DESCRIPTION: PROTOCOL OF FISH SURVEY

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID
PRE	PRE-EMERGENCY RULE PROTOCOLS
UNK	UNKNOWN

ITEM: Pt_type

FORMAT: TYPE: CHARACTER, LENGTH: 4

DESCRIPTION: THE TYPE OF POINT REPRESENTED UNDER THE SPECIFIED PROTOCOL.

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID

ITEM: Bnd_type

FORMAT: TYPE: CHARACTER, LENGTH: 2

DESCRIPTION: PHYSICAL PLACEMENT OF POINT (NEEDED FOR MODELING PURPOSES).

CODE	CODE DESCRIPTION
A	MID-CHANNEL END OF HABITAT
B	CONFLUENCE POINT (NON-FISH-BEARING STREAM LATERALLHY INTERSECTING A FISH-BEARING STREAM)
C	TRIBUTARY JUNCTION (TWO OR MORE NON FISH-BEARING STREAMS JOIN TO FORM A FISH-BEARING STREAM

ITEM: End_type
TITLE: END TYPE OF FISH POINT

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: THE REASON FOR THE PLACEMENT OF END POINT.

CODE CODE DESCRIPTION

1	NATURAL END (BND_TYPE B,C OR SIZE RELATED, (WIDTH/BASIN SIZE)
2	GRADIENT RELATED (e.g., WATER FALLS)
3	LARGE WOODY DEBRIS (LWD)
4	ROAD CULVERT
5	MASS WASTING EVENT (LANDSLIDE)
6	BEAVER DAM or other NON-PERMANENT DAM
7	OTHER DAM (PERMANENT)
8	WATER QUALITY LIMITER
9	NONE
10	UNKNOWN

ITEM: Det_met

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: METHOD USED TO DETECT POINT

CODE	CODE DESCRIPTION
1	ELECTRO-SHOCKING
2	DAY SNORKELING
3	NIGHT SNORKELING
4	VISUAL OBSERVATION

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION5)

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION

5) Where is the electronic copy being kept?

On Washington Trout's Document Server.

Curriculum Vitae

Stephen C. Conroy, Ph.D

Address: 10624 165th St.
Renton WA 98055

Telephone: (425) 277 7868 (home)
(425) 788 1167 (work)

email: watrout@eskimo.com

Undergraduate Degree: B.Sc. with Honours, 1980. University of Aberdeen, Scotland, U.K. Major: Biochemistry

Graduate Degree: Ph.D. 1984. University of Aberdeen, Scotland, U.K. Field of study: Enzymology

Employment History:

University of Aberdeen, Scotland, U.K.	Research Assistant.	1980-1984
University of Colorado, Denver, CO.	Research Fellow.	1984-1985
Case Western Reserve University, Cleveland, OH.	Research Associate.	1985-1987
University of Washington, Seattle, WA.	Senior Fellow.	1987-1992
Fred Hutchinson Cancer Research Center, Seattle, WA.	Staff Scientist.	1992-1995
Washington Trout, Duvall WA.	Science/Research Director	1996-present

Editorial Positions

Manuscript reviewer, "The Journal of Biological Chemistry" 1985-1987.
Manuscript reviewer, "Biochemistry" 1987-1994.
Manuscript reviewer, "Washington Trout Report" 1996-present

Grant Awards

Weiss Creek Restoration and Deer Creek Stream Typing. $300,000 from Washington Jobs For The Environment Program (JFE 9809)

North Fork Stillaguamish Engineered Log Jam Project. $160, 127 from Washington Department of Fish & Wildlife.

Griffin Creek Restoration. $49,600 from National Fish and Wildlife Foundation.

Skykomish Culvert Inventory & Analysis. $44,500 from Washington Department of Transportation.

Weiss Creek Demonstration Project. $40,000 from Snohomish Watershed Basin Work Group.

Salmonid habitat identification/stream typing project. $33,200 from King County Water Quality Block Grant.

Stream Typing and Culvert Analysis. $30,000 from the Bullitt Foundation.

Stream Typing and Culvert Analysis. $10,000 from the General Services Foundation.

Stream Typing and Culvert Analysis. $10,000 from the Horizons Foundation.

Stream Typing and Culvert Analysis. $5,000 from The Trout and Salmon Foundation.

Cherry Creek Riparian Restoration. $3,000 from Stilly-Snohomish Regional Fisheries Enhancement Group.

Tolt steelhead molecular genetics project. $250 from Puget Sound Flyfishers

Tolt summer steelhead monitoring project. $250 from Puget Sound Flyfishers

Typical Responsibilities

Supervised up to eight field biologists performing stream typing across the Western Cascades and in the Lower Columbia. Obtained grants and contracts for stream typing and in-stream restoration projects, published technical reports, supervised budgetary requirements, participated in TFW technical committees. Taught stream typing courses to TFW partners and consultants. Participated in snorkel surveys and electrofishing surveys. Experienced in non-lethal tissue sampling from fish for DNA analysis.
Coordinated culvert inventory and analysis projects, analyzed data, maintained databases and prioritized projects for restoration. Participated in formal training courses regarding culvert assessments and helped refine class materials and content.
Project manager for in-stream restoration in Weiss Creek and Griffin Creek. Projects involve permit acquisition, channel construction, LWD placement, riparian planting and fencing, and public outreach and education. Delivered oral and written reports to grantors and agencies.

Published Essays (Fisheries/Ecology)

Conroy, S.C. "Genetic Diversity in *Salmonidae*" The Osprey, 12: 5 (1991).

Conroy, S.C. Habitat Lost and Found; Part 1. Washington Trout Report (1996)

Conroy, S.C. Molecular Biology Comes to the Tolt. Washington Trout Report (1996)

Conroy, S.C. Habitat Lost and Found; Part 2. Washington Trout Report (1997)

Conroy, S.C. Stream Typing. Northwest Fishing Holes, (1996)

Conroy, S.C. Atlantic Salmon; Friend or Foe? Northwest Fishing Holes, (1997)

Conroy, S.C. Genetic Diversity in Salmon. Washington Wildlife Magazine, volume I, number II, 1997

Conroy, S.C. Habitat Identification and Development: The Need For Streamside Buffer Zones. Washington Trout Technical Report TR-98-1 (1998).

Scientific Publications (Peer Reviewed)

Conroy, S.C.; Adams, B.; Pain, R.H.; Fothergill, L.A. "3-Phosphoglycerate Kinase Purified by Affinity Elution has Tightly Bound 3-Phosphoglycerate." FEBS Letts. 128 353-355 (1981).

Dobson, M.J.; Tuite, M.F.; Roberts, N.A.; Kingsman, A.J.; Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A. "Conservation of High Efficiency Promoter Sites in *Saccharomyces cerevissiae*." Nucleic Acids Research 10 2625-2637 (1982).

Watson, H.C.; Walker, N.; Shaw, P.J.; Bryant, T.N.; Wendell, P.; Fothergill, L.A.; Perkins, R.E.; Conroy, S.C.; Dobson, M.J.; Tuite, M.F.; Kingsman, A.J.; Kingsman, S.M. "Sequence and Structure of Yeast 3-Phosphoglycerate Kinase." EMBO 1 1635-1640 (1982)

Conroy, S.C. "Sequence, Structure and Activity of Yeast 3-Phosphoglycerate Kinase" Ph.D Thesis, University of Aberdeen, Scotland, U.K. (1983).

Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A.; Tuite, M.F.; Dobson, M.J.; Kingsman, S.M.; Kingsman, A.J. "The Complete Amino Acid Sequence of Yeast 3-Phosphoglycerate Kinase" Biochemical J. 211 199-218 (1983).

Conroy, S.C.; Dever, T.E.; Owens, C.L.; and Merrick, W.C. "Characterization of the 46,000-Dalton Subunit of eIF-4F." Arch. Biochem. Biophys. 282 363-371 (1990)

Merrick, W.C.; Dever, T.E.; Kinzy, T.G.; Conroy, S.C.; Cavallius, J.; Owens, C.L. "Characterization of Protein Synthesis Factors from Rabbit Reticuloctyes." Biochimica et Biophysica Acta 1050 235-240 (1990).

Hagen, F.S.; Arguelles, C.; Sui, L.; Zhang, W.; Seidel, P.R.; Conroy, S.C.; Petra, P.H. "Construction of a Full-Length cDNA for the Sex Steroid Binding Protein of Human Plasma or Androgen Binding Protein of Human Testis (SBP/ABP or SHBG/ABP). Expression and Preliminary Characterization of the Recombinant Protein." FEBS Letts. 299 23-27 (1992).

Conroy, S.C., Hart, C.E., Perez-Reyes, N., Giachelli, C.M., Schwartz, S.M., McDougall, J.K. "Characterization of Human Aortic Smooth Muscle Cells Expressing HPV16 E6E7 Open Reading Frames." American J. of Pathology, 147 753-762 (1995).

Conroy, S.C., Morales, T.H., Stuart, K. "Partial Purification and Characterization of a Terminal Uridyl Transferase from *Leishmania tarantolae*." Manuscript in preparation.

Bonin, L, Tedford, K., Perez-Reyes, N., McDougall, J.K. & Conroy, S.C. "Gene expression in extended life-span human smooth muscle cells derived from atherosclerotic plaque." In press.

Contributed Papers

Conroy, S.C. "Binding of Substrate to 3-Phosphoglycerate Kinase." Scottish Protein Society, Aberdeen, Scotland. 1982.

Conroy,S.C. "Sequence, structure and Activity of 3-Phosphoglycerate Kinase" Scottish Protein Society, Stirling, Scotland. 1983.

Merrick, W.C.; Conroy, S.C.; Dever, T.E.; Brabanec, A.M.; and Owens, C.L. "Protein Synthesis Factors That Interact With RNA And Nucleotides." FASEB J 1988, Washington, D.C.

Perez-Reyes, N., Conroy, S.C., Halpert, C.L., Smith, P.P., Benditt, E.P., McDougall, J.K. "Immortalization of Primary Human Smooth Muscle Cells." FASEB J 6:A1032, 1992.

Conroy, S.C., Hart, C.E., Perez-Reyes, N., McDougall, J.K. "Phenotypic Characterization of Immortalized Vascular Smooth Muscle Cells." FASEB J 7:A758, 1993.

Scatena, M., Conroy, S.C., Tedford, K. & McDougall, J.K. "Increased ubiquitin expression in human atherosclerotic plaque-derived smooth muscle cells." FASEB J. 1996.

Conroy, S.C. "Habitat Lost and Found" 1st Annual Wildlife Congress. Washington Department of Fish and Wildlife. January 1997.

Mary Lou White
2905 Birchwood
Bellingham, WA 98225
(360) 671-8839

Experience:

1994-Present **Field Biologist/Project Manager**
Washington Trout • Duvall, Washington

- Crew leader and field biologist for fish habitat assessments, stream typing, scientific data collection, culvert assessments, riparian planting and monitoring, 1994-present.

- Project manager for culvert replacement, stream channel restoration, road abandonment, and riparian revegetation grant projects completed in 1996 & 1997; combined worth of grants over $500,000. Supervised 30 people, including five contractors working simultaneously on six road abandonment and three restoration projects.

- Additional responsibilities include the following: (1) documenting and entering data; (2) preparing contracts; (3) obtaining permits; (4) writing quarterly and final reports; (5) instructing restoration and culvert assessment workshops.

1992-Present **Owner/Hydrologic Technician & Environmental Consultant** • Bellingham, Washington

Representative clients: Washington Trout, Water Resource Consulting, Puget Power, Joanne Greenberg (N-SEA).

Assist hydrologic consultants in gathering, documenting and presenting information for impending watershed projects.

- Determine flow line estimates for application in determining time-of concentration.

- Research private landowner water rights.

- Using S.C.S. method, time-of-concentration and curve number assignments, calculate runoff flow from an urban watershed.

- Utilize aerial photos to determine land use activities.

- Measure lateral movement of channels based on aerial photo interpretation.

- Planimeter or digitize basins and sub-basins.

- Use maps, Quattro Pro, Excel, WordPerfect, Microsoft Word, or R-base, to document data or assemble reports.

- Conducted Wellhead Protection Program for Everson, WA.

1991-1992

- **Fisheries Technician** • Center for Streamside Studies • University of Washington, Seattle, Washington.
- Timber/Fish/Wildlife ambient monitoring; collected data on stream discharge, bankfull width and depth, gradient, fish habitat, mass wasting, valley bottom and riparian characteristics.
- Established photo points for long-term monitoring of stream channel changes.
- Used scantron for data documentation.

1989-1990

Hydrologic Technician • U.S.F.S. Mount Baker Ranger District • Sedro Woolley, WA.

- Assisted in layout and preparation of watershed/fisheries habitat improvement projects; monitored completed projects by recording graphics and establishing photo points.
- Created a stream file monitoring guide.
- Assisted in spotted owl surveys.

1984-1989

Forestry Technician • U.S.F.S. Fernan Ranger District • Coeur d'Alene, Idaho.

- Project supervisor - Fish habitat improvement structure installations; watershed inventories; coring and embeddedness surveys.
- Inventoried system and non-system roads; updated drainage map with culvert and road erosion site locations; documented problems and prescribed solutions.
- Arranged and assembled district watershed atlas for 62 stream drainages.
- Collected water samples and stream flow measurements; electrofished and snorkeled.
- Created a Future Fish Habitat Improvement Guide.
- Conducted field studies and documented data for fish habitat, elk browse, piliated woodpecker range management and watershed inventories.
- Assembled historical information for G.I.S. input.
- Served on initial attack crew for wild fire suppression.

Skills:

- **Computer**: Microsoft Word, WordPerfect, Excel, Quattro Pro and Quicken.
- **Habitat Assessments**: All modules of TFW methodology, or Hankin & Reeves. TFW quality assurance qualified.
- **Stream typing**: DNR certified.
- **Surveying**: Stream profiles (longitudinal or cross section), culvert assessments, or road abandonment.
- **Aerial Photo Interpretation.**
- **Equipment**: Compass, clinometer, planimeter, McNeil sampler, electroshocker, increment borer, flow meter.

Training:

- Timber Fish Wildlife Ambient Monitoring Workshops 1994-97
- Stream Typing Emergency Ruling workshop, DNR 1997
- 319 Grant Request Workshop, 1997
- Culvert College, Washington Trout, 1995
- CPR, 1993, 1994
- Effective management, U.S.F.S. 1988
- Defensive Driving - U.S.F.S. 1984-89
- Baci to Basics - Compass & First Aid Training, 1989
- Fire Suppression & Saw Training, 1984, 1985.

Awards:

- Recognized for significant contribution to the success of the Mt. Baker Ranger District Fisheries & Watershed Program during the 1989 field season.
- Awarded Certificate of Merit and Cash Award for extra effort and positive attitude in data base input and maintenance of fisheries, habitat database on Fernan District and for outstanding effort and high quality road condition inventories and work on the watershed road inventory database.

Education:

June 1994	**Bachelor of Science** Western Washington Univeristy, Bellingham, WA Major: Watershed Studies; Minor: Biology.
May 1979	**Associate of Arts** Lincoln Land Community College, Springfield, IL.

Relevant courses:
Water resources, soils, stream ecology, hydrology, water quality, fluvial geomorphology, ichthyology, watershed management, limnology, entomology, botany, biometrics and biology.

References:

Kurt Beardslee, Executive Director
Washington Trout, Duvall, WA (425) 788-1167

Steve Conroy, Ph.D. Science/Research Director
Washington Trout, Duvall, WA (425) 78-1167

Karen F. Welch, M.S., or Peter Willing, Ph.D., Hydrologist
Water Resource Consultants
1903 Broadway, Bellingham, WA (360) 734-1445

Robin Sanders, Hydrologist
Olympic National Forest, 1835 Black Lake Blvd. SW, Olympia, WA (360) 956-2433

Ed Lider, Fisheries Biologist
Fernan Ranger District, Coeur d'Alene, Idaho (208) 752-1221, 664-2318

Caroline Hidy, Fisheries Biologist
2695 Highway 200, Box 212
Trout Creek, MT 59874, (406) 599-2714.

David Crabb
17425 Turtle Lane
Bow, WA 98232
phone: (360) 724-4902

Education:	Master of Science in Geography with Planning Western Washington University, Bellingham, Washington 1985.
	Secondary Teacher Certification (Social Studies) Western Washington University, 1982
	Fifth Year History, San Diego State University, San Diego CA, 1973
	Bachelor of Arts in History, Grove City College, Grove City PA, 1971
Teaching Experience	Graduate Teaching Assistant in Physical and Human Geography, Western Washington University, Bellingham, WA 1984-1985
	Substitute Teacher grades 7-12 in Sedro-Wooley, Burlington-Edison, Mt. Vernon and Arlington school districts 1982-83
Work History	1994-present: Washington Trout, Cuvall, WA. Watershed analysis water typing, fish habitat restoration, riparian protection and revegetation.
	1976-present: Forest Contractor, providing tree planting and inventory survey skills for reforestation, forest management plans.
	1977-1978: Scott Paper Company, Hamilton, WA . Reforestation, pre-commercial thinning.
	1974: Whatcom Falls Park Fish Hatchery, Bellingham, WA. Hatchery maintenance, landscaping and rockeries.
Skills	All aspects of reforestation, crew leadeership and training, culvert analysis, stream typing, rockeries.

Training	Culvert assessment, water typing methodology, electrofishing, habitat surveying, spawning surveys, riparian revegetation, salmonid identification.
Personal Data	Born 1949, married, two children, health excellent, take pleasure in all family-oriented activities, especially backpacking and camping, gardening and basketball. Interested in reading and stewardship of the environment.

Bill McMillan

Perhaps best known as an author and master of fishing for steelhead trout using dry lines, Bill McMillan has devoted the greater part of a lifetime to fishing Northwestern rivers and sharing the enchantment of the experience through the written word and public speaking.

McMillan has authored numerous articles in *Salmon Trout Steelheader* magazine, *Wild Steelhead and Atlantic Salmon* magazine, and many others. His book *Dry Line Steelhead* has been described as "a graduate course in steelhead fly fishing." Most recently, McMillan spent two seasons on Russia's Kamchatka Peninsula as resident camp director for the joint Russian/American scientific expedition coordinated by the Wild Salmon Foundation.

For 40 years, McMillan's attention has been focused on the plight of wild salmonids, particularly regarding competition with hatchery-raised fish and the decline of their habitat's quality and availability. Concerns he raised decades ago regarding threats to wild salmonids have all been substantiated and vindicated. His extensive and precise field journals have filled a gap in statistics that the Washington State Department of Fish & Wildlife never kept, and he is widely quoted in academic fisheries papers.

An internationally esteemed author on conservation, fish, flyfishing and nature topics, he served on the Gifford Pinchot Forest's Spotted Owl Citizen's Advisory Board from 1989-1990 and on the Washington Department of Wildlife's Fishery Policy Task Force from 1990-1993.

McMillan, a founding board member and past President who has served on Washington Trout's board for all but two years, studied fisheries, English and philosophy at Clark College, University of Washington, Portland State and Central Washington. He co-founded the Clark-Skamania Flyfishers in 1975 and initiated spawning surveys in 1979 and snorkel surveys in 1983 on several rivers in Southwest Washington. An early and ardent conservationist, he has spent a lifetime advocating for the wild fish.

JOHN E. MEANS
2710 114th Way S.W.
Olympia, Washington 98512

RESUME OF QUALIFICATIONS

(206)-956-9103

OBJECTIVE WATERSHED ANALYSIS TECHNICIAN

EDUCATION:

CULVERT ANALYSIS TRAINING
Washington Trout, Duvall , WA 1994

COLLEGE COURSE WORK
South Sound Commmunity College
Olympia, WA 1994

Everett Community College, Everett , WA 1983

HIGH SCHOOL
Juanita High School, Kirkland, WA 1977

EXPERIENCE:....

- o Field Service, research and data collection,
- o Computer applications and hardware support
- o Installation management, procurement, layout
- o Provide liaison between customers and company, follow up, solve problems and ensure customer satisfaction. Customer training and support.
- o Performance of a wide variety of mechanical electrical and construction skills.

EMPLOYMENT HISTORY

June 1988 to present

Washington State Dept of Fisheries.
Wild Salmon Production and Survival Evaluation Program. This program has measured wild coho smolt production, harvest and escapement through trapping and coded wire tagging of juveniles in various river systems. During the 1993 and 1994 coho smolt migration periods I was stationed at the Bingham Creek (Satsop River) trap facility and the Skagit River trap in 1992. Specific duties were, 24 hour trap operation, species identification (vertebrate and invertebrate) and enumeration, recording of catch and tagging data, coded wire tagging, length frequencies of salmonids, specimen preservation and physical measurements of stream conditions, ie. Lux, stream height, TSS sampling, Imhoff cone and temperature. I was also responsible for establishing the protocol for safe and efficient fish handling procedures. During this time I was also a member of the NATURES team and provided the same services to this WDF and NMFS research project. Being stationed at this location allowed me the opportunity to observe and study the stream ecosystem which was of great personal interest.

WDF. Harvest Management, Soft Data Unit.
From 1990 thru 1993 during the commercial fishing season (July to Jan) I was responsible for monitoring commercial salmon catch data, ensuring accurate principle data sources, summarization and processing data for the Auxilary Fish Catch Record System that is used for in-season harvest management. I was also responsible for biological and catch corrections in processed data in the Prime computer system files. The job required a thorough knowledge of the commercial fishing industry, salmon stock composition and run timing. Our unit was also responsible for PC hardware and software support for the harvest management division. At this time I also participated in Puget Sound purse seine test fishing, in which I performed GSI, fecundity, scale and catch composition sampling. During slow periods of commercial fishing I was charged with finding and sampling little known sport fisheries on the beaches and estuary's of South Puget Sound and Hood Canal.

WDF.Puget Sound Sport Emphasis Sampling.
As a Sport Sampler in 1989 and 1990 I conducted interviews with sport salmon anglers on Puget Sound and the Straight of Juan de Fuca, recording angler catch, effort and biological data. Scale sampling and coded wire tag recovery were also performed.

Related volunteer experience.:
South Sound Fly Fishers, Director.
The following is a list of activities and accomplishments which I have been involved with that are combined efforts of the So. Sound Fly Fishers and Washington Dept of Fish and Wildlife.

I was lead person for a cooperative project with WDFW doing a creel census on the South Fork Toutle River during the Feb-March wild winter steelhead fishery in 1993 and 1994.

I am the SSFF representative on the citizen advisory committee to WDFW's Wild Salmonid Policy meetings.

Conducted electro-fishing projects on the North Fork Toutle and Green River tributaries in cooperation with WDFW for five consecutive years, establishing base line data of juvenile wild salmonid populations and stream habitat analysis.

Began work on a Sea-run Cutthroat Trout Bibliographic Database. This work has received wide support from conservation, sport, and government organizations. It is expected to be a 3 year project.

Participated in snorkel survey's in the Tolt, Washougal and Wind rivers in conjunction with Clark-Skamania Fly Fishers and Washington Trout. These surveys are to continue baseline data of wild summer steelhead populations in these rivers.

Dec. 1982 to June 88 — **Cutting Edge Floor Covering**
As part owner of Cutting Edge Floorcovering I had many responsibility's in the operation of a small business. Contract commercial floorcovering of large office buildings such as the Columbia Center, Century Tower, etc. provided the business base. My specific duties included, sales, small - business management, blueprint takeoffs, materials estimations, procurement and layout. A thorough understanding of floor covering technologies and building construction techniques were also required. Coordination of workspace, material transport and time scheduling between the prime contractor, sub-contractor's and my crew was done on a daily basis to achieve timely completion of the job and assure customer satisfaction.

Jan. 82 to Dec. 82 — **Design Interiors**
Floorcovering installation apprentice. Assisted and installed all types of commercial floorcoverings in new construction and renovation of large office buildings in downtown Seattle

Feb. 79 to Dec.81 — **Seattle Industrial Controlled Heat**
Seattle Industrial Controlled Heat was a company that specialized in the manufacture of portable industrial heat treating and stress relieving equipment. My position with them was essentially two fold. As a shop electrician/mechanic my duties involved welding, fitting, and mechanical fabrication of the equipment. I also participated in the schematic drafting and design and the subsequent electrical wiring and installation of the equipment. We also provided a nationwide heat treating and stress relieving service of industrial apparatus in oil refinery's, shipyards, nuclear plants, etc. As a field service technician I would travel with the equipment to the site for installation which included wiring and any training required by the customer.
During this time I held a limited industrial electricians license.

Personal Data: Married, 3 children, excellent health.
Hobby: Fly fishing for salmon and steelhead.

Personal and professional references are available on request

DENNIS O. BROWN
15309.5 PORTLAND AVE. SW
TACOMA, WASHINGTON 98498
(206) 588-1794

April 2, 1996

TO WHOM IT MAY IT CONCERN:

This is a work history of Dennis O. Brown.

WORK HISTORY

Sept. 6, 1995 to Feb. 20, 1996	Bates Technical College Long-Haul Trucking Program South Campus 2201 South 78th Street Tacoma, Washington 98409-5847 (206) 596-1753 (Sharon Wade)	(GPA 95%)
Nov. 93 to Aug. 95	Witcraft & Swope Contract Cutters 7901 Holiday Valley Ct. NW Olympia, Washington 98504 (360) 866-9110 (Steve or Marti Witcraft)	Timber Faller $30.00 per. hr.
Mar. 88 to Nov. 93	#208 Shake & Shingle Griffiths Inc. PO Box 208 Moclips, Washington 98562 (360) 276-4640 (Annette Griffiths)	Everything From Truck Driver to Millwright
Feb. 85 to Mar. 88	Pearson Forest Products Molips, Washington 98562 (Out of business/no phone)	Everything From Truck Driver to Millwright

DENNIS O. BROWN
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TACOMA, WASHINGTON 98498
(206) 588-1794

April 2, 1996

SKILLS

TRUCKS DRIVEN

Straight Trucks, Tandum and Single Axles, Hydraulic or Air Brakes.

Flatbeds, Dump Trucks, GI Duce and a Half, Geophysical Vibrators (6 x 6 on and off road), Buses.

Tractor Trailer: Semi-dumps, Flatbeds, Vans, and Doubles.

EQUIPMENT OPERATED

Most types and brands of Forklifts, Front-end Loaders, Loggstackers, Cats, and Lumber Carriers.

RELATED WORK

Maintenance Mechanic on equipment operated, (Trucks and Loaders, etc...)

Industrial Millwright, including Welding and Maintenance Mechanic for Shake and Shingle mills, Sawmills, and other production type sites.

Electrician: Commercial, Industrial, and Residential.

I have also been superintendent, manager, and foreman for companies that I have worked for in the past.

Frank Staller
16 Malone Hill Branch Road
Elma, Washington 98541
(360) 482-2960

Education & Training

St. Benedict's High School, Chicago, Illinois, 1974 diploma.

DeVry Institute of Technology, Chicago, Illinois, Electronics Technician degree, 1976.

Grays Harbor College, Aberdeen, Washington, Environmental Services Contracting Certificate 1996.

Northwest Indian Fisheries Commission, TFW Monitoring Training Workshop, 1997.

Department of Natural Resources & Quinault Nation: DNR Stream Typing Updated Rulings & Electroshocking Workshop, 1997.

Specialized Training

Power Squadron boating course; U.S. Forest Service forest fire training; defensive driving certificate; First Aid and CPR; Hazmat Awareness Level; Swiftwater First Responder; Swiftwater Boat Rescue; Wilderness Survival; Wilderness First Aid; Helicopter I evacuation, safety and man-tracking, and culvert analysis.

Streamtyping Experience

Washington Trout, P.O. Box 402, Duvall, WA 98019
Scientific Field Technician: Three years of stream surveying, using maps and compass to report on condition of streams related to fish presence, barriers and condition for re-typing classification. I submitted reports and upgraded maps after streamtyping. I also did culvert analysis on Type 3 waters. I worked on road closure and culvert replacement projects, operated pumps, assisted in surveying and stream monitoring.

Washington Department of Fish & Wildlife, Montesano:
Stream surveyor using maps and compass to collect information on streams related to fish presence and barriers for stream type verification.

Self-employed timber salvage contractor: Eight years subcontracting cedar salvage through Weyerhaeuser and other private landowners to salvage down and dead cedar logs for roofing material. I ran chainsaw, graded blocks and partook in helicopter logging operations. We cut down dead fir logs into cants with portable chainsaw mill and flew them out with helicopter assistance.

Timber Faller: For six months I felled and bucked timber for private landowners for partial and clear-cut operations.

Forestry technician for USDA Forest Service, Quinault, WA for four nine-month seasons: set up logging areas by traversing boundaries, surveyed for new roads, prepared profile surveys, assisted in cruise plots and marked trees, plus assisted in transient

survey of national forest boundaries, placing section corner markers and marking bearing trees.

Other work has included two seasons as a fire crewman, three years in horticulture/landscaping, experience planting and thinning trees, building and maintaining the Quinault trail system plus two years as electronic technician.

Volunteer Activities

Grays Harbor Search & Rescue, Chehalis Valley Restoration wood Duck Project, Washington Department of Fish & Wildlife elk relocation project plus oak habitat mapping.

Gregory Ericksen
2832 Pacific
Hoquiam, Washington 98550
360-533-2058

General Summary	20 years' experience in positions requiring coordinated mental and physical skills to ensure productivity and safety. Work equally well in a teaming environment or with minimal supervision. My varied work experiences indicate willingness and ability to learn.
Streamtyping Experience	Washington Trout, Duvall, WA.: I have taught stream typing to crews and TFW partners and participated in restoration projects including road closures, culvert surveys and replacement, and collected scientific data for Washington Trout and for Thomas Travis Young, Olympia (consultant). I have performed streamtyping for the Washington Department of Natural Resources, Olympic Peninsula Office, Aberdeen, WA, the Department of Fish & Wildlife at Montesano, WA and stream typing plus tree planting for Weyerhaeuser. I have more than three years' experience in streamtyping.
Other Experience	Heavy equipment operator Rigging operator Mechanic Carpenter Landscaping Supervisory Watershed Restoration
Education	Washington State University survey class, Adopt-A-Stream, Everett WA. Grays Harbor College, Aberdeen, Washington: Watershed analysis/data collection. Department of Natural Resources wetland verification class, Forks, WA. Hoquiam High School, Hoquiam, Washington.
References	Available upon request.

1 ITT Rayonier Pulp Mill 1977-1982
Yard Crew Run Equipment Fork lifts all sizes, Front End-loader, Back Hoe, Bob Cats, Riggin Slinger for lifting + Replacing Equipment Motor's, Pumps, Steam lines ect. Basically Anything in mill. Leadman for Crews + Work Alone. Take care of all safety equipm in the entire mill + Order + Replace.

2 Earley tire Co. 1983-1988
Auto Mech. Certified in Diagnostic Scope, Brake's, Air Cond. Tune-ups + Brakeman + Service A/C systems was work Done Schooling to Be Certified for all Area's.

3 Weyco. 1989-90 Plant trees for them + contract Work for them in tree planting Area of Work and Some Cedar Block cutting for them contract cutting

4 Work for Quality Homes const. Clark + Son + Locke Const. Building houses from ground up + foundation's also with Clark + Son was all commercial Building's
From 89-1994

5 Washington Dept. Fish + Wildlife 1995
Stream Retyping + Mapping of Streams + Restoration Work

Greg Ericksen

ROGER R. KRINGEN
Box 866
Elma, WA 98541
Phone: (360) 482-4042

POSITION DESIRED Stream Survey Technician

WORK EXPERIENCE

QUINAULT DEPT. OF ENVIRONMENTAL PROTECTION

Stream Type Technician

Quinault Indian Nation Taholah, WA. November 1995 to present. Duties include:

-Acquiring and organizing the road and field maps required to perform surveys on type 4 and 5 streams on a township-by-township basis across the Olympic Peninsula.

-Utilizing forest practice base maps and hydro maps in coordination with road maps from timber companies, Forest Service, USGS, and other sources to locate streams in the field.

-Employing electroshocker or visual methods to determine if salmonids are present in streams. If salmonid presence is verified, survey is continued upstream until practical fish passage limit is reached and flagged as end of type 3 water. Position is noted on map by orientating with side-tributaries, topographic irregularities or other physical features. Stream characteristics such as substrate, wetted width, ordinary high water mark, large woody debris, canopy and gradient are noted as well as any observance of salamanders, frogs or other riparian species. Mass-wasting, debris flows or other geologic events are noted and mapped.

-At office, survey results and pertinent information are transferred to data cards, and stream type changes or verifications are color-coded on file copies of forest practice base maps. High culverts or other man-made blockages are documented on fish passage forms.

-Review and on-site inspection of forest practice applications.

MUCKLESHOOT FISHERIES DEPARTMENT

Stream Type Technician

Muckleshoot Indian Tribe Auburn, WA. Seasonal employment from June 1996 to October 1996. Duties: Similar to those with QIN, but additional emphasis was placed on initiating development of a data bank documenting the maximum gradient limits of salmonid occurrence in the Washington Cascades. Job required backpacking in and camping overnight in Clearwater Wilderness and other remote areas.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

Stream Typing Field Supervisor

Montesano, WA June 1994 to July 1995.
Duties: Supervision of 6-man stream typing crew included interviewing job applicants, crew-member training, directing work activities, maintaining time sheets, scheduling equipment maintenance, monitoring incoming field data and contacting private landowners to acquire permission to enter their properties.

ADDITIONAL WORK EXPERIENCE

-Contracted for Weyerhaeuser Corporation to collect riparian zone shade data during Little North River-Vesta Creek Watershed Analysis.

-Two years experience as chain-man and rod-man for soil and water conservation district.

-Longtime logger with extensive experience as timber faller, chaser, chokerman and cat operator.

FORMAL TRAINING

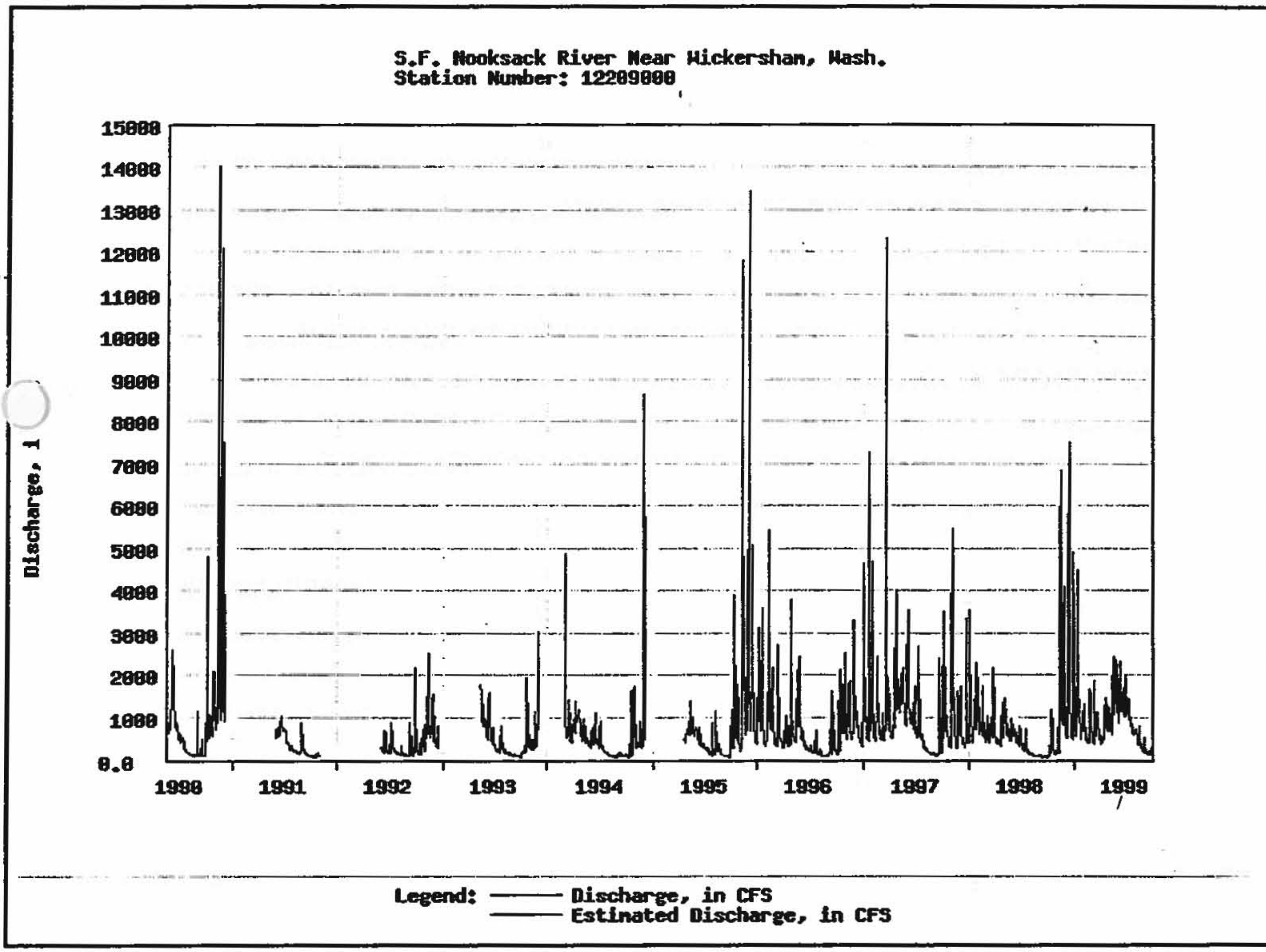
-DNR Wetland Recognition and Designation
-Forest Practices Road Maintenance and Abandonment

EDUCATION

Associate of Arts and Sciences Degree Grays Harbor Community College, Aberdeen, WA June 1994. Graduated #2 of 300 with 3.95 GPA.

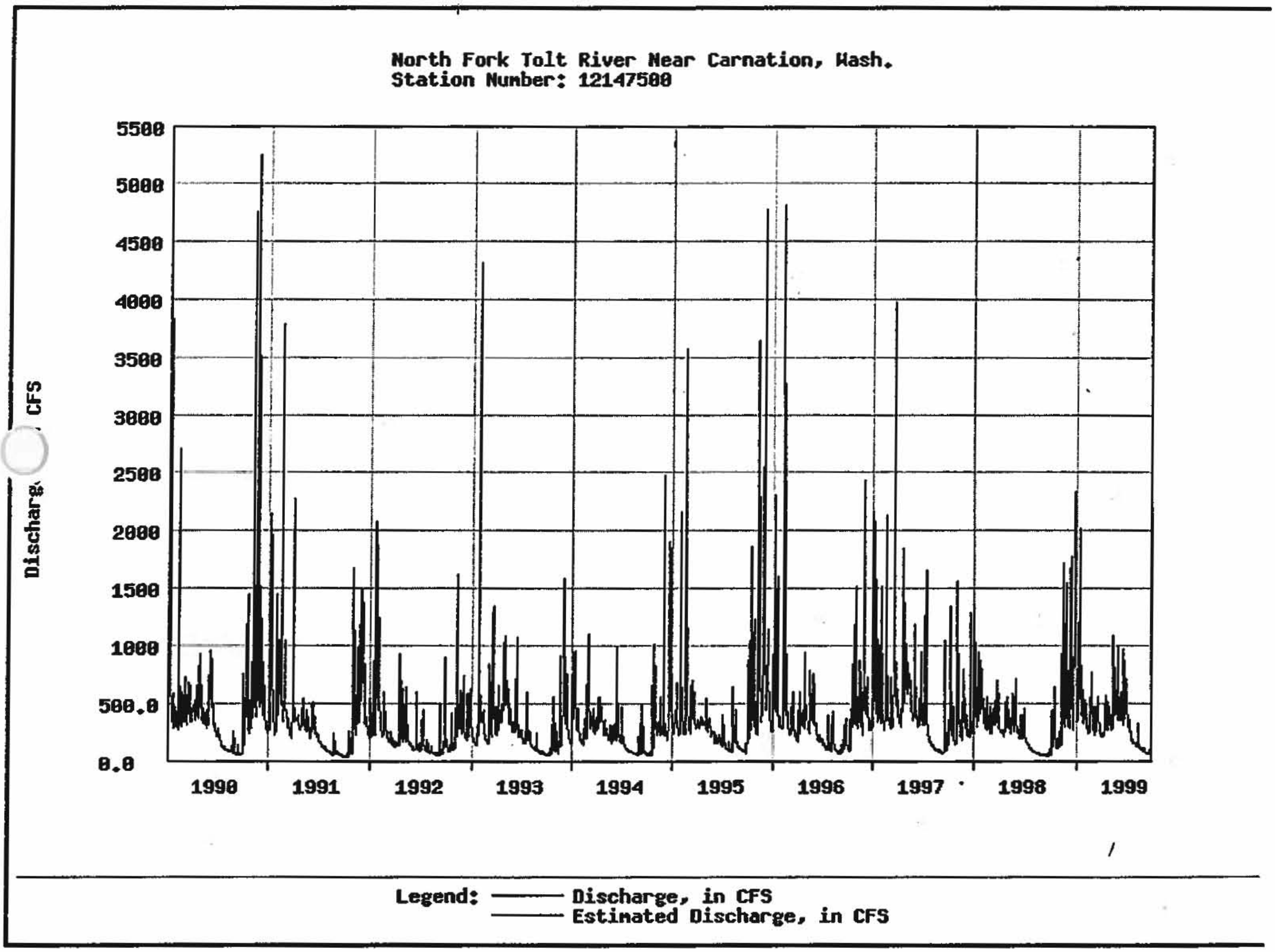
References available upon request.

Historical Streamflow Daily Values Graph for S.F. Nooksack River Near Wickersham, Wash. (12209000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

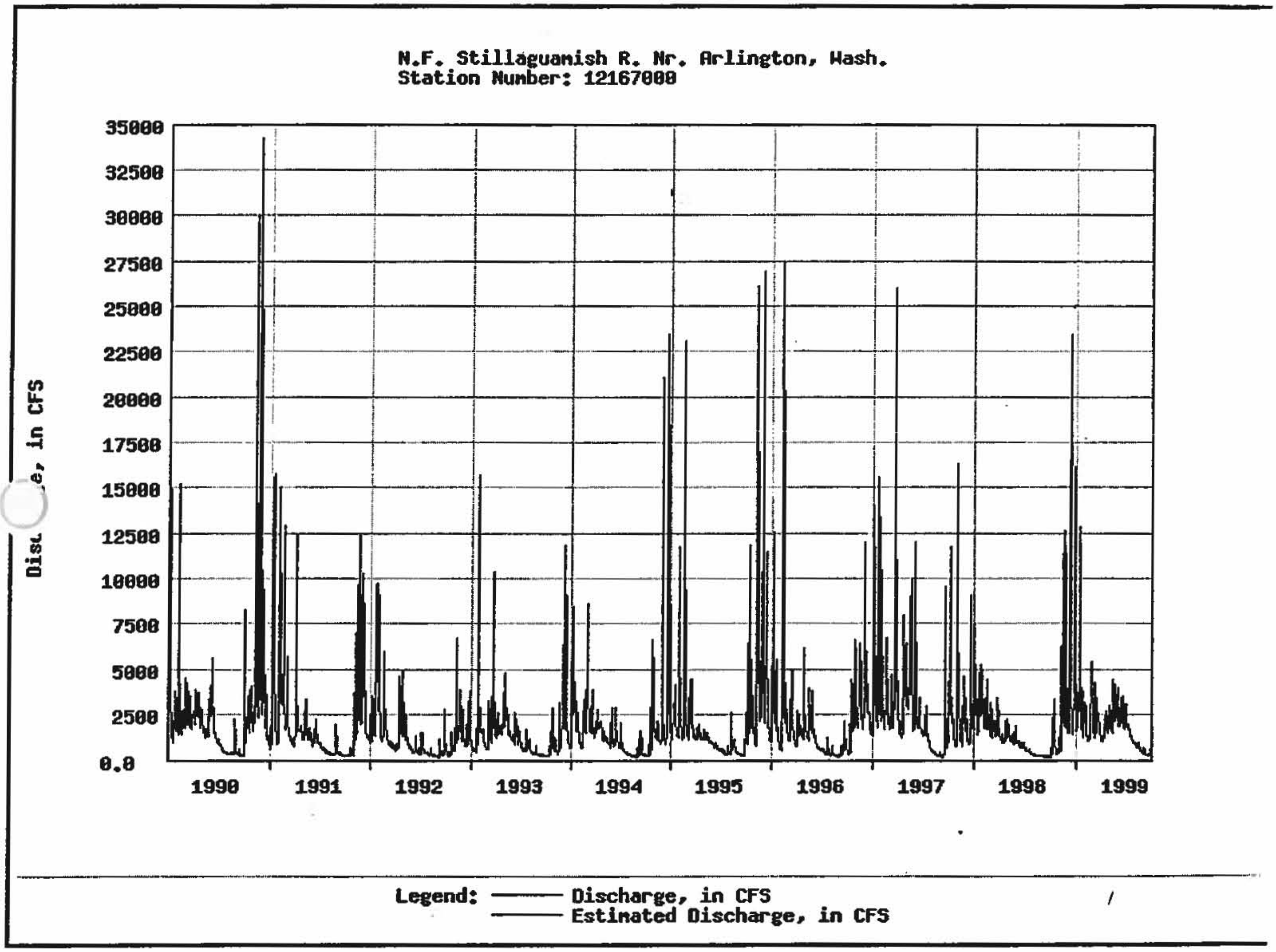
Historical Streamflow Daily Values Graph for North Fork Tolt River Near Carnation, Wash. (12147500)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn Why you might press this button

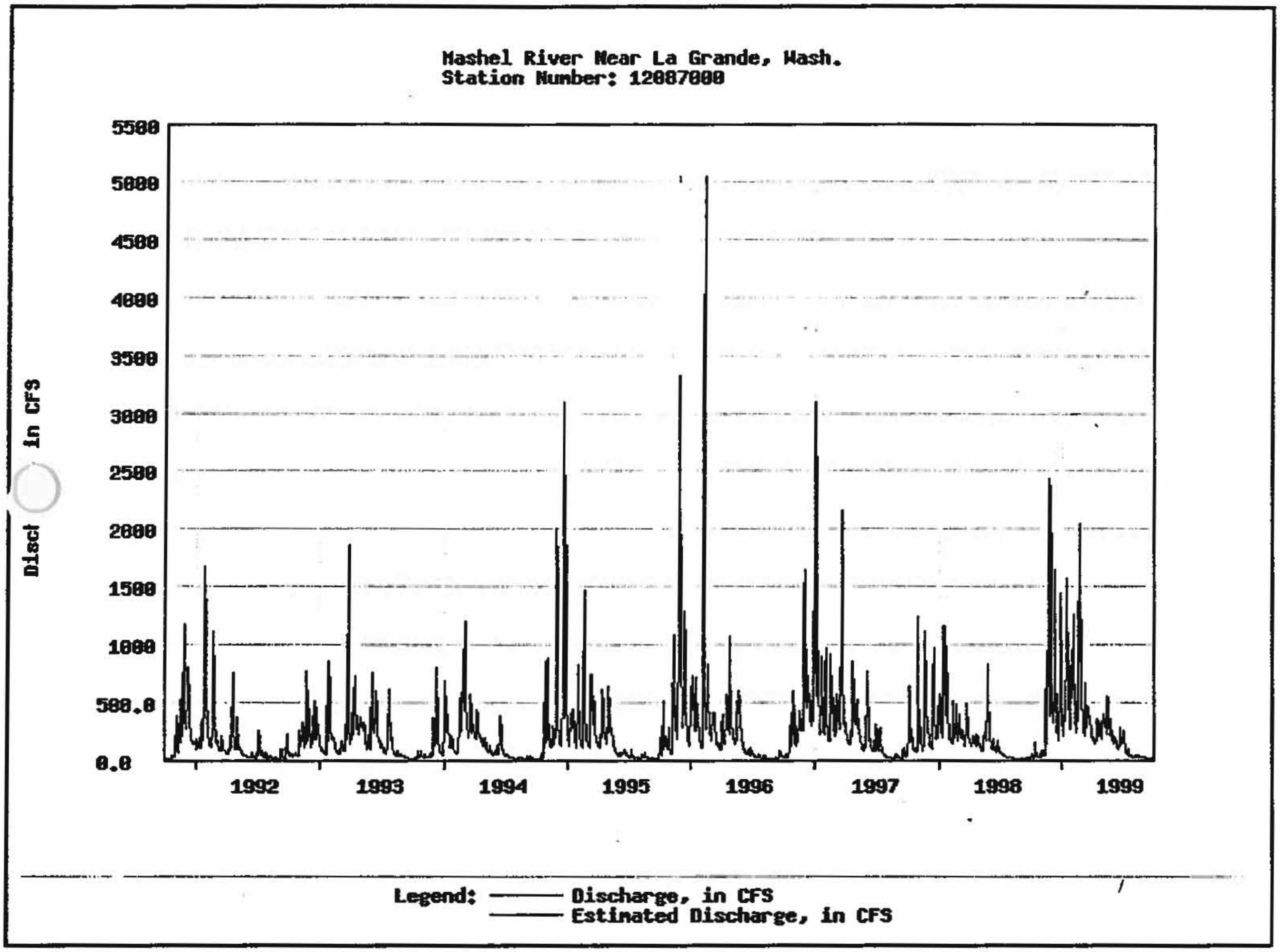
Historical Streamflow Daily Values Graph for N.F. Stillaguamish R. Nr. Arlington, Wash. (12167000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn Why you might press this button

Historical Streamflow Daily Values Graph for Mashel River Near La Grande, Wash. (12087000)

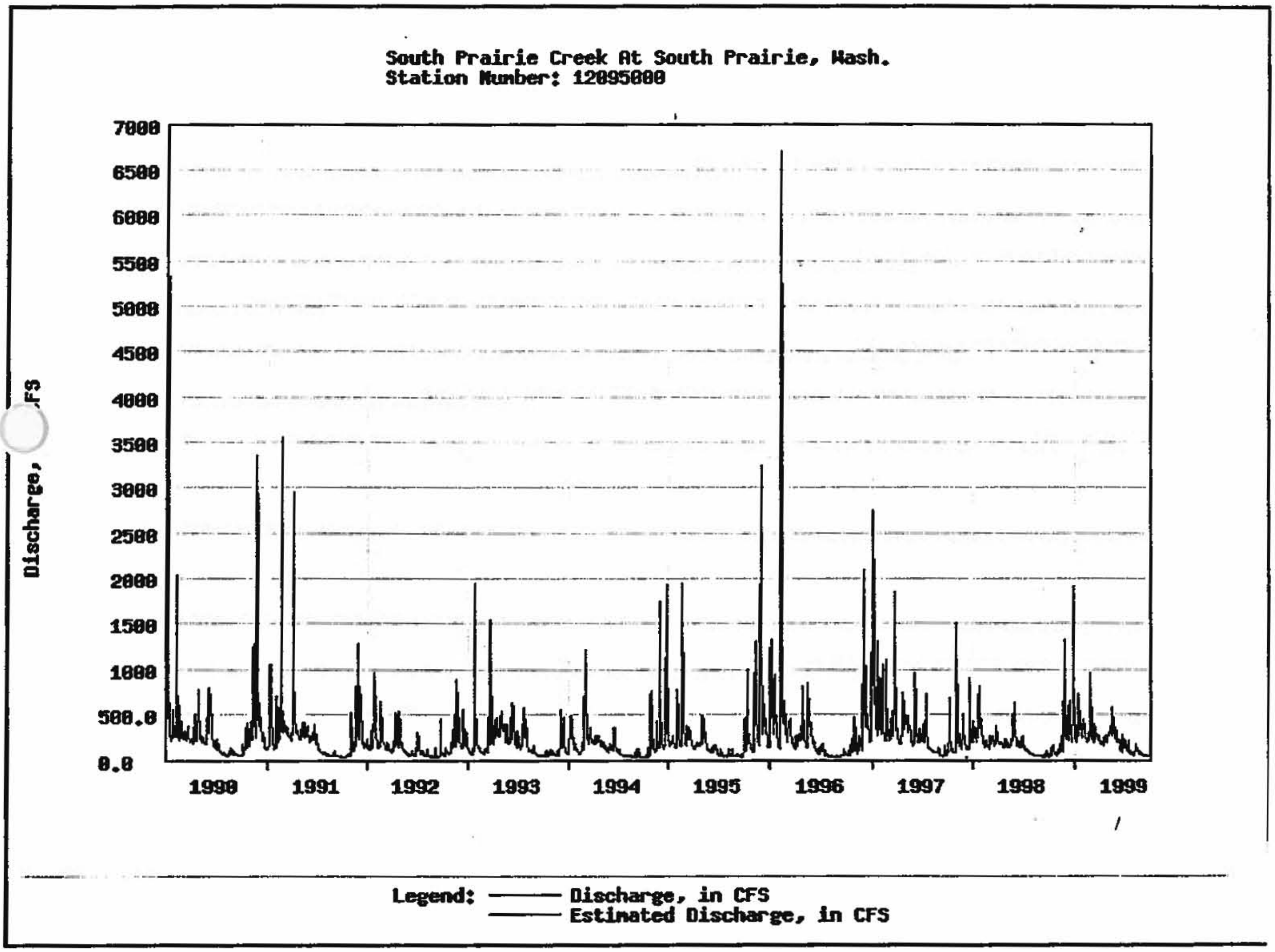


Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn | Why you might press this button

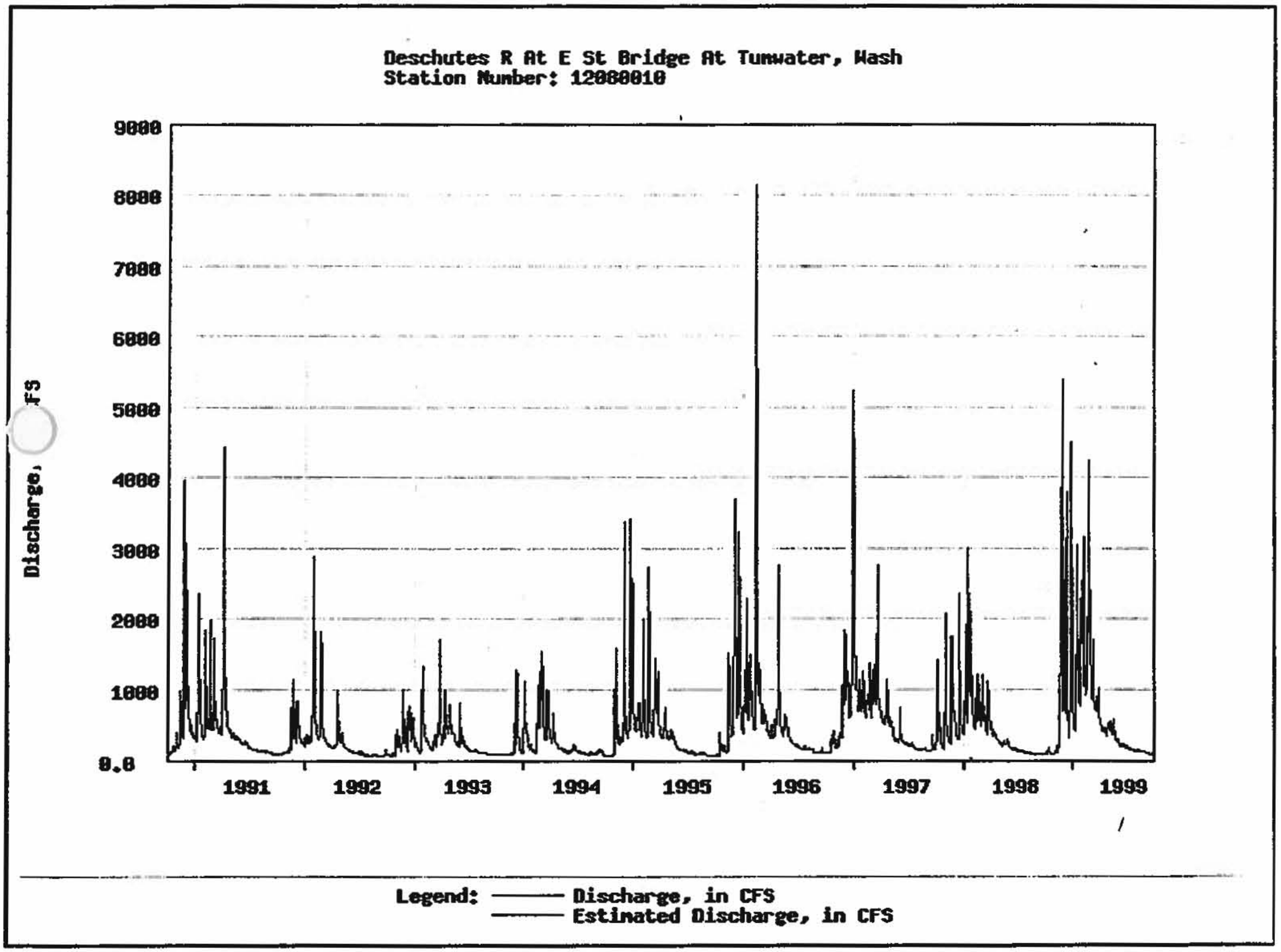
USGS
science for a changing world

Historical Streamflow Daily Values Graph for South Prairie Creek At South Prairie, Wash. (12095000)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Historical Streamflow Daily Values Graph for Deschutes R At E St Bridge At Tumwater, Wash (12080010)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

SNOQUALMIE RIVER
Lower Mainstem

This drainage section includes the lower 12 miles of Snoqualmie River from a few miles above Duvall downstream to the confluence with the Skykomish River (R.M. 20.5). Eleven tributaries enter in this section, adding more than 83 total stream miles. Principal access in this northwest King-southwest Snohomish counties section is provided by State Highway 203 running south from Monroe.

Stream Description

From stream mile 12.0 the Snoqualmie River meanders northeast approximately five miles to Cherry Creek, then northwest to the confluence with the kykomish River. Principal tributaries include Tuck, Cherry, and Peoples creeks.

The flat valley floor is two miles wide and is cleared with only occasional strips or small thickets of deciduous trees and underbrush. The low, rolling hills bordering the valley are moderately steep-sloped with deciduous and some mixed conifer cover. Land use is almost exclusively agricultural pasture land. Recreation use is heavy, consisting of both fishing and hunting. The only community development is Duvall; however, there are a few widely scattered rural residences within this section. Some logging occurs in the upper Cherry Creek watershed.

Through this section, the Snoqualmie River is contained within a broad channel ranging from 30 to 45 yards during fall months. The gradient is gentle with a few nearly flat stretches. The channel meanders back and forth across the valley, forming oxbows. Stream flow is sluggish in many stretches, with numerous long, deep pools and slow-moving glides predominating. Stream bottom is primarily sand and silt, with only a few short, scattered gravel-riffle sections, generally heavily silted. Most banks are moderately high, sharply sloped earth cuts, with a few gently sloped sand-gravel beaches. Some bank protection work has taken place at certain locations within this stretch of river in the form of artificial contour and rock riprap, cabled logs, and discarded car bodies or other large debris to divert flow from easily eroded banks.

Bank cover is sparse to moderately dense, consisting almost entirely of intermittent strips or small thickets of deciduous trees and underbrush. In many areas this growth actually overhangs the banks, and with numerous logs and accumulated debris extending out from the shore, provides favorable protective cover for fish life.

Tributaries in this section exhibit gentle to moderate gradients over their lower reaches as they course across the valley floor. Their upper slopes, however, are quite steep and generally offer limited access to salmon. Through their accessible reaches, most of these streams contain good pool-riffle conditions within relatively narrow stream channels. Stream bottoms are predominantly gravel and sand over the lower reaches, with gravel and some rubble materials above. Tributary cover is usually moderate to dense growth of mainly deciduous trees and underbrush.

Salmon Utilization

This lower Snoqualmie River section provides transportation for all salmon utilizing the upper drainage. Chinook, coho, pink, and chum salmon inhabit these waters. Only limited spawning habitat is available in the Snoqualmie; however, tributaries, including Cherry, Peoples, and Tuck creeks, support good to excellent spawning populations. These tributaries as well as this section of mainstem river provide important rearing habitat for juvenile salmon.

Limiting Factors

One factor limiting salmon production is low summer stream flow in some of the smaller tributaries. This restricts rearing potential and, when continuing into the fall months, can inhibit adult salmon access. One activity which could potentially limit production is clear-cut logging over some reaches of upper tributary drainages. Such logging can influence the productive capacity of streams emerging from such areas, as well as affect production in their drainagesbelow. Another potential limiting condition involves water quality throughout the lower mainstem Snoqualmie. The slow-moving water lacks cover and is more easily warmed, and offers the potential for concentrating pollutants that could severely affect the natural production capabilities. Occasionally, heavy poaching activity occurs on adult salmon in some of the smaller tributaries.

Beneficial Developments

No facilities or programs have been undertaken in this drainage section to specifically benefit salmon production. Occasionally, stream maintenance activities involving removal of minor jams are undertaken on small streams.

Habitat Needs

The major requirement to maintain salmon production potential in this section is to protect the natural conditions that presently exist, i.e. natural stream cover, pool-riffle character, quantity and quality of stream gravel, good water quality, etc. Restoration of natural stream cover where it has already been eliminated is highly desirable, particularly on the tributary drainages.

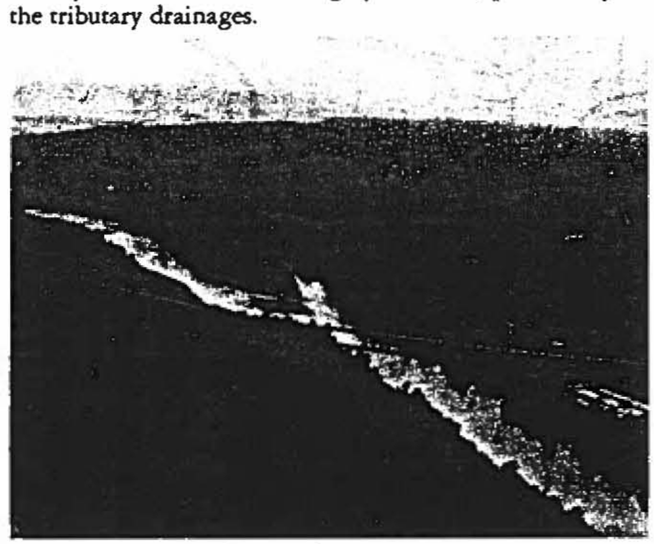
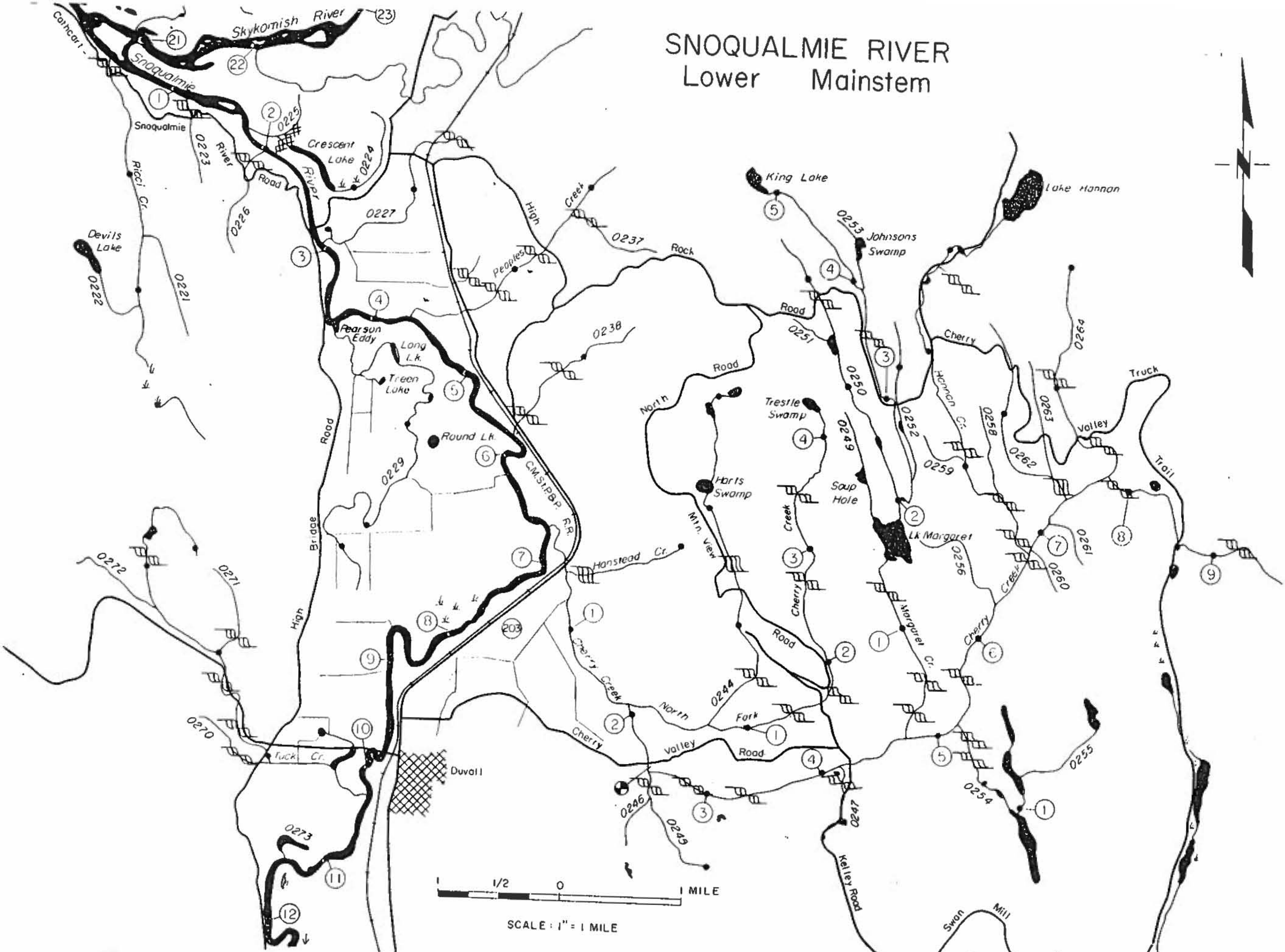


PHOTO 07-19. Confluence of the Skykomish and Snoqualmie Rivers.


SNOQUALMIE RIVER
Lower Mainstem
Skykomish River
Snoqualmie
Cathcart
Snoqualmie River Road
Crescent Lake
River
Ricci Cr.
Devils Lake
Pearson Eddy
Long Lk.
Treen Lake
Round Lk.
High Bridge Road
High Creek
Peoples
Rock Road
North Road
C.M.St.P.&P. R.R.
Hanstead Cr.
Mtn. View Road
Cherry Creek
North Fork
Cherry Valley Road
Harts Swamp
Trestle Swamp
Soup Hole
Lk Margaret
Margaret Cr.
King Lake
Johnsons Swamp
Lake Hannan
Hannan Cr.
Cherry
Cherry Creek
Truck Trail
Valley
Tuck Cr.
Duvall
Kelley Road
Swan Mill Road
0221
0222
0223
0224
0225
0226
0227
0229
0237
0238
0244
0246
0247
0249
0250
0251
0252
0253
0254
0255
0256
0258
0259
0260
0261
0262
0263
0264
0270
0271
0272
0273
203
1/2
0
1 MILE
SCALE: 1" = 1 MILE

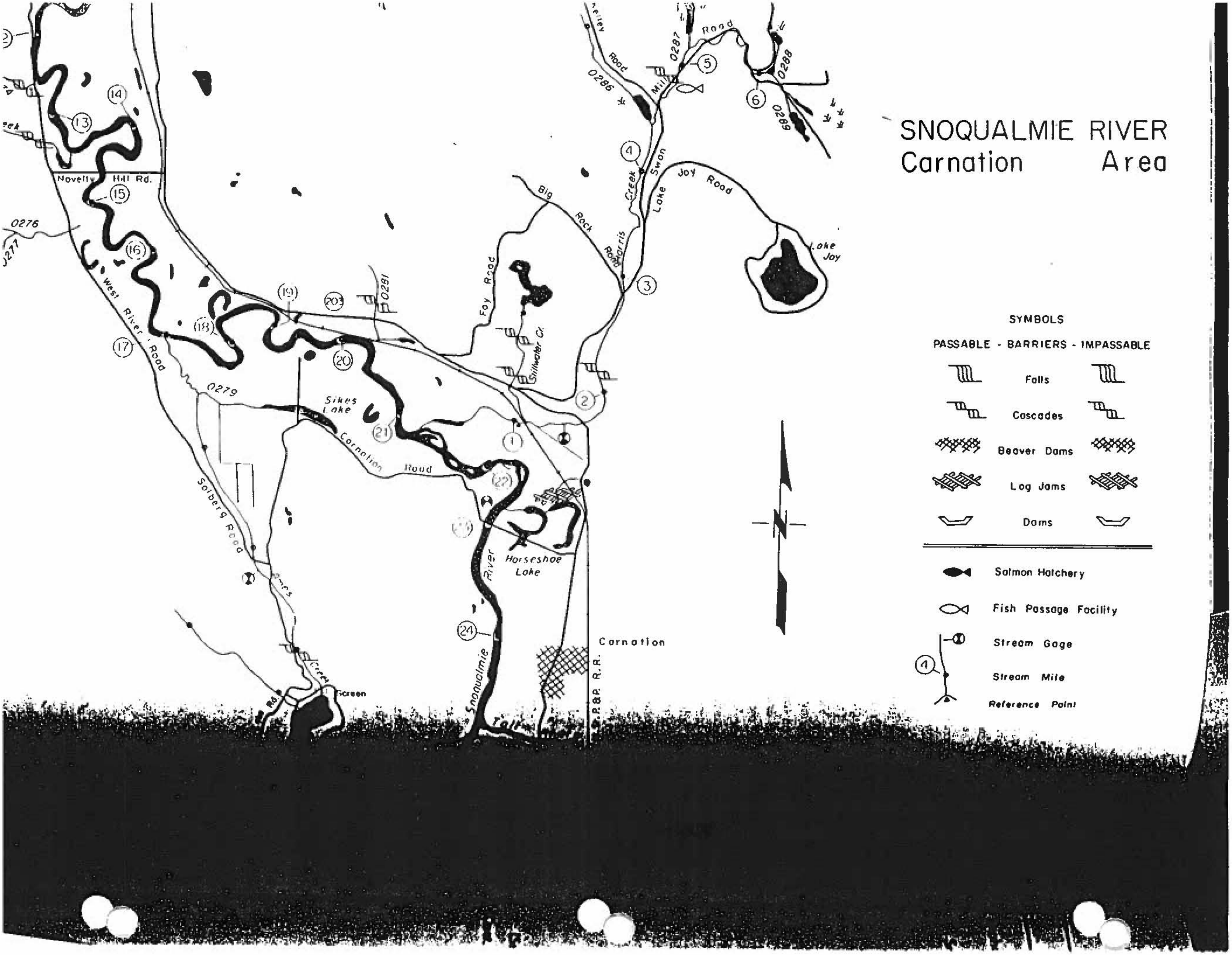
SNOQUALMIE RIVER — LOWER MAINSTEM

Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho Pink, Chum
0219	Snoqualmie River	LB-20.5	84.55	693.0	Chin., Coho, Pink, Chum
0220	Ricci Creek	LB-0.4	3.5	—	(Coho)
0224	Unnamed	RB-1.7	1.7	—	Unknown
	Crescent Lake	Outlet-0.35	—	—	
0227	Unnamed	RB-2.9	1.9	—	(Coho)
	Drainage Ditch	LB-0.2	~ 2.1	—	Unknown
0229	Pearson Eddy Creek	LB-3.6	4.35	—	Unknown
	Long Lake	Outlet-1.0	—	—	
0233	Drainage Ditch	RB-3.85	~ 1.3	—	Unknown
0236	Peoples Creek	RB-4.3	2.3	—	Coho
0238	Unnamed (Duvall Cr)	RB-5.7	1.5	—	(Coho)
0240	Cherry Creek	RB-6.7	9.9	—	Chin., Coho, Pink, (Chum)
0241	Hanstead Creek	RB-0.5	1.0	—	Unknown
0242	Drainage Ditch	LB-0.75	~ 3.5	—	Unknown
0243	N. Fk. Cherry Cr.	RB-1.9	4.2	—	Coho, (Pink), (Chum)
0244	Unnamed	RB-0.7	3.1	—	(Coho)
	Harts Swamp	Outlet-2.15	—	—	
	Unnamed Lk.	Outlet-2.8	—	—	
	Unnamed Lk.	Outlet-3.1	—	—	
	Trestle Swamp	Outlet-4.2		—	
0245	Unnamed	LB-2.5	1.0	—	Unknown
0248	Margaret Creek	RB-4.7	5.1	—	(Coho)
	Margaret Lk.	Outlet-1.55	—	—	
0250	Unnamed	RB-2.0	2.4	—	None
	Roth's Sw.	Outlet-0.45	—	—	
	Unnamed Lk.	Outlet-1.35	—	—	
0252	Unnamed	LB-2.2	1.3	—	
	King Lake	Outlet-5.1	—	—	
0254	Unnamed	LB-5.2	1.6	—	Unknown
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-0.85	—	—	
	Unnamed Lk.	Outlet-1.15	—	—	
	Unnamed Lk.	Outlet-1.6	—	—	
0257	Hannan Cr.	RB-6.8	3.55	—	(Coho)

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
	Unnamed Lk.	Outlet-2.65	—	—	
	Lake Hannan	Outlet-3.55	—	—	
0262	Unnamed	RB-7.4	1.9	—	None
0264	Unnamed	RB-7.8	2.0	—	(Coho)
	Cherry Lake	Outlet-9.9	—	—	
0267	Tuck Creek	LB-10.3	4.05	—	Coho, (Chum)
0268	Drainage Ditch	LB-0.4	~ 1.1	—	Unknown
	Unnamed Lake	Outlet-3.25	—	—	

(Cont. Snohomish 703)



SNOQUALMIE RIVER
Carnation Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Novelty Hill Rd.
West River Road
Solberg Road
Carnation Road
Big Rock Road
Foy Road
Stillwater Cr.
Lake Joy Road
Swan Lake
Lake Joy
Sikes Lake
Horseshoe Lake
Snoqualmie River
Carnation
0276
0277
0279
0281
0286
0287
0288
0289
Screen

SNOQUALMIE RIVER — CARNATION AREA
Snohomish River Basin — WRIA 07

Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
Snohomish River				Chin., Coho, Pink, Chum
Snoqualmie River				Chin., Coho, Pink, Chum
Adair Creek	LB-13.35	1.65	—	Unknown
Unnamed	LB-15.1	1.05	—	Unknown
Ames Creek	LB-17.0	5.2	—	Coho, (Chum)
Unnamed	RB-0.55	0.7	—	Unknown
Drain. Ditch	LB-0.25	~ 1.6	—	Unknown
Sikes Lake	Outlet-0.7			
Ames Lake	Outlet-3.5	—	—	
Harris Creek	RB-21.3	6.45	—	Coho, (Chum)
Unnamed Lake	Outlet-0.2	—	—	
Stillwater Cr.	RB-1.11	1.1	—	Coho
Unnamed	RB-4.45	1.1	—	Coho
Unnamed Lake	Outlet-6.1	—	—	
Unnamed Lake	Outlet-6.45	—	—	
Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)

(See Snohomish 803)
(See Snohomish 1003)

This section includes the lower 9.0 miles of Tolt River with nine tributaries, excluding the South Fork, providing an additional 13.2 stream miles. The Tolt River originates in the range of mountains including Mt. Index, Red Mountain, and Mt. Phelps east of the Snoqualmie River, then flows southwest to its confluence with the Snoqualmie (R.M. 24.9) near the town of Carnation. The entire watershed lies within King County and road access to the lower river is provided by the Tolt River Road along the north bank, upstream from about six miles, and by the Bunker Road on the south bank from the mouth to river mile 1.8. Stossel Creek is the principal tributary and is accessible from the Tolt Truck Trail. The upper watershed will be discussed with Map 901.

Stream Description

The lower Tolt River includes the 9.0 miles below the confluence of the North and South forks. Flows are controlled by the spillway releases from the Seattle Water Supply Reservoir on the South Fork. The peaks of the upper watershed mountain range extend to 5,000-foot elevation and drop rapidly from steep canyon boulder zones to the 450 -foot elevation near the forks. The Tolt River Valley broadens below this point and becomes predominantly of floodway character. Stream width varies from 45 to 75 feet above river mile 5.0 and extends to 90 feet in the lower river. Channel splitting and overflow side channels occur below river mile 4.0. Above river mile 5.0 the streambed is comprised mostly of rubble and boulders with few patch gravel areas. Flows are mostly of fast riffle character with a few rapids. Below river mile 5.0 the bottom composition changes, with the streambed exhibiting rubble and gravel with a few boulder-strewn sections. Proceeding downstream from R.M. 5.0 there are increasing sections of gravel riffles and generally good pool-riffle balance.

Land use is confined to a few permanent small rural farms in the lower 2 miles, with heavy recreational use up to river mile 6.0 at the end of the Tolt River Road. Some logging occurs in the upper section near the forks. Stossel Creek is the principal tributary providing 4.45 miles of accessible stream. This tributary contains several reaches of beaver ponds. There are 8 short tributaries that also provide considerable drainage runoff to this system. These contain good shade cover and some sections suitable for salmon production.

Salmon Utilization

Chinook, coho, chum and pink inhabit the lower Tolt River with chinook and coho ascending this entire section and chum and pink utilizing the lower 4.0 miles, particularly the channel splits and overflow channels. Coho ascend all of the accessible portions of the tributaries, particularly Stossel Creek and Langlois Creek.

Limiting Factors

Steep gradients, cascades and falls restrict some fish use in the smaller unnamed tributaries. Gravel removal, particularly in the lower river, has altered the streambed conditions. Riprapping and other flood control measures below river mile 4.0 has tended to eliminate natural overflow channels and construct the main channel in some cases. Cleared logged-off slopes in the upper watershed contribute to the flash flooding and silting in the basin. Large boulders in the streambed limit the spawning areas. The Seattle-Tolt Water Reservoir controls the flows from the South Fork, reducing summer rearing capacity.

Beneficial Developments

A U.S.G.S. gaging station, located about 0.5 mile downstream of the confluence of the South Fork, has continuously recorded stream flow measurements from the Seattle Water Reservoir since 1952. Another U.S.G.S. gaging station, with records dating back to 1928, is located near the mouth of Stossel Creek. Negotiations for minimum flow releases for fish use were initiated in 1957 but have never been consummated into a formal agreement. Based on average flows of 200 cfs from September 15 to June 1, and 125 cfs from June 1 to September 15, as measured below Stossel Creek, releases from the Seattle Storage Dam would amount to 38 cfs in the winter period and 24.5 cfs in the summer period. In critical water years, which occur one out of ten, the reduction of 30% in these quantities would be made in the monthly release schedule.

Habitat Needs

A firm minimum flow agreement should be negotiated through the Department of Ecology with Seattle Water Department for Tolt River Reservoir releases for fish use. Gravel removal operations in the lower Tolt River should be prohibited as recruitment of gravel is minimal in this river.

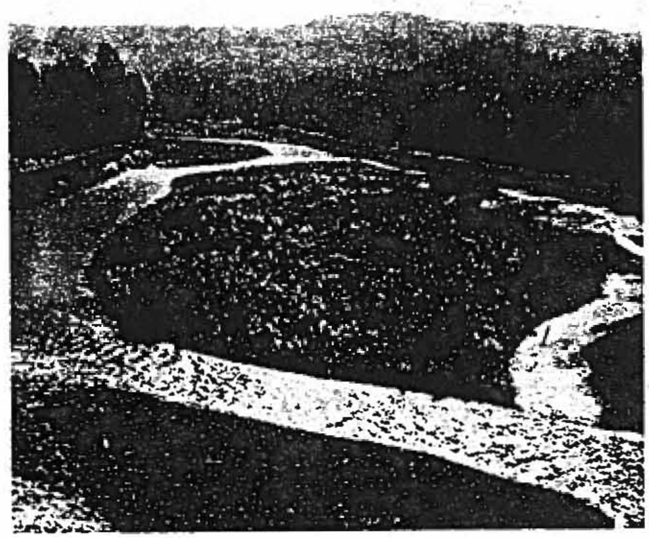
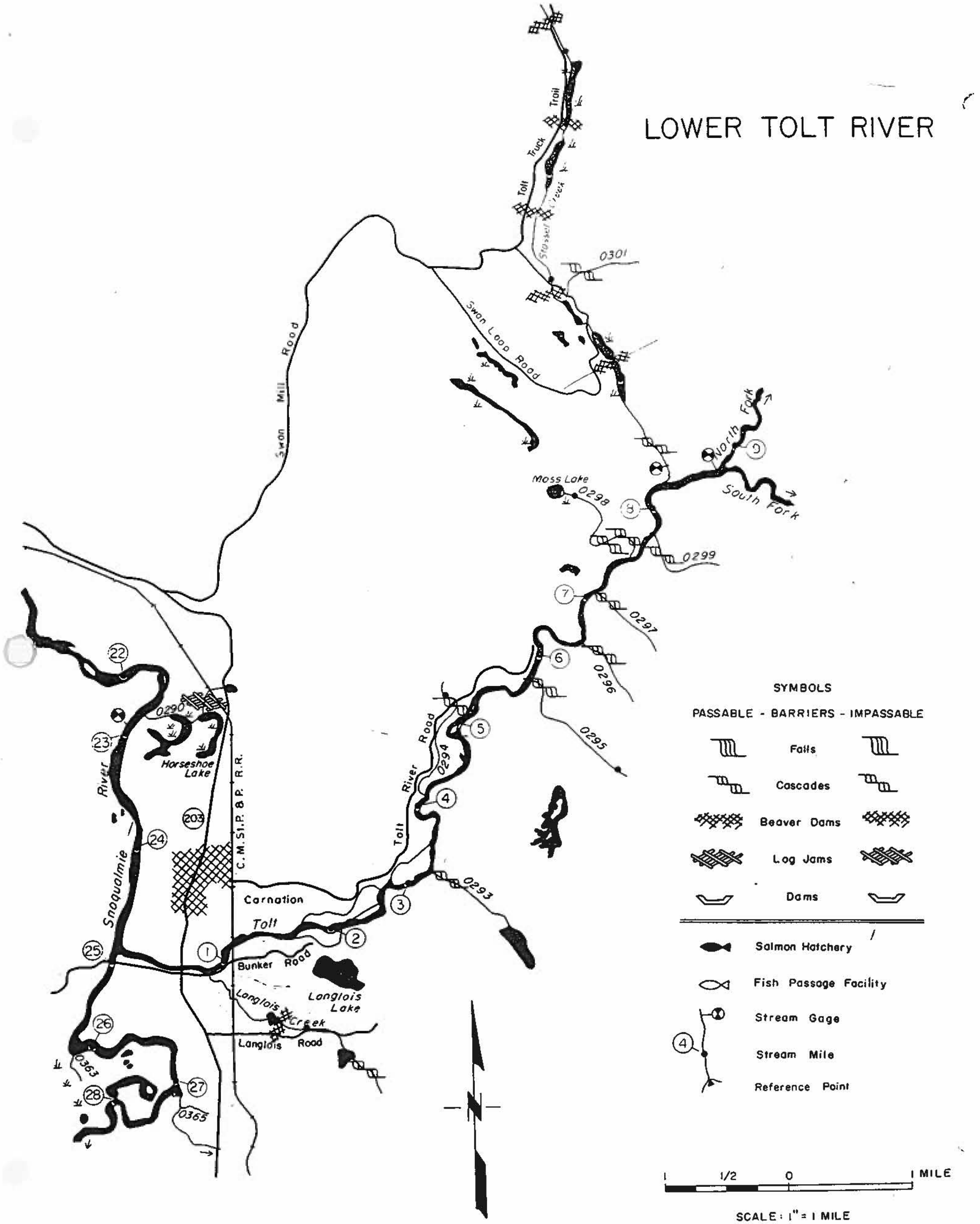


PHOTO 07-21. Set back levees on lower Tolt River allows the river to meander.

LOWER TOLT RIVER



LOWER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)
0292	Langlois Creek	LB-0.85	1.85	—	Coho
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-1.4	—	—	
0294	Unnamed	RB-4.1	1.1	—	(Chin), Coho
0295	Unnamed	LB-5.8	1.1	—	Unknown
0298	Unnamed	RB-7.5	1.15	—	(Coho)
0300	Stossel Cr.	RB-8.3	4.45	—	Coho
	Unnamed Lk.	Outlet-0.8	—	—	
	Unnamed Lk.	Outlet-1.2	—	—	
	Unnamed Lk.	Outlet-1.56	—	—	
	Unnamed Lk.	Outlet-2.9	—	—	
	Unnamed Lk.	Outlet-3.4	—	—	
	Unnamed Lk.	Outlet-4.45	—	—	
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
	(See Snohomish 903)				
	Tolt R. cont. as No. Fk. Tolt R.	(@ mi. 8.81)	—	—	
	(Cont. Snohomish 903)				

This section covers the upper Tolt River basin. Above the South Fork (R.M. 8.8) it continues as North Fork more than 17 miles. Some 22 tributaries and 50 stream miles. The South Fork is also about 17 miles long, with 15 tributaries adding 30 stream miles. The area is located six miles east of Carnation, in north-central King County. Access is via logging roads from the town of Snoqualmie. The North Fork and tributaries above R.M. 18 are within Snoqualmie National Forest. Also, much of the area is managed as watershed by the City of Seattle.

Stream Description

From the northwest slopes of Red Mountain the North Fork flows first northwest, then west about eight miles, then southwest nine miles to the South Fork confluence. The only large tributary other than the South Fork is North Fork Creek.

Over its upper 6-7 miles the North Fork cuts through a narrow, steep-sloped valley. The upper three or so miles hold dense conifer forest; the lower slopes mostly clear-cut. Downstream from Titicaca Creek (R.M. 20.6) the valley shallows and broadens for six miles, showing many clear-cuts and various stages of reforestation. The lower six miles cut through deep ravine-canyon terrain, where most side slopes are thickly forested. Similar mountain terrain exists over the South Fork; however, most slopes here hold dense forest cover. Little development has occurred in the upper drainage. Principal activity is logging, with some recreation.

The North Fork's upper six miles are mostly steep, the stream's narrow channel holding some falls, numerous cascades, a few short pool-riffle stretches. Widths range 2-6 yards, the bottom mainly boulder and rubble, little gravel.

The gradient over the next six miles is mostly moderate. Fall widths range 5-10 yards, with some channel splitting. There are a number of good pool-riffle stretches, with the bottom being mainly rubble and gravel, and a few boulder areas. Banks are mostly low earth or rock cuts, with a few gravel-rubble beaches. Cover consists of patches or strips of mainly deciduous growth and some mixed conifer.

Over the next 3-4 miles, the ravine-canyon area presents mostly steep gradient, with numerous falls, cascades, and rapids, and only a few deep pools and short riffles. One large falls, exceeding 25 feet, is located about R.M. 10.8. Stream widths above the falls range from 4 to 9 yards. The bottom is mostly large rock and boulders, with some bedrock and a few rubble-patch gravel stretches.

The lower two miles of the reach present moderately steep gradient. The channel remains confined, ranging 5-12 yards in width in the fall, exhibiting numerous cascades and rapids, and occasional pools and short riffles. The bottom is boulder and rubble, with some patch gravel. Banks are steep-sloped, maintaining moderate to dense deciduous/conifer cover where logging has not occurred.

The South Fork's upper three miles is steep gradient stream, with conditions much the same as in the upper North Fork. For the next three miles, the gradient is moderately steep, with the stream presenting mostly fast riffles, a few cascades, and some short pool-riffle stretches. Here, fall widths range 3-5 yards, with the bottom composed mostly of rubble and scattered boulders, and some patch gravel areas. Cover is mostly conifer timber, with some mixed deciduous growth. Seattle's South Fork Tolt Reservoir encompasses the next 3.5 miles (R.M. 8.5-12.0). A large falls is located just downstream from the dam. Over the remaining eight or so miles the South Fork presents moderately steep to steep gradient, with mostly fast riffles and some cascades, particularly in a short canyon (R.M. 2.5-3.5). Stream widths range from 5 to 14 yards. Some deep pools, with a few short riffles, exist along this lower stretch. The bottom is mainly rubble and boulders, with a few short gravel riffles and patch gravel strips. The South Fork banks are generally sharp earth or rock cuts holding dense cover, except for the lower river stretches where clear-cut logging has occurred.

Nearly all smaller tributaries exhibit steep mountain stream character, with numerous cascades and rapids, and mostly boulder and rubble bottoms.

Salmon Utilization

This section receives limited salmon use, some chinook and coho ascending the North Fork about a mile, the South Fork as far as eight miles. Chinook juveniles rear for a short time in these waters, coho having year-round habitation.

Limiting Factors

Natural salmon production limitations include the North Fork and South Fork falls, plus the steep gradient restricting spawning habitat within accessible stream reaches. Additional factors include low flows during critical dry seasons, and occasional heavy siltation from a South Fork slide.

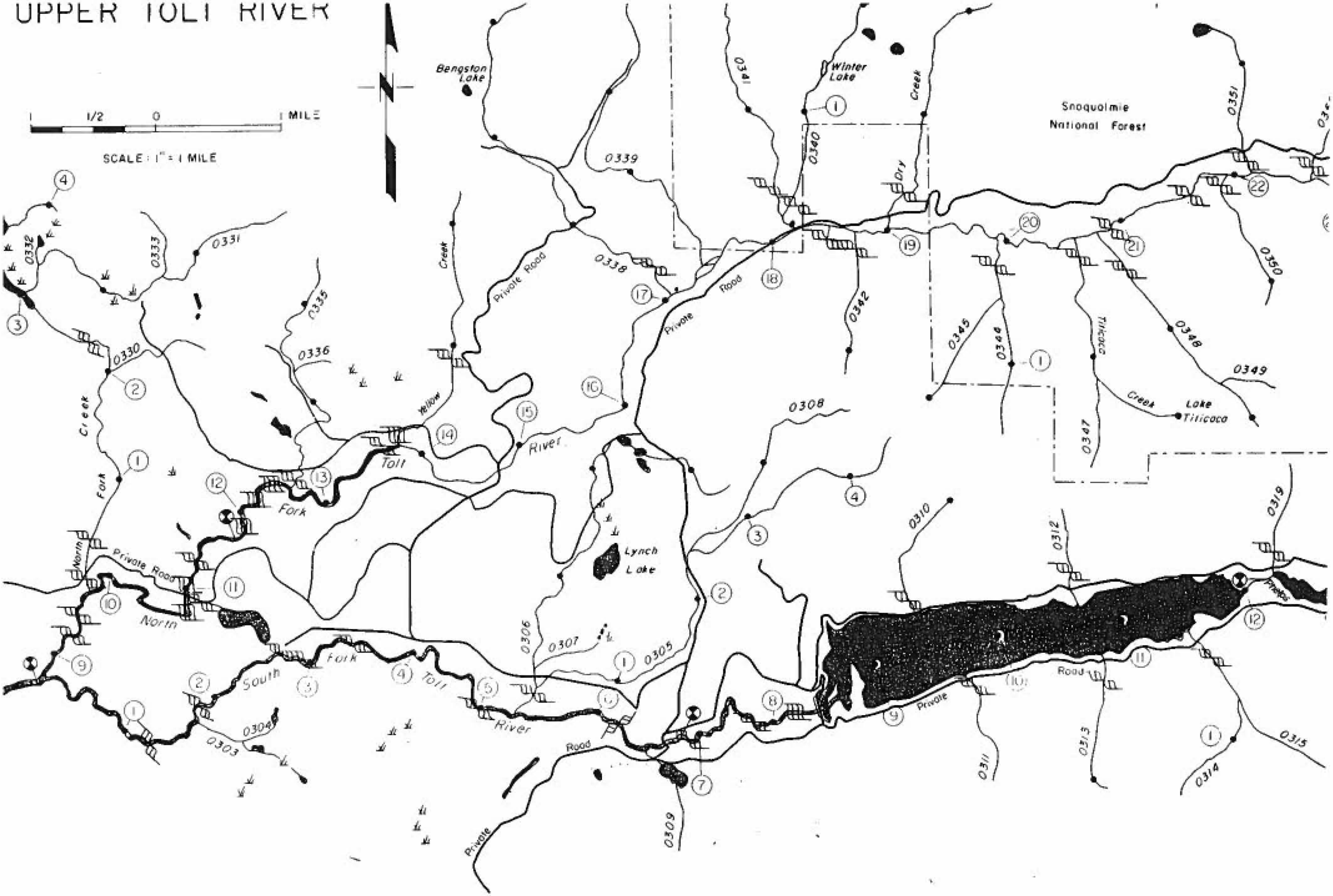
Beneficial Developments

The only programs to benefit salmon production is a minimum flow agreement with the City of Seattle to insure against severe flow reductions.

Habitat Needs

Requirements to maintain production habitat include preserving stream side cover, and maintaining stream conditions in a near natural state. Containment of the South Fork slide would benefit the more productive areas downstream.

UPPER TOLT RIVER



UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River				Chin., Coho, Pink, (Chum)
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
0305	Unnamed	RB-5.3	4.5	—	Unknown
0306	Unnamed	RB-0.3	3.4	—	None
	Unnamed Lake	Outlet-2.3	—	—	
	Unnamed Lake	Outlet-2.5	—	—	
0308	Unnamed	RB-2.45	1.9	—	None
	Tolt-Seattle Water Sup. Res.	Outlet-8.4	—	—	
0310	Unnamed	RB-9.4	1.0	—	None
0313	Unnamed	LB-10.8	1.1	—	None
1314	Unnamed	LB-11.5	1.6	—	None
0315	Unnamed	RB-0.7	1.0	—	None
0316	Phelps Cr.	LB-12.3	2.2	—	None
0320	Unnamed	RB-12.9	1.0	—	None
0323	Unnamed	RB-14.5	1.0	—	None
	Tolt R. cont. as N. F. Tolt R.	@ mi. 8.81	—	49.3	
0329	N. Fork Creek	RB-9.7	4.1	7.53	Unknown
	Unnamed Lake	Outlet-2.85	—	—	
0331	Unnamed	LB-3.0	2.8	—	None
	Unnamed Lake	Outlet-3.55	—	—	
0335	Unnamed	RB-12.6	2.5	—	None
0337	Yellow Creek	RB-13.8	2.2	—	None
0338	Unnamed	RB-17.05	3.7	—	None
0339	Unnamed	RB-17.4	2.9	—	None
0340	Unnamed	RB-18.25	3.0	—	None
0341	Unnamed	RB-0.15	2.7	—	None
	Winter Lake	Outlet-1.35	—	—	
0342	Unnamed	LB-18.7	1.2	—	None
0343	Dry Creek	RB-19.0	2.4	—	None
0344	Unnamed	LB-19.9	1.6	—	None
0345	Unnamed	LB-0.5	1.0	—	None

UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0346	Titacaca Creek	LB-20.6	1.9	—	None
	Lk. Titicaca	Outlet-1.9	—	—	
0348	Unnamed	LB-20.8	2.1	—	None
0350	Unnamed	LB-21.9	1.2	—	None
0351	Unnamed	RB-22.1	1.4	—	None
0352	Unnamed	RB-22.6	1.1	—	None
0353	Unnamed	RB-23.1	1.2	—	None
0354	Unnamed	RB-23.39	1.4	—	None
0355	Titicaed Cr.	LB-23.4	1.65	—	None
	Titicaed Lk.	Outlet-1.65	—	—	
0358	Unnamed	RB-23.55	1.1	—	None

Thirteen miles of main Snoqualmie River are covered in this section from Tolt River upstream to Tokul Creek, plus fourteen tributaries exclusive of the Raging River, providing an additional 51.0 stream miles. The principal town in this valley section is Fall City located near the confluence of the Raging River with the Snoqualmie River at mile 36.0. Access along this stretch of river is by the Fall City to Monroe State Highway 203 on the east valley, and by the west valley road which connects to the Redmond-Fall City State Highway 522 two miles northwest of Fall City. This portion of the Snoqualmie River lies within King County. The Raging River will be presented in Map 1101.

Stream Description

This section of the Snoqualmie River from river mile 25.0 at the mouth of the Tolt River upstream to river mile 39.3 near Tokul Creek, about a mile below Snoqualmie Falls, provides the floodway for the extensive mountainous headwaters of this watershed above the falls. The Snoqualmie River winds in shallow bends downstream to river mile 33.5, below which it forms extensive oxbows and zigzags across the valley floor in serpentine fashion downstream to the town of Carnation. The valley averages about 1.5 miles in width with hillsides rising to the 400-foot elevation, forming valley walls on either side. Many large side sloughs formed by overflow waters are located in this stretch, with the largest group located on the east valley side between river mile 36.0 and 33.0 below Fall City. The mainstem Snoqualmie varies in width from 150 to 400 feet, averaging about 250 feet over much of the distance. Gradient is extremely shallow, descending from 100-foot elevation to 55-foot elevation within this 13.8 mile distance, with only a five-foot drop in the lower 6 miles. Below river mile 33.0 the river becomes a slow, deep slough, confined within diked banks with heavy mud and silt bottoms. Few patch gravel shoreline bars are present even on inside curves. Long gravel riffles with goo gravel composition occur between river mile 34.0 and 35.0. Above this point, the river again becomes deep and slow moving. Good tree cover with brush-covered banks occurs throughout this section. Land use is essentially agricultural and pastural. Due to annual flooding in the valley, there are only scattered rural homes.

Griffin Creek is a major tributary providing some 13 stream miles of drainage. The creek ranges from 10 to 25 feet in width with fair gravel composition. The average flow from 20 years of record is 42.3 cfs. Many beaver dams and swamps occur above stream mile 5.0 and much of the upper watershed has been logged off. Many summer homes are located on the lower stream.

Patterson Creek is 9.25 miles in length with an additional 9.7 miles of tributaries. It is a typical lowland-type stream with fair to good gravel, good pool-riffle balance and excellent shade and cover. Average discharge for 19 years of record is 32.2 cfs.

Salmon Utilization

Chinook, coho, chum and pink salmon utilize the mainstem Snoqualmie within this section for transportation, spawning and rearing. Chinook spawning is intense between river mile 34.0 and 35.0 with some chum and pink utilizing this same area as well as the mouth of the Raging River. Below R.M. 33.5 there is minimal spawning area with only a few shoreline gravel sections. Coho utilize mainly the tributaries; especially Griffin Creek, Patterson Creek, Skunk Creek, and the lower accessible portions of the other small unnamed tributaries. In Griffin Creek the main coho spawning occurs between R.M. 3.0 and 5.1 at the outlet of the lower swamp lake.

Limiting Factors

Heavy snowmelts and runoffs from above Snoqualmie Falls create heavy flooding in the valley. The I-90 road construction on Snoqualmie Pass Highway causes heavy silt loads in the lower river. Heavy deposits of silt and mud are found throughout the deep, slow oxbows of the lower river. Logging in the headwaters of Griffin Creek creates heavy runoff and gravel bed shifting in this stream. Steep gradients and cascades of the small independent tributaries reduce the streams to minimum salmon usage.

Beneficial Developments

No facilities or programs have been undertaken in this section to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production habitat in this section include: developing zoning laws preventing construction of permanent buildings within the flood plain; coordinating flood control activities with King County Flood Control; and the development of a good watershed management plan to preserve the environment.

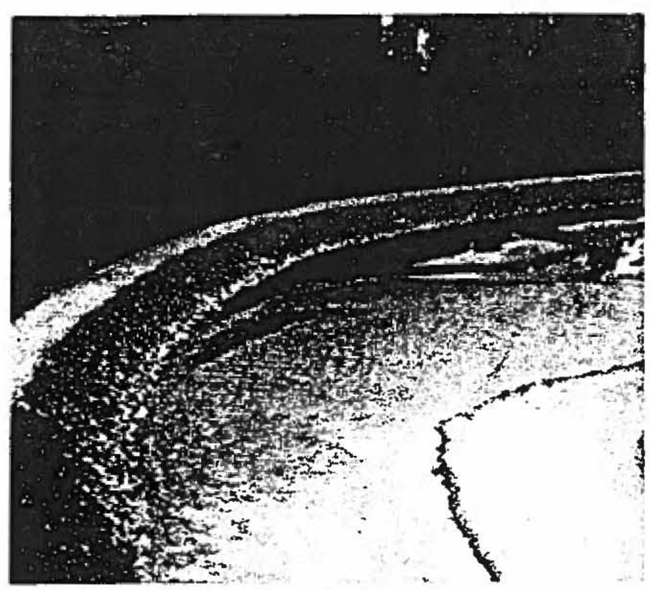
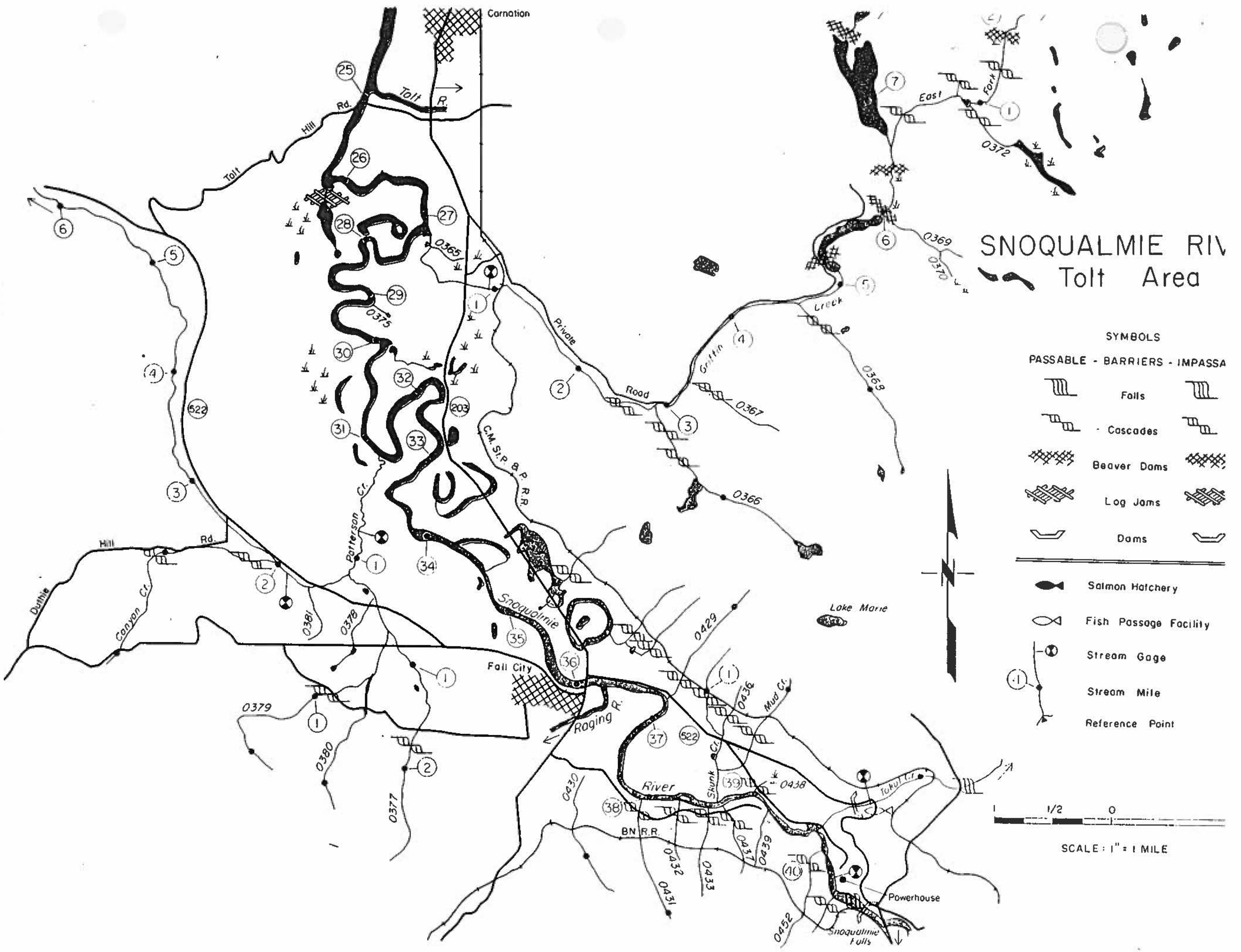


PHOTO 07-22. Good chinook riffles on Snoqualmie River.



SNOQUALMIE RIV
Tolt Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSA
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
SCALE: 1" = 1 MILE
Carnation
Tolt R.
Tolt Hill Rd.
Private Road
Griffin Creek
East Fork
C.M. St.P. & P. R.R.
Patterson Cr.
Snoqualmie
Fall City
Raging R.
River
Skunk Cr.
Mud Cr.
Tokul Cr.
BN R.R.
Lake Marie
Powerhouse
Snoqualmie Falls
Canyon Cr.
Duthie
Hill Rd.
522
203
0365
0366
0367
0368
0369
0370
0372
0375
0377
0378
0379
0380
0381
0429
0430
0431
0432
0433
0436
0437
0438
0439
0452

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River			—	Chin., Coho, Pink, Chum
0219	Snoqualmie River	LB-20.5		—	Chin., Coho, Pink, Chum
0364	Griffin Creek	RB-27.2	11.4	—	Chin., Coho, Pink, (Chum)
0366	Unnamed	LB-2.9	1.75	—	(Coho)
	Unnamed Lk.	Outlet-0.75	—	—	
	Unnamed Lk.	Outlet-1.75		—	—
0368	Unnamed	LB-4.6	1.7	—	(Coho)
	Unnamed Lk.	Outlet-5.1	—	—	
0371	East Fork	LB-6.6	3.3	—	Coho
	Unnamed Lk.	Outlet-0.9	—	—	
	Unnamed Lk.	Outlet-2.6	—	—	
	Hull Lake	Outlet-3.05	—	—	
	Unnamed Lk.	Outlet-3.3	—	—	
	Unnamed Lk.	Outlet-6.75	—	—	
	Unnamed Lk.	Outlet-7.8	—	—	
	Unnamed Lk.	Outlet-8.9	—	—	
	Unnamed Lk.	Outlet-11.0	—	—	
0376	Patterson Creek	LB-31.2	9.25	—	Coho
0377	Unnamed	RB-1.2	2.9	—	Coho
0379	Unnamed	LB-0.6	2.2	—	Unknown
0380	Unnamed	RB-0.55	1.2	—	Unknown
0382	Canyon Creek	RB-2.0	2.1	—	(Coho)
0383	Unnamed	RB-6.5	1.3	—	Unknown
	Unnamed Lake	Outlet-9.25	—	—	
0384	Raging River	LB-36.2	15.2	—	Chin., Coho, Pink, (Chum)
	(See Snohomish 1103)				
0429	Unnamed	RB-36.8	1.2	—	Unknown
0430	Unnamed	LB-37.65	1.4	—	Unknown
0431	Unnamed	LB-37.95	1.0	—	Unknown
0434	Skunk Creek	RB-38.64	1.4	—	Coho
0435	Mud Creek	LB-0.3	1.1	—	(Coho)
	(Cont. Snohomish 1303)				

UPPER SOUTH PRAIRIE CREEK

This drainage section covers the upper South Prairie Creek above R.M. 12.0. The headwaters lie in the Snoqualmie National Forest near Old Baldy Mountain, Burnt Mountain, and the Three Sisters Mountain near the northwest corner of Mount Rainier National Park in Pierce County. From here the stream generally courses northwesterly towards the town of Buckley. Within this ten-mile section of upper South Prairie Creek, three major tributaries plus eight smaller tributaries provide an additional 34.65 stream miles.

Stream Description

The headwaters of the South Fork and East Fork originate near the Burnt Mountain and Old Baldy Mountain range at the 4,000-foot elevation. The upper headwaters of Beaver Creek and New Pond Creek flow from the Three Sisters Mountain range, several miles north, at the 3,200-foot elevation. They flow generally westward to their confluence with South Prairie Creek. The entire upper South Prairie Creek watershed lies in densely forested mountainous terrain above any major towns or communities. Logging is the principal activity throughout this area, with selective clear-cut sections. Much of the upper watersheds above the forks and along the creek bottoms have been extensively logged in years past. Some mining activity occurs in the mountain peak areas along the Carbon Ridge. Many small mountain lakes, which attract recreational use, also are found throughout this range.

The only access to the upper watershed is out of the town of Wilkeson by two logging roads, the Littlejohn Road and the East Prairie Road. Jeep trails branching off these roads are the only other accesses to the tributaries of the upper watershed.

Above R.M. 14.5 the upper South Prairie Creek and its tributaries course through steep-sloped high mountain terrain containing moderately steep gradients with numerous cascades and rapids and few pools or riffles. Bottom composition is primarily of boulder and rubble with some patch gravel areas. The mainstem stream banks and streambeds below New Pond Creek are quite stable with only a few natural earth-cut exposed areas. Except for the logged-off portions along the upper stream sections, there is good stream cover and shade from dense conifer timber stands.

Salmon Utilization

Salmon use within this area is restricted below R.M. 15.0 where steep cascade sections are located. A diversion dam at stream mile 15.7 provides a total block to salmon migration. Chinook, coho, and pink salmon utilize the stream below. Beaver Creek is inhabited by chinook, pink, and coho in the lower portion and coho in the upper portion, while only coho salmon utilize New Pond Creek. Juvenile chinook and coho rear in the lower three miles between R.M. 12 and 15 of this section.

Limiting Factors

The steep terrain, swift velocities, and many falls and cascades above stream mile 15.0 offer little potential for anadromous production. No fish passage facilities are associated with the diversion dam at R.M. 15.7. Heavy flood runoff waters associated with the steep mountainous terrain have scoured away much of the spawning gravel through the deep ravines and cascade sections of the upper watershed. Boulders, logs, and debris jams also limit the available areas for fish use. Logging and road construction in the upper watersheds have caused considerable silting in lower South Prairie Creek.

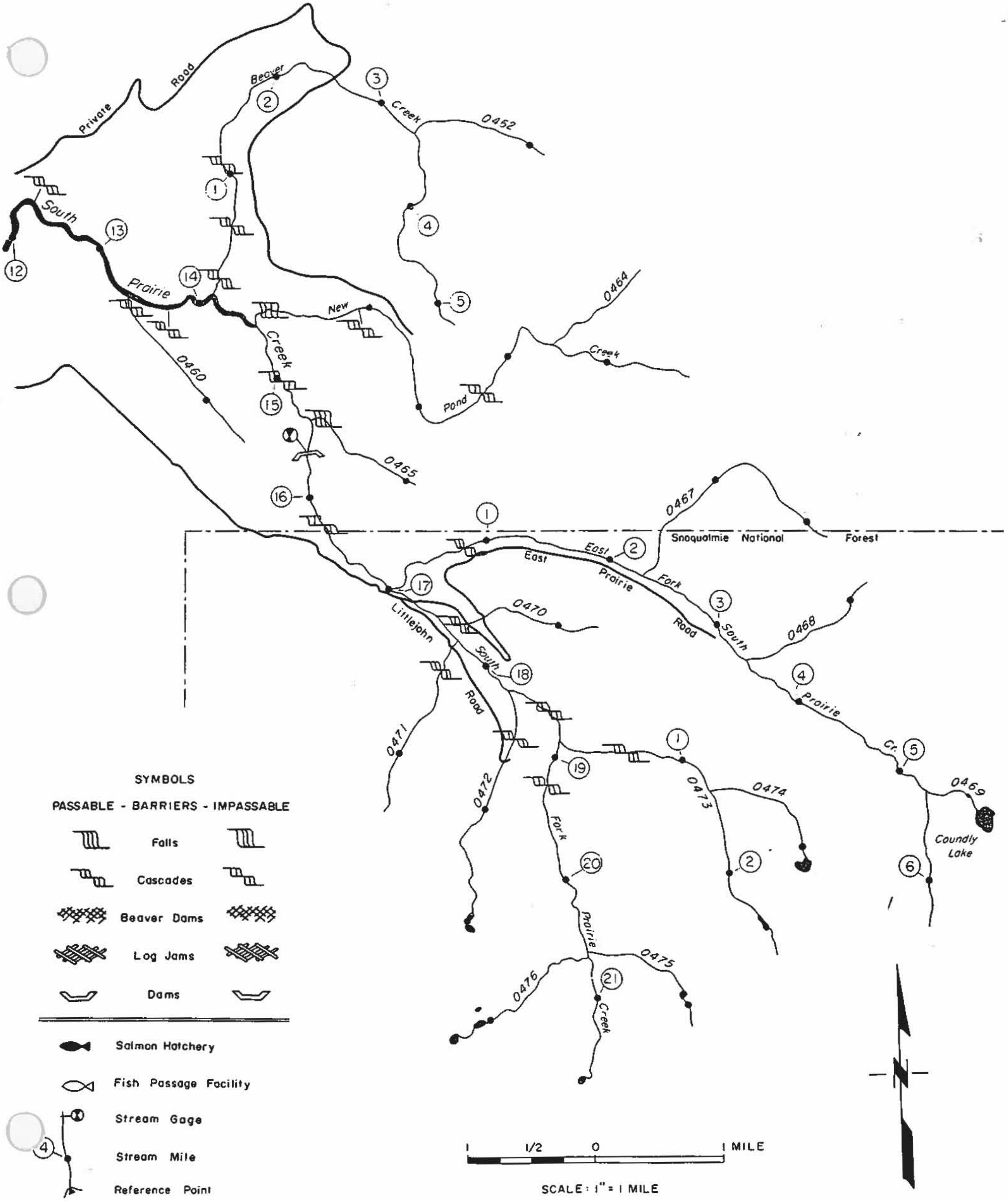
Beneficial Developments

No projects have been undertaken within this section to benefit salmon production.

Habitat Needs

This entire watershed, except for logged areas, remains essentially in its natural pristine state. Logging and road building operations throughout the upper watershed should conform to practices that will maintain clean, free-flowing streams. Buffer strips should be left in the logging areas near the upper watershed streams. Reforestation is mandatory and should be carried out as soon as possible after logging operations have ceased.

UPPER SOUTH PRAIRIE CREEK



UPPER SOUTH PRAIRIE CREEK
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0413	Carbon River				Chin., Coho, Pink, Chum
0429	S. Prairie Cr.				Chin., Coho, Pink, Chum
0460	Unnamed	LB-13.4	1.5	—	Unknown
0461	Beaver Creek	RB-14.1	5.25	—	(Chin.), Coho, (Chum)
0462	Unnamed	RB-3.35	1.15	—	None
0463	New Pond Creek	RB-14.55	4.65	—	(Coho)
0465	Unnamed	RB-15.4	1.05	—	Unknown
0466	East Fork S. Prairie Cr.	RB-17.0	6.4	—	None
0467	Unnamed	RB-2.3	2.2	—	None
0468	Unnamed	RB-3.4	1.2	—	None
	S. Prairie Cr. cont. as S.Fk. Prairie Cr.	@ mi. 17.01		—	
0470	Unnamed	RB-17.5	1.3	—	None
0471	Unnamed	LB-17.7	1.5	—	None
0472	Unnamed	LB-18.25	2.0	—	None
0473	Unnamed	RB-18.85	2.85	—	None
0474	Unnamed	RB-1.3	1.1	—	None
0475	Unnamed	RB-20.6	1.2	—	None
0476	Unnamed	LB-20.65	1.3	—	None

This section includes the lower 12 miles of South Prairie Creek above its confluence with the Carbon River on the right bank at R.M. 5.9 immediately below the State Highway 162 bridge. Wilkeson Creek is a major tributary along with eight smaller tributaries having a total of 41.9 linear stream miles. The watershed is located near the communities of Wilkeson, Burnett, and South Prairie in Pierce County. Access to this area is by State Highway 162 and by the Spiketon-Wilkeson Road.

Stream Description

From R.M. 12.0 South Prairie Creek generally zigzags for 7 miles to the town of South Prairie where it then turns and flows southwest to its confluence with the Carbon River at R.M. 5.9. Within the upper 4 miles of this section the creek cuts through steep ravine-type terrain, with a confined stream channel. At R.M. 8.0 near the community of Burnett, the hillsides give way to more gently sloping terrain and widening valley floor. From this point downstream the creek flows through well defined channels. The valley floor intermittently broadens and narrows downstream to the mouth. This lower section contains increasing amounts of open farmlands separated by intermittent stands or strips of deciduous trees and brush. Land use is agricultural in the lower valley and logging and mining in the upper watershed.

South Prairie Creek exhibits a moderate gradient throughout the valley floor. The stream contains good shade and cover with overhanging banks and has an average discharge of 250 cfs at the gage at South Prairie. Stream widths vary from 10 to 70 yards. The valley hillsides rise from 500 to 700-foot elevation and are covered with mixed deciduous and coniferous forests. Most of these 12 miles contain good pool-riffle proportions and excellent stream substrate.

Wilkeson Creek is the major tributary within this section and contains 12.3 miles of stream plus 5 smaller tributaries providing an additional 21.3 linear miles. The upper headwaters are formed from the South Fork Gail Creek and from West Fork Gail Creek which originate in the Gleason Hills. This drainage flows northerly through the town of Wilkeson to its confluence with South Prairie Creek at R.M. 6.7. The upper watershed originates in a rather pristine area of mountainous terrain with steep gradient, numerous cascades, and is heavily forested. A steep cascade at R.M. 6.8 is a total barrier to fish passage. The lower stream contains excellent pool-riffle balance and much good gravel substrate. The moderately steep gradient shallows in the lower 3 miles. This stream is well covered with deciduous trees and brush along the banks throughout the entire length.

Salmon Utilization

The lower 8 miles of South Prairie Creek provides the major spawning habitat within the system and this drainage is utilized by chinook, pink, chum, and coho. The lower 6.8 stream miles of Wilkeson Creek provide excellent spawning and rearing habitat, with heaviest usage by coho. Each of the accessible unnamed tributaries receives annual runs of coho and a few are utilized by chum in the lower reaches.

Limiting Factors

The major limiting factor within this drainage section is the natural occurrence of low summer flows that reduce the available rearing area throughout the stream. Flood control measures have been undertaken in the lower stream section including gravel removal, bank erosion controls, and channel changes. Heavy silting and gravel compaction have resulted from these types of operations. Coal waste from former mining operations in the upper Wilkeson watershed has settled in the lower stream. Poaching has always been a serious problem in this lower South Prairie Creek area.

Beneficial Developments

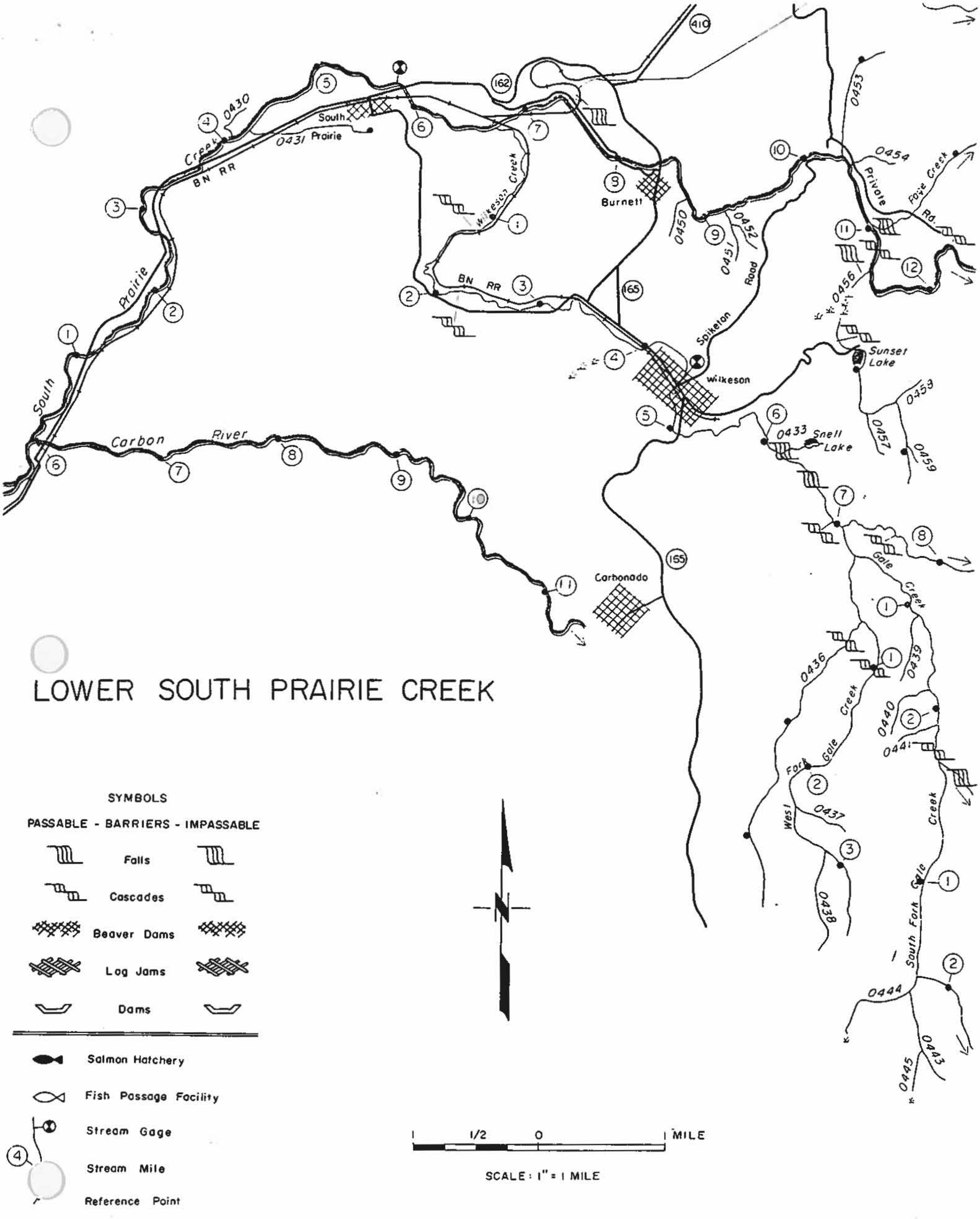
No facility developments or programs have been undertaken within this section to benefit salmon production.

Habitat Needs

A major requirement for maintaining salmon production potential within this drainage section is to preserve existing stream cover and the natural pool-riffle balance. Future mining operations in the upper watershed, particularly for coal, should be monitored closely to preserve the water quality of the area. A good watershed management plan should be developed under the Shorelines Management Act by the local communities to preserve this watershed in its natural state.

PHOTO 10-18. South Prairie Creek has a gentle gradient.

LOWER SOUTH PRAIRIE CREEK



LOWER SOUTH PRAIRIE CREEK
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0413	Carbon River				Chin., Coho, Pink, Chum
0429	S. Prairie Creek	RB-5.9	21.65	—	Chin., Coho, Pink, Chum
0431	Unnamed	LB-4.2	1.0	—	(Coho), (Chum)
0432	Wilkeson Creek	LB-6.7	12.3	—	Chin., Coho, Pink, (Chum)
0434	Gale Creek	LB-7.05	7.7	—	None
0435	West Fork Gale Creek	LB-0.3	3.6	—	None
0436	Unnamed	LB-0.5	2.6	—	None
0442	South Fork	LB-2.4	3.2	—	None
	Gale Creek	LB-2.4	3.2	—	None
0446	Unnamed	LB-5.5	1.4	—	None
0447	Unnamed	RB-5.8	2.0	—	None
0448	Unnamed	RB-8.6	2.6	—	None
0449	Drainage Ditch	RB-7.4	~ 4.15	—	Coho,Pink,(Chum)
0453	Unnamed	RB-10.2	1.1	—	Coho, (Chum)
0455	Page Creek	RB-11.0	2.25	—	Unknown
0456	Unnamed	LB-11.4	2.2	—	(Coho), (Chum)
	Sunset Lake	Outlet-0.85	—	—	

(Cont. Puyallup 1103)

WHITE RIVER
Clearwater Area

This section of the White River includes 10 miles of mainstem plus the entire Clearwater drainage and six tributaries to the White River, for a total of 84.35 stream miles. Access along this stretch of river is via the Chinook Pass Highway 410 which parallels the mainstem, and by private logging roads. This entire section of drainage all lies within King County.

Stream Description

The mainstem White River from R.M. 31 to 35 is inundated by the Mud Mountain Dam Reservoir which backs up to approximately R.M. 35.5 above the confluence of the Clearwater River. The stream above this point meanders to R.M. 42.0. There are six tributary streams draining into the White River plus 10.5 miles of Clearwater with some 14 moderate to small tributaries totalling more than 40.45 stream miles. The White River is a glacial stream and shows mountainous characteristics including heavy boulders, rubble, and large gravel, meandering with many channel splits and deep-cut banks. The Clearwater River originates from springs and natural runoff on Bear Head Mountain, and flows northerly 10.5 miles to the confluence with the White River at R.M. 35.3. Approximately a mile and a half downstream is Canyon Creek which originates from small lakes and groundwater runoff from the Three Sisters Mountain Range. It flows northerly 5.8 miles to its confluence with the White River at R.M. 33.8. The other tributary streams include Clay Creek, Cyclone Creek, West Twin, and East Twin creeks. These originate from the slopes of Grass Mountain north of the White River. They all contain steep cascade sections approximately 0.5 mile above their mouths.

The White River has a gradient of approximately 50 feet per mile and contains fast-moving flows. The main river and tributary creeks in the upper portion of this section all show the effects of heavy flood flows and runoffs. The hillside area between Clay Creek and East Twin Creek has been heavily logged in past years. Mostly deciduous trees and brush are found along the river banks and side slopes of the valley with some mixed conifer. Slash burns from logging have left the area barren.

The Clearwater River descends through a narrow, steep, heavily forested valley above R.M. 4.0. The lower valley gradually broadens and the gradient becomes moderate. Heavy rubble predominates in this section with considerable angular rock and gravel in the lower portions of the tributaries. Access is by a private logging road and jeep trail.

Land use is logging and recreation, with minimal development due to the precipitous terrain. Most of the land is owned by Weyerhaeuser Timber Company or other private logging interests. Gravel mining for road construction is also prevalent.

Salmon Utilization

Although salmon are transported and released 10 miles above the dam near Greenwater, the adult chinook and coho still manage to move downstream and into the Clearwater system. Both chinook and coho adults ascend Clearwater River beyond R.M. 5.0. Coho are also known to inhabit the lower 1.5 miles of Canyon Creek. Minimal spawning and rearing area is available within the main White River above the reservoir in this section. Coho can also utilize the lower tributary sections of streams entering the Clearwater River. Juvenile spring chinook and coho rear within the tributaries of this section of river the year around.

Limiting Factors

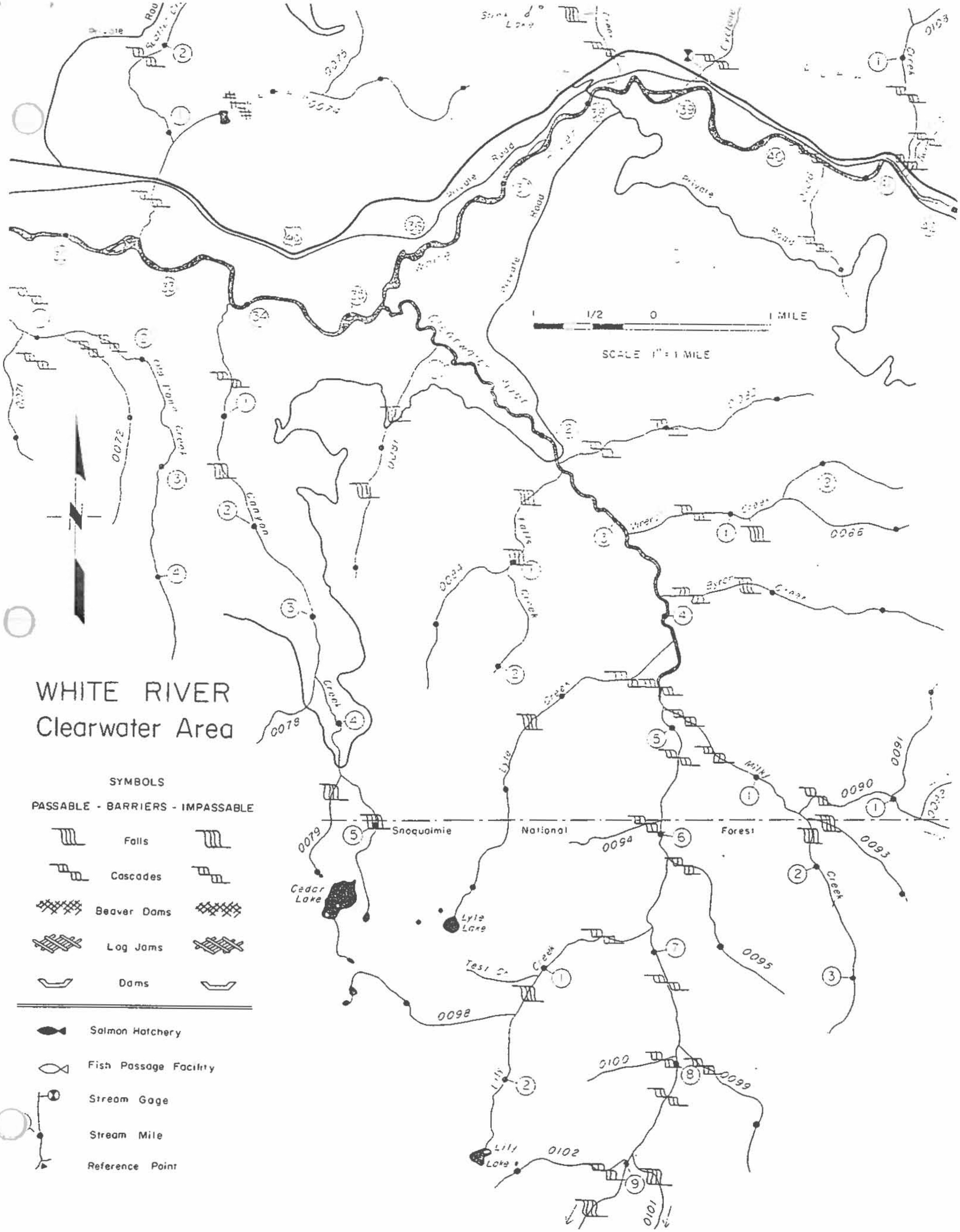
The major limiting factors curtailing salmon production include flooding from snow melt runoff, heavy silt loads from logging operations, large boulders and rubble material throughout the area, low summer flows restricting the available rearing area, limited food supply in glacial atersheds, and extreme cold water temperatures within the river and reservoir. Flash flooding and channel shifting are perhaps the most serious limiting factors impacting salmon production. Road construction and logging within the area have stripped much of nutrients from the land. Flood control measures along the Chinook Pass Highway have also been extensive.

Beneficial Developments

No specific fish facilities or programs have been undertaken within this section of river to benefit salmon production. Hatchery plants of chinook and coho are released into the system to supplement runs that are depleted due to environmental degradation.

Habitat Needs

Coordinated logging agreements between the Weyerhaeuser Timber Company and other private logging companies with the fisheries agencies should be encouraged in order to protect the natural stream habitat within the area. Rehabilitation of streams that have suffered from poor logging practices should be addressed in this agreement. Barren area fry plants into the upper watershed would also be beneficial. Establishment of streambed controls within the mainstem of the White river through this section should be evaluated.


WHITE RIVER
Clearwater Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
SCALE 1" = 1 MILE
1/2
0
1 MILE
Snoqualmie
National
Forest
Cedar Lake
Lyle Lake
Lily Lake
Test Cr
Milk
Byron
Canyon
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0072
0078
0079
0090
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0093
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0100
0101
0102

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0021	Puyallup River				Chin., Coho, Pink, Chum
0031	White River				Chin., Coho, Pink, Chum
0073	Scatter Creek	RB-32.7	5.1	—	Coho
0074	Unnamed	LB-0.9	3.05	—	None
	Unnamed Lake	Outlet-0.5	—	—	
0076	Unnamed	LB-3.85	1.5	—	None
0077	Canyon Creek	LB-33.85	5.8	6.05	Coho
0079	Unnamed	LB-4.45	1.0	—	None
	Unnamed Lake	Outlet-5.8	—	—	
0080	Clearwater River	LB-35.3	10.5	37.8	Chin., Coho
0081	Unnamed	LB-0.75	2.1	—	Coho
0082	Unnamed	RB-2.31	2.35	—	(Coho)
0083	Falls Creek	LB-2.4	2.05	—	(Coho)
0084	Unnamed	LB-1.1	1.5	—	None
0085	Mineral Creek	RB-3.15	2.7	—	(Coho)
0086	Unnamed	LB-1.5	1.15	—	None
0087	Byron Creek	RB-3.8	2.5	—	(Coho)
0088	Lyle Creek	LB-4.2	3.35	—	(Coho)
0089	Milky Creek	RB-4.8	3.55	6.99	(Chin.), (Coho)
0090	Unnamed	RB-1.5	2.8	—	None
0091	Unnamed	RB-0.85	1.1	—	None
0092	Unnamed	RB-1.2	1.1	—	None
0093	Unnamed	RB-1.6	1.1	—	None
0095	Unnamed	RB-6.2	1.7	—	Unknown
0096	Lily Creek	LB-6.8	2.7	—	(Coho)
0098	Unnamed	LB-1.5	1.6	—	None
	Lily Lake	Outlet-2.7	—	—	
0099	Unnamed	RB-7.85	1.5	—	Unknown
0101	Unnamed	RB-8.9	2.2	—	None
0102	Unnamed	LB-8.95	1.2	—	None
0103	Clay Creek	RB-38.2	1.7	—	None
0105	Cyclone Creek	RB-38.95	2.1	—	None
0106	Unnamed	LB-40.6	1.2	—	None
0107	W. Twin Creek	RB-41.4	2.7	—	None
0108	Unnamed	LB-1.3	1.8	—	None
0109	E. Twin Creek	RB-41.5	2.65	—	None

WHITE RIVER — CLEARWATER AREA
Puyallup Basin — WRIA 10

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0110	Unnamed	LB-1.0	1.3	—	None
0111	Unnamed	LB-1.9	1.0	—	None
	(Cont. Puyallup 503)				

MASHEL RIVER DRAINAGE

This section includes the entire Mashel River drainage with over 20 miles of mainstem plus seven tributaries providing another 67 linear stream miles. The majority of this drainage is located east of Eatonville in southern Pierce County. Access is via the Mount Rainier National Park Highway, and various county and private roads out of Eatonville.

Stream Description

From mountain slopes about ten miles east of Eatonville, the Mashel winds its way more than 20 miles west and southwest to enter the Nisqually River (R.M. 39.6) northwest of La Grande. Principal tributaries are Busy Wild and Beaver creeks in the upper drainage, and the Little Mashel River in the lower reaches.

Through the majority of its drainage the Mashel cuts through a shallow, relatively narrow, steep-sloped, forested valley. A number of short, canyon-ravine stretches are encountered. Only in the Eatonville vicinity does the valley broaden to any extent, and this extends for only about a mile. Cover is mainly mixed deciduous and coniferous growth over the upper drainage, and predominantly deciduous trees and brush below. Principal land use is timber production with some agriculture and recreation. Development is sparse with a few scattered rural residences, generally downstream from the town of Eatonville.

From its headwaters downstream about six miles to Busy Wild Creek (R.M. 14.5) the Mashel has a fairly steep gradient, with a few falls, and numerous cascades. These are interspersed with some fast riffles and a few pools. In its narrowly confined channel the bottom is largely boulder and rubble, some bedrock, and only occasional gravel-rubble riffles. Its banks are fairly steep-sided earth or rock cuts, maintaining little cover and much of this upper area has been clear-cut.

Below Busy Wild Creek for approximately 9 miles, the river's gradient is moderately steep. The channel remains quite confined, with fall season flows covering 6 to 12 yards. It is mostly a fast riffle stretch with some cascades and a few relatively large pools. Stream-side cover is dense deciduous trees and underbrush.

In the two miles below Eatonville, the river has a moderate gradient with relatively good pool-riffle stream conditions. The channel is fairly stable with some braiding. Fall season flows range from 8 to 15 yards in width. Here, the bottom is predominantly rubble and gravel, with a few scattered boulders. The banks are low earth cuts or gravel-rubble side beaches. Cover consists of moderate stands or strips of mostly deciduous growth.

Through the lower 4 miles, the Mashel cuts through a narrow, shallow valley, with alternating moderate to moderately steep gradients. The confined channel width ranges from 6 to 12 yards during the fall. The bottom is composed mostly of rubble and gravel, with some bedrock and a few boulder-strewn sections. This area contains fast riffle-type character with occasional good quality pool-riffle stretches, particularly over the lower half-mile. Stream banks are usually natural earth or rock cuts, and a few relatively narrow rubble-gravel beaches. Cover is mainly thick deciduous growth.

Busy Wild Creek has a moderate gradient for nearly 5 miles, with relatively good pool-riffle balance and predominantly gravel-rubble bottom. Its cover is moderate growths of deciduous and low coniferous trees. Beaver Creek and the

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Busy Wild Creek has a moderate gradient for nearly 5 miles, with relatively good pool-riffle balance and predominantly gravel-rubble bottom. Its cover is moderate growths of deciduous and low coniferous trees. Beaver Creek and the Little Mashel River each have falls very near their mouths. The areas above the falls contain moderate gradient stream character for most of their upper stream courses. Most smaller tributaries to the Mashel exhibit steeper mountain-type stream character over much of their lengths, with little access or favorable salmon habitat.

Salmon Utilization

The accessible reaches of the Mashel drainage are utilized primarily by chinook and coho, with pink extending to the Eatonville vicinity. Chum are confined primarily to lower river stretches. Chinook spawn principally in the main river with coho extending into accessible tributaries. Juvenile salmon rearing takes place throughout the accessible stream reaches, with coho having year around habitation.

Limiting Factors

The canyon above Eatonville creates fish passage delays, particularly during low flow periods. This is sometimes compounded by the buildup of logging debris in the stream. Also, flash flooding and unusually heavy siltation are considered problems. Poaching is sometimes prevalent in the lower half-mile.

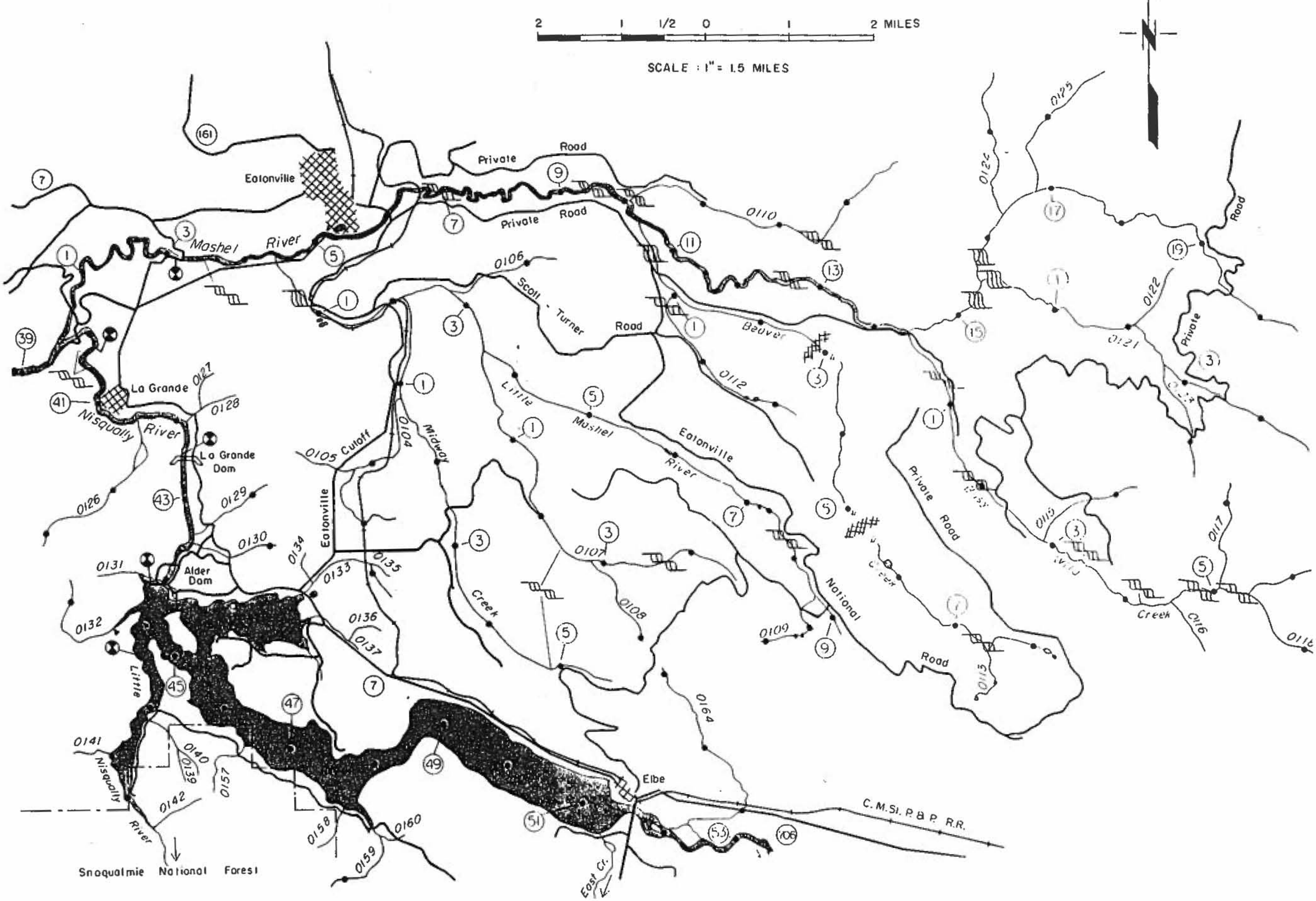
Beneficial Developments

Log jam removal and planting of hatchery-reared fish are the only projects that are performed benefiting salmon production in this section.

Habitat Needs

The principal requirement is to maintain stream and streambed conditions in as near natural state as possible.

MASHEL RIVER DRAINAGE



Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0008	Nisqually River				
0101	Mashel River	RB-39.6	20.5	83.5	Chin., Coho, Pink, (Chum)
0102	Little Mashel R.	LB-4.35	9.2	—	Coho
0103	Midway Creek	LB-2.1	5.6	7.24	None
0104	Unnamed	LB-1.2	2.4	—	None
0106	Unnamed	RB-2.8	1.3	—	None
0107	Unnamed	LB-3.6	4.7	—	None
0108	Unnamed	LB-2.9	1.1	—	None
0109	Unnamed	LB-8.6	1.0	—	None
0110	Unnamed	RB-10.1	3.75	—	Unknown
0111	Beaver Creek	LB-10.4	8.3	—	(Coho)
0112	Unnamed	LB-0.95	2.35	—	None
0114	Busy Wild Creek	LB-14.5	7.8	—	(Chin.), (Coho)
0115	Unnamed	RB-2.9	1.3	—	Unknown
0117	Unnamed	RB-5.1	1.15	—	None
0118	Unnamed	LB-5.45	2.7	—	None
0119	Unnamed	RB-6.4	1.4	—	None
0121	Unnamed	LB-15.6	4.75	—	None
0123	Unnamed	LB-2.7	1.4	—	None
0124	Unnamed	RB-16.4	1.7	—	None
0125	Unnamed	RB-16.85	1.9	—	None

DESCHUTES RIVER
Tumwater Area

This segment covers the lower 19 miles of the Deschutes River, plus 6 tributaries totalling nearly 24 linear miles of stream drainage. The area extends from the Olympia-Tumwater vicinity southeast toward the town of Rainier in central Thurston County, and is accessible via county roads.

Stream Description

From the vicinity of the Military Road crossing (R.M. 19.5), about 2.5 miles west of Rainier, the Deschutes River meanders in a northwest direction more than 17.5 miles to Tumwater Falls, from there into Capitol Lake, then north for about 1.5 miles to salt water at the southern tip of Budd Inlet. Six tributaries enter the Deschutes before it reaches Capitol Lake, the principal one being Spurgeon Creek. Percival Creek enters directly into Capitol Lake (see Deschutes-101).

The Deschutes River, plus a majority of its tributaries, flows over moderate to gently sloped terrain. Adjacent land is primarily agricultural, with scattered residential development. Intermittent sections have been cleared for grazing or annual crop production. Considerable land remains in second or third growth forest consisting of mixed deciduous and conifer growth. Increasing numbers of rural and suburban dwellings, plus a large golf course are encountered as a stream moves toward more heavily populated Tumwater and Olympia. Suburban development, particularly of summer and recreational housing, is increasing along the upper portion of this section. Considerable recreation use is also made of this area.

The Deschutes River meanders a great deal, offering a moderate gradient with a good to excellent pool-riffle balance. Channel widths range from 6 to over 20 yards, with numerous broad, clean gravel riffles. Bottom composition is mainly gravel and rubble, and is generally quite stable. Shorelines consist mainly of broad, gently sloping gravel beaches and low, steep slope earth banks. A few higher, steep, unprotected earth banks are found along this stretch. Along some stream sections, the bank has been contoured and riprapped for protection, particularly over the lower 4-5 miles. Stream-side cover consists of intermittent stands or strips of deciduous growth, interspersed by cleared farm or recreational use of land.

Capitol Lake is a shallow, 300 acre impoundment approximately 1.5 miles in length. The lake is situated in a relatively shallow basin, its shoreline consisting of riprap along the roads or steep slope, heavily wooded, sparsely developed hillsides.

Salmon Utilization

The lower Deschutes River, including Capitol Lake, is the major transportation reach for salmon using this system. The river in this section provides the main spawning habitat for chinook salmon in the entire Deschutes drainage. Coho also spawn here, as well as in each of the accessible tributaries. Juvenile chinook salmon rear through the spring and summer within these waters, while juvenile coho maintain year around residence. In addition to the natural fish production, highly significant numbers and pounds of chinook are reared in Capitol Lake by feeding artificial diets.

Limiting Factors

The major factors limiting salmon production in this section include warm summer temperatures, siltation in Capitol Lake and the lower 2-3 miles of river, low summer-fall flows in the Deschutes and its tributaries, plus streambed and bank alterations associated with land development and erosion control.

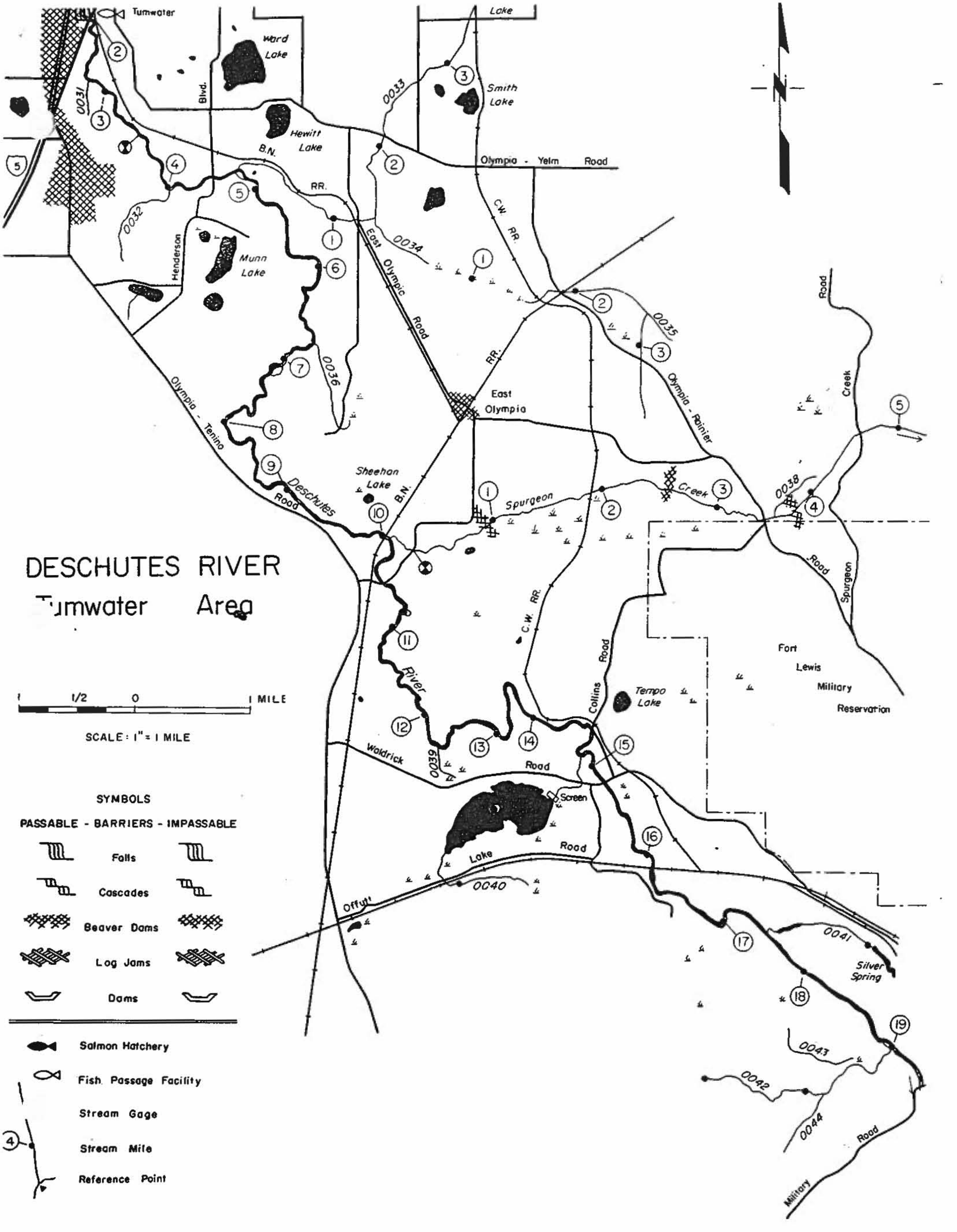
Beneficial Development

This section of the Deschutes River has two fish passage facilities. One is located at the dam impounding Capitol Lake, providing passage from salt to fresh water. The other is at Tumwater Falls consisting of three ladder facilities providing access to the upper river. Trapping facilities are available at the upper Tumwater ladder where chinook eggs are taken for artificial production. Hatchery produced juvenile chinook are planted into Capitol Lake, many of which are fed artificial diets and other that utilize the lake's natural productivity.

Habitat Needs

Any alterations of the existing environment in this section must be compatible to fish requirements. Capitol Lake should be reclaimed by selective dredging and future sedimentation or land fills carefully controlled to maintain present and future production.

PHOTO 13-11. Typical river section above Tumwater Falls.



DESCHUTES RIVER
Tumwater Area
1/2
0
1 MILE
SCALE: 1" = 1 MILE
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Tumwater
Ward Lake
Smith Lake
Hewitt Lake
Munn Lake
Sheehan Lake
Tempo Lake
Olympia - Yelm Road
East Olympic Road
Olympia - Tenino Road
Olympia - Rainier
East Olympia
Spurgeon Creek
Deschutes River
Waldrick Road
Lake Road
Offutt
Collins Road
Military Road
Fort Lewis Military Reservation
Silver Spring
Screen
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0044

DESCHUTES RIVER — TUMWATER AREA
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River			—	Chin., Coho, (Chum)
0033	Unnamed	RB-4.7	4.15	—	Coho
0034	Unnamed	LB-1.4	3.6	—	Unknown
	Little Chambers Lake	Outlet-3.65	—	—	
	Chambers Lake	Outlet-4.15	—	—	
0037	Spurgeon Creek	RB-10.01	5.8	—	(Chin.), Coho
0040	Unnamed	LB-14.8	2.6	—	Coho
	Offutt Lake	Outlet-0.5	—	—	
0041	Unnamed (Silver Springs-local name)	RB-17.5	1.0	—	Coho
0042	Unnamed	LB-18.9	2.0	—	Coho
	(Cont. Deschutes 303)				

DESCHUTES RIVER
Lake Lawrence Area

This section covers approximately 12 miles of the main-stem Deschutes River, plus 4 smaller tributaries providing more than 17 additional stream miles. The area is located just a few miles south of the town of Rainier in southeastern Thurston County. Access is via Highway 507 out of Rainier, the Vail Loop Road, and private logging roads extending into the drainage.

Stream Description

From a point about a half-mile above Pipeline Creek (R.M. 31.0) the Deschutes River flows generally west-northwest for 12 miles, passing beneath the Rainier-Tenino Highway about 2.5 miles southwest of Rainier and Military Road immediately north of Lake McIntosh. Principal tributaries include Pipeline Creek, Lake Lawrence Outlet, Reichel Lake drainage, and one small unnamed spring feed stream (R.M. 20.9). Lake McIntosh does not provide a true surface connection with the Deschutes.

The Deschutes channel winds across a relatively broad, gently sloping valley floor through this section. The same is true with tributaries, except for the upper, steeper slope of Pipeline Creek and of one feeder tributary to the Reichel Lake drainage. The Deschutes skirts along the north rim of the valley bordered by mountainous terrain, and the steeper side slopes densely forested with mostly conifer timber. The valley floor has cleared farmland with intermittent stands of mixed deciduous and conifer growth. Aside from the small community of Vail, this section is developed mostly with rural-type residences and small summer home development along the river. Forested slopes on either side of the floor are managed principally for logging with numerous cleared sections, particularly over the upper drainage. Also, moderate to heavy recreation use is made of the area.

The Deschutes channel presents a moderate gradient through this section, with only occasional reaches showing steeper conditions. Stream widths range from 4 to 16 yards, averaging about 10 yards. A good pool-riffle balance exists and stream bank cover is generally dense, thus promoting exceptional rearing conditions through much of the area. The stream bottom is quite stable, comprised mainly of large rubble, with boulders and gravel interspersed across most riffles. Most pools are quite shallow and contain sand and fine gravel bottom material. Stream banks are generally quite low and stable and comprised of gently sloping gravel beaches with a few sharp earth cuts. Stream-side cover consists of moderate to dense stands or strips of deciduous trees and underbrush.

Salmon Utilization

This section of the Deschutes provides transportation for adult and juvenile salmon that utilize the upper drainage. Limited spawning area in this section is used largely by chinook and by some coho which also use the accessible tributaries. Juvenile chinook rear through the spring months in these waters with coho inhabiting the stream year around, particularly in stretches of dense stream-side cover.

Limiting Factors

Factors which limit salmon production in this section include low summer flows in the main channel as well as in the small feeder streams, stream bank clearing through logging or development projects, removal of streambed gravel, and poaching of adult salmon.

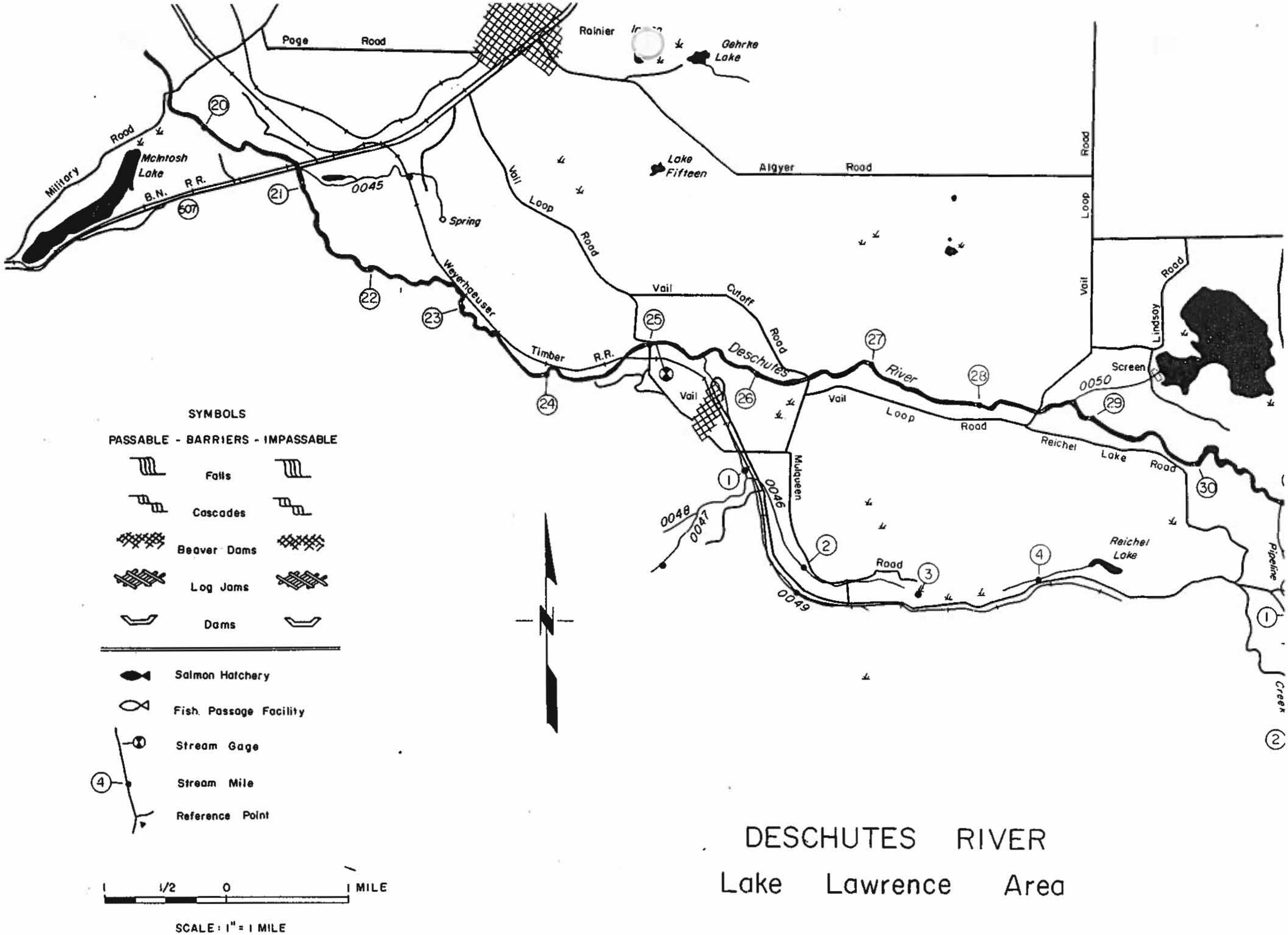
Beneficial Developments

No facilities or programs have been undertaken within this area to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production potential within this drainage section include preserving the existing stream bank cover, and curtailment of gravel removal projects. Logging plans and operations should be coordinated with Fisheries' needs to reduce the impact on the natural stream habitat.

PHOTO 13-12. Good pool riffle section in middle Deschutes River.



DESCHUTES RIVER

Lake Lawrence Area

DESCHUTES RIVER — LAKE LAWRENCE AREA
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River				Chin., Coho, (Chum)
0045	Unnamed	RB-20.85	1.6	—	Coho
0046	Unnamed	LB-25.5	4.5	—	Coho
0047	Unnamed	LB-1.1	1.1	—	Unknown
0049	Unnamed	LB-1.15	1.6	—	(Coho)
	Reichel Lake	Outlet-4.5	—	—	
0051	Pipeline Creek	LB-31.0	2.8	—	Coho
0052	Unnamed	RB-0.5	1.2	—	Coho
0053	Hull Creek	RB-0.9	2.0	—	(Coho)
	(Cont. Deschutes 403)				

DESCHUTES RIVER
Headwaters

This drainage section encompasses the entire upper Deschutes River including nearly 18 miles of mainstem, plus 21 tributaries adding nearly 92 stream miles. The area is located about six miles southwest of Alder Lake in eastern Thurston County. Access is available by private logging roads southeast of Rainier and the small community of Vail. The upper reaches of some tributaries, plus the upper main Deschutes, from just below Buck Creek, are within Snoqualmie National Forest.

Stream Description

From its mountain headwater southeast of Alder Lake, the Deschutes flows generally north for nearly seven miles to its major tributary, the Little Deschutes River (R.M. 42.5). From here it travels mainly west for more than six miles to the vicinity of Fall Creek (R.M. 35.3), then generally northwest toward Pipeline Creek (R.M. 31.0). In addition to the Little Deschutes River and Fall Creek, principal tributaries entering within this section include Lincoln, Thurston, Johnson, Huckleberry, and Mitchell creeks.

In this section, the Deschutes channel, as well as the majority of its tributaries, fall over mostly steep terrain with the streambeds confined by relatively narrow valleys. Adjacent slopes are quite steep and most are densely forested. Over the lower 3-4 miles of this section the Deschutes moves out onto a more gently sloping, wider valley floor. Here the adjacent hillsides are still densely forested, having mixed deciduous and conifer growth. Practically no development has taken place in the upper watershed, and only widely separated farms and a few recreational homes are located along the lower 5-6 miles.

The Deschutes River presents two slightly different environment types in this section. Above Deschutes Falls (R.M. 41.1), the gradient is moderately steep, in some sections presenting a series of short cascades. Stream widths range from 2 to 12 yards, averaging about seven yards. There are relatively high proportions of fast riffle and rapids sections. Pools, although somewhat scarce, are generally quite deep. The stream bottom is predominantly rubble and boulder with some lengthy sections of bedrock. Stream banks have moderate to dense conifer and deciduous growth, providing good to excellent cover for much of the area.

Below Deschutes Falls the channel gradient is mostly moderate, with only occasional rapid or cascade stretches. Stream widths range from 4 to over 17 yards, averaging near 10 yards. A good pool-riffle balance prevails, with most pools being quite deep and well shaded. The stream bottom is predominantly clean rubble and gravel, with only a few sections having a large proportion of boulders. Stream banks are mostly low and sharp cut, containing dense stands of mixed deciduous and conifer growth. The channel is well shaded and quite stable.

Virtually all tributaries entering the Deschutes in this section exhibit a swift-flowing character. Boulders and cascades predominate, with only the lower reaches of tributaries entering below Deschutes Falls offering relatively stable gravel and rubble bottoms, and fairly good pool-riffle conditions.

Salmon Utilization

Salmon use within this section is restricted to the mainstream river below Deschutes Falls, and to the lower reaches of tributaries entering just below the falls. The river receives scattered concentrations of chinook spawning, primarily in the lower 5 or 6 miles below Mitchell Creek. Some coho spawning takes place in the main channel up to the falls, as well as in the accessible portions of lower tributaries. Juvenile rearing occurs primarily in the main channel, and in those tributaries that maintain adequate summer flows. Juvenile chinook rear through the spring months, with coho inhabiting these waters year-round.

Limiting Factors

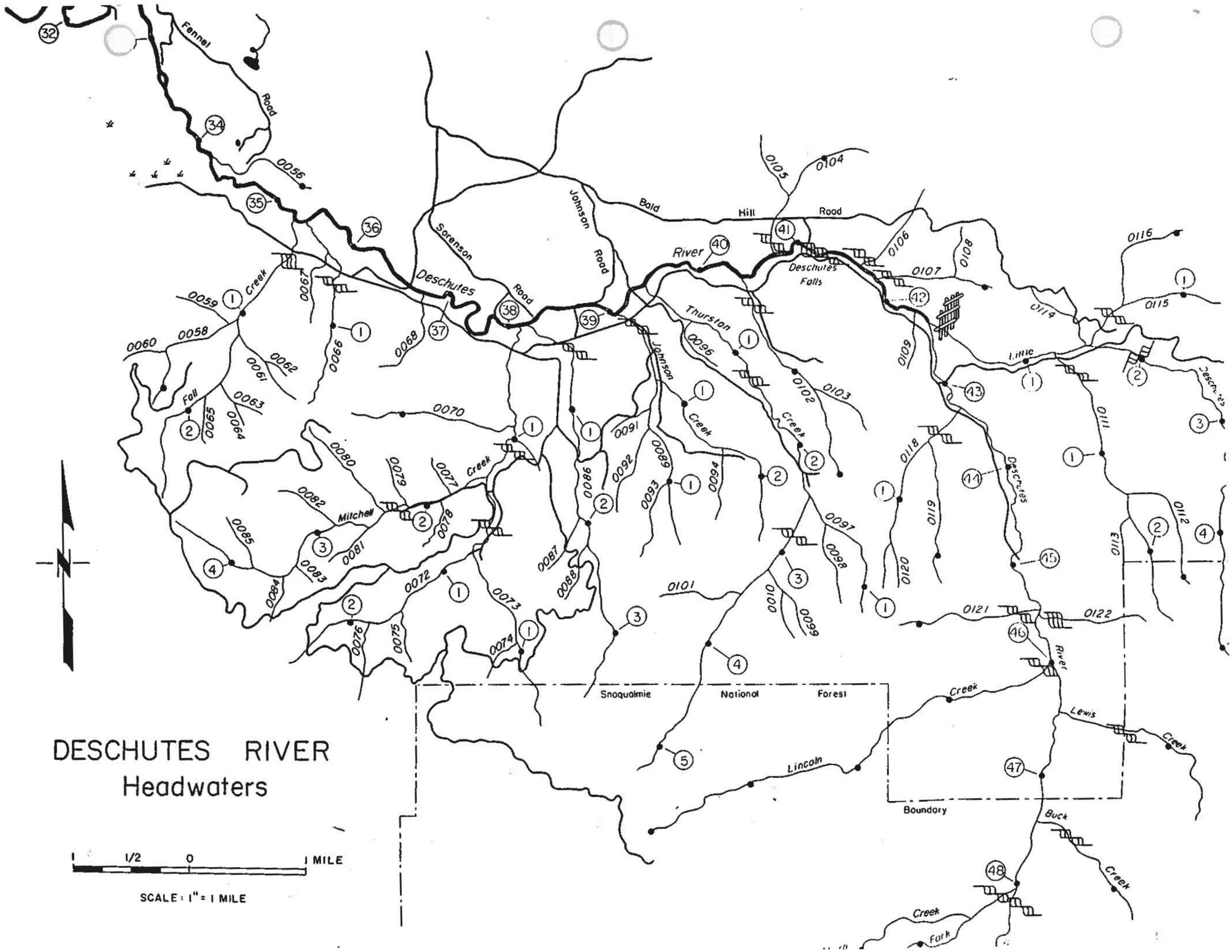
The principal factors limiting salmon production in this section include the total barrier at Deschutes Falls, and the occurrence of low summer flow conditions. Above Deschutes Falls additional cascades and falls, plus the general steep gradients, limit the salmon production potential. Clear-cut section logging and associated road building, along with occasional gravel removal operations, serve as further limitations to salmon production within this upper drainage.

Beneficial Developments

No other facilities, projects, or programs have been undertaken within this section to directly benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production potential of the upper Deschutes drainage include preserving existing streamnbank cover and curtailment of gravel removal and stream channel alterations. Replacement of stream-side cover along reaches already cleared would be highly desirable.


DESCHUTES RIVER
Headwaters
1/2
0
1 MILE
SCALE: 1" = 1 MILE
Deschutes
River
Deschutes Falls
Bald Hill Road
Johnson Road
Sorenson Road
Fennel Road
Thurston Creek
Johnson Creek
Mitchell Creek
Fall Creek
Little Deschutes
Lincoln Creek
Lewis Creek
Buck Creek
Fork Creek
Snoqualmie National Forest Boundary

DESCHUTES RIVER — HEADWATERS
Deschutes Basin — WRIA 13

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0028	Deschutes River				Chin., Coho, (Chum)
0056	Unnamed	RB-34.2	1.1	—	Unknown
0057	Fall Creek	LB-35.3	2.9	—	Coho
0058	Unnamed	LB-1.1	1.2	—	None
0066	Unnamed	LB-35.4	1.7	—	Coho
0069	Mitchell Creek	LB-38.15	4.6	—	(Chin.), Coho
0070	Unnamed	LB-0.9	1.4	—	Unknown
0072	Unnamed	RB-1.4	2.8	—	None
0073	Unnamed	RB-0.75	1.7	—	None
0086	Unnamed (Huckleberry Cr.)	LB-38.2	3.6	—	(Chin.), Coho
0089	Johnson Creek	LB-39.1	2.6	—	(Coho)
0090	Unnamed	LB-0.7	1.7	—	None
0095	Thurston Creek	LB-39.4	5.3	—	(Chin.), Coho
0097	Unnamed	RB-2.5	1.2	—	None
0102	Unnamed	LB-40.4	2.0	—	(Coho)
0104	Unnamed	RB-40.7	1.4	—	Unknown
0107	Unnamed	RB-41.8	1.0	—	None
0110	Little Deschutes R.	RB-42.5	5.7	7.89	None
0111	Unnamed	LB-1.2	2.7	—	None
0112	Unnamed	RB-1.5	1.1	—	None
0115	Unnamed	RB-1.55	1.4	—	None
0116	Unnamed	RB-0.5	1.0	—	None
0117	Unnamed	RB-3.5	1.2	—	None
0118	Unnamed	LB-43.3	1.8	—	None
0119	Unnamed	RB-0.4	1.3	—	None
0121	Unnamed	LB-45.45	1.2	—	None
0123	Lincoln Creek	LB-46.0	4.0	—	None
0124	Lewis Creek	RB-46.5	1.7	—	None
0125	Buck Creek	RB-47.4	1.4	—	None
0126	W. Fk. Deschutes R.	LB-48.0	2.7	—	None
0127	Thorn Creek	LB-0.4	1.8	—	None
0128	Ware Creek	RB-48.6	1.0	—	None
0129	Hard Creek	RB-49.0	1.1	—	None
0130	Mine Creek	RB-49.6	1.1	—	None

BLACK RIVER

Black River originates in Black Lake southwest of Olympia. Its total drainage includes an estimated 136 square miles. There are 28.0 miles of mainstem channel and 15 tributaries providing an additional 84.0 miles of stream drainage.

Stream Description

Black River flows in a southwesterly direction out of Black Lake through the town of Littlerock. The course turns west near Rochester and continues in this direction to its confluence with the Chehalis River. A number of tributaries enter the Black River channel. These include Bloom's Ditch, Dempsey, Salmon, Waddell, Beaver, and Mima creeks, in addition to a few smaller unnamed streams.

The eastern portion of the Black River watershed is generally gentle hills and prairie land. Most of the prairie and some of the moderately sloping hills are presently utilized for agriculture. Some prairie farmlands also border the west side of Black River for a distance of up to 3 miles. The Black Hills, rising to over 2,500 feet, form the major portion of the westerly watershed. The Black Hills are forested with second -growth conifers. Some second-growth logging is underway.

Black Lake is heavily developed as a residential area as is Scott Lake on a Black River tributary. Other residential areas include Littlerock and Rochester. Numerous rural farm houses are located throughout the lowlands of the watershed.

Much of the Black River channel is almost entirely pool area. Pool-riffle areas are found near Littlerock and in the lower 7 miles. The channel width ranges from 5 to 30 yards. Bottom material is mostly gravel and rubble in the swifter flowing sections, and mud and sand in the long, quiet pool areas. Plant and algal growth is common in these reduced-velocity areas. Stream-side vegetation is mostly of deciduous brush and provides good stream bank cover.

Salmon Utilization

The Black River drainage has a significant run of coho and a small run of chinook. The watershed formerly supported large chum runs; however, recent surveys have indicated that this species may now be totally lacking. Black River provides transportation and rearing area for coho. Coho distribution in the watershed is nearly unlimited. A few barriers exist on the upper reaches of the tributaries, but for the most part do not block major production areas. Chinook spawning is known to occur in the river near Littlerock from mile 16.0 to 17.3 and likely occurs from mile 0.0 to 7.0. All of the mainstem Black River and at least 47.5 miles of tributaries are presently accessible for salmon production.

Limiting Factors

Chinook production in the mainstem of Black River is limited by a lack of good quality spawning area. Chinook spawning is not known to occur in any of the tributaries. Low summer flows influence coho production in several of the tributary streams. Low flow areas include Beaver, Salmon, and Dempsey creeks, and Bloom's Ditch. Low flows, particularly in Beaver Creek, are further diminished by irrigation diversions. Summer water temperatures in the lower reaches of Black River are quite high and have an adverse effect on juvenile rearing. The lower river also has a large population of predacious fishes which prey heavily on rearing juveniles and smolts. The upper reaches of Mima Creek and its tributaries are severely silted from past logging operations. Beaver dams on Beaver Creek and several Mima Creek tributaries prevent coho from utilizing minor potential production areas. A water diversion dam on Mima Creek may periodically delay adult coho and undoubtedly blocks chum.

Beneficial Developments

No hatchery facilities are maintained in this drainage. Streams periodically receive plants of coho fry and yearlings. A water diversion dam on Blooms' Ditch is equipped with a fishway.

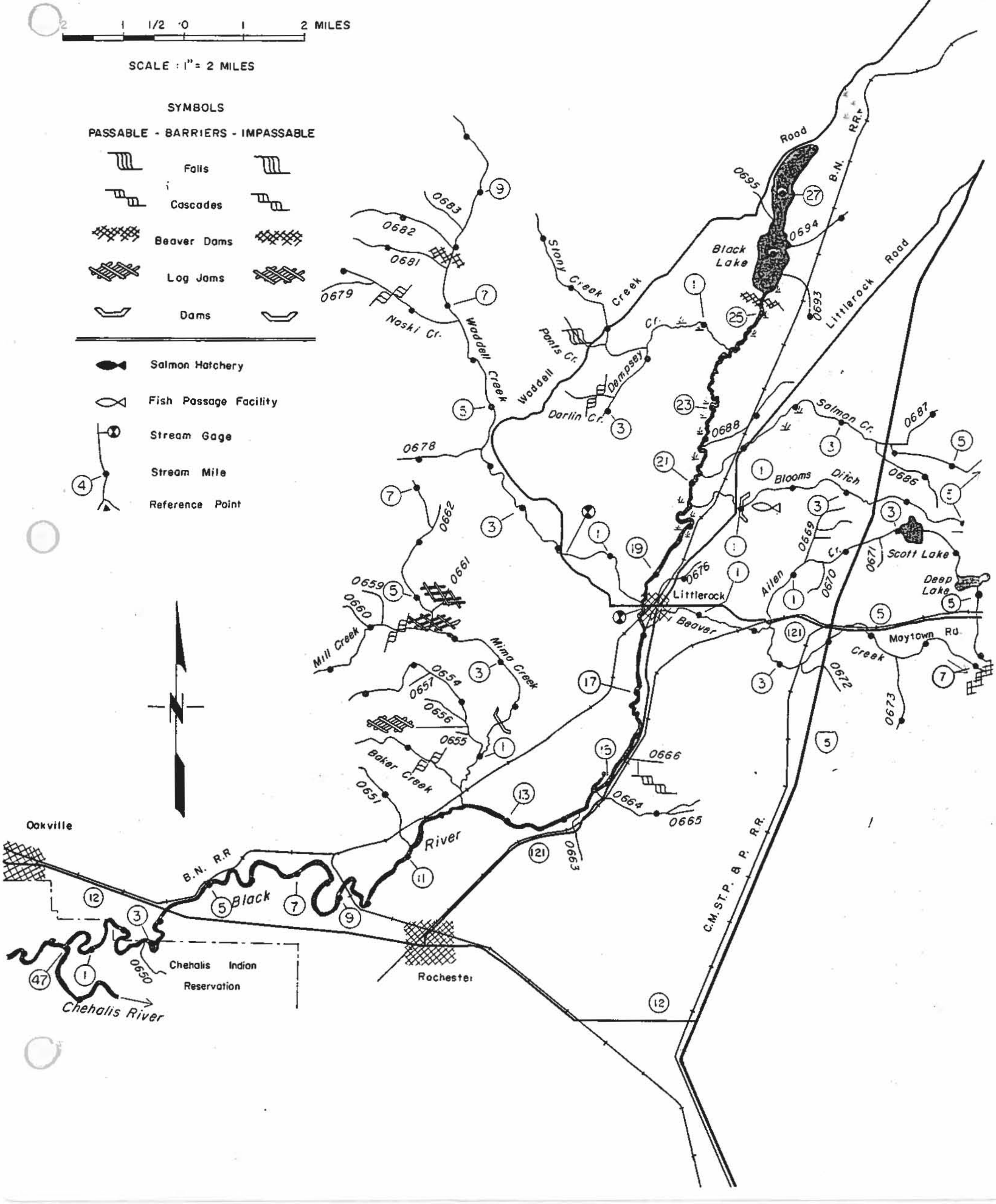
Habitat Needs

Maintenance of salmon runs in the Black River drainage will require strict controls on future development. Residential and summer-home development is likely to expand rapidly on the upper watershed, particularly on Beaver and Dempsey creeks. Logging of second-growth timber and associated road construction in the western half of the drainage could severely damage coho production if proper steps are not taken to prevent deterioration of water and streambed quality.

PHOTO 22-21. Fishway on Blooms Ditch diversion dam.

BLACK RIVER

Upper Chehalis Basin



BLACK RIVER
Chehalis Basin — WRIA 22 & 23

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0190	Chehalis River				
0649	Black River	RB-47.0	28.0	136.0	Coho,Chum,Chin.
0651	Unnamed	RB-11.15	1.75	—	Coho
0652	Mima Creek	RB-12.4	7.15	15.1	Coho
0653	Baker Creek	RB-0.3	1.9	—	Coho
0654	Unnamed	RB-1.0	3.3	—	Coho
0658	Mill Creek	RB-4.3	2.3	—	None
0664	Unnamed	LB-14.85	1.8	—	Coho
0667	Beaver Creek	LB-18.1	11.4	—	Coho
0668	Allen Creek	RB-2.3	6.3	—	Coho
0669	Drainage Ditch	RB-1.25	~ 2.1	—	
	Scott Lake	Outlet-3.0	—	—	
	Deep Lake	Outlet-4.5	—	—	
0673	Unnamed	LB-5.6	1.2	—	Coho
0674	Unnamed	LB-7.7	1.6	—	Coho
0675	Unnamed	LB-10.4	1.0	—	Coho
0676	Unnamed	LB-18.11	1.4	—	Unknown
0677	Waddell Creek	RB-18.5	10.4	18.2	Coho
0678	Unnamed	RB-4.3	1.4	—	Unknown
0679	Noski Creek	RB-6.7	2.0	—	Coho
0681	Unnamed	RB-7.6	1.6	—	Coho
0682	Unnamed	RB-8.0	1.85	—	Coho
0684	Bloom's Ditch	LB-20.6	8.5	—	Coho
	Pitman Lake	Outlet-6.5	—	—	
0685	Salmon Creek	LB-21.3	7.4	—	Coho
0686	Unnamed	LB-3.65	1.7	—	Coho
0687	Unnamed	RB-3.9	1.1	—	Unknown
0688	Unnamed	LB-21.8	1.8	—	Unknown
0689	Dempsey Creek	RB-24.2	3.05	—	Coho
0690	Stony Creek	LB-1.9	3.3	—	Coho
	Black Lake	Outlet-25.3	—	—	
0693	Unnamed	LS-25.6	1.1	—	Unknown
0694	Unnamed	LS-26.1	1.3	—	Unknown

Appendix C

Quality Assurance Information Report Form

Please see cover letter for instructions. Answer as many of these questions as you can. This is not a test, and not all questions need to be answered affirmatively or in a certain way for a dataset to be included in the model. The Water Type Committee will review the information on a dataset-by-dataset basis.

A) Who collected the data?

1) Agency or company. Include address:

Washington Trout
PO Box 402
Duvall, Washington 98019

2) Principal investigator. Name, professional address, and short paragraph of qualifications and background.

Steve Conroy, Please see C-1 in Appendix C.

3) Field survey crews. Names, short paragraph of qualifications and training in last fish or last habitat field methodologies. Attach additional pages if necessary.

Please see C- 1 in Appendix C.

B) When and Where was the data collected?

1) Year in which the data was collected. Please use one year per dataset.

1998 - Last Salmonid Protocal

2) Months in which the data were collected.

February, March, April, May, June, July, August, November, and December

i) Was the data collected in the sampling protocol window (March 15 through July 15)? 45% - 4 Last Salmonid, and 16 Last Fish Habitat Points were collected in the sampling window.

ii) How would you characterize stream flow during the sampling period? (I.e., Higher than average flow conditions, Average, lower than average or mixed)

Please see C-2 in Appendix C

3) What basins is the data from? (Use names, and WRIA codes).

Stillaguamish (Deer Cr. Tribs) - 050173
Snoqualmie (Tribs to Snoq.) - 070219

4) Describe the sampling area (basins, watersheds, ownerships, tribal U&As) in as much detail as possible.

Please see C-3 in Appendix C

C) Sampling Objectives and Design.

1) Was this data collection effort exclusively for the purpose of collecting last fish or last habitat data? **No.**

If YES, what was the sampling design?

i) Complete sampling of watersheds, or basins?

ii) Complete or partial ownership sampling? ....

iii) Random sampling? .....

iv) Other? (Explain with attachment)...............

2) Was this data collection effort part of a last fish assessment associated with an FPA or prospective timber harvest site? No

If YES:

i) Did sampling extend beyond the boundary of the harvest site as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

ii) Did sampling consistently extend beyond the ownership boundary as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

If you answer 'no' to either question above, do not submit dataset.

3) Was sampling incidental to other research or assessment objectives? Yes

If YES:
i) Were there aspects of the sampling design that would be considered non-random or potentially biased for the purposes of last fish or last habitat determination? Please specify at end of questionaire.

ii) Did sampling target a specific species, elevation, ownership, etc.?

D) What Field Methodology was Used?

1) Which field sampling protocol was used?
Forest Practice Board Manual Protocal (Last Salmonid) was utilized with the following modifications: 1) streams were not methodically surveyed beyound the break for a minimum of 12 pools or ¼ mile 2) Although Washington Trout crews typically utilize electroshockers in determining fish presence, visual determination of presence are also made without using electroshockers.

2) What field equipment was used to validate fish present or absence? Electroshocker? Snorkeling? Night-time snorkeling? Other?

Electroshocker, Visual identification, or visual, followed by Electroshocking in the absence of visual confirmation.

3) Was sampling for fish systematically carried a full 0.25 miles above the last fish or last habitat?
No

If you answer 'no', do not submit dataset.

4) How was the last fish or last habitat location marked in the field, i.e., monumented for future reference? Describe the appearance of the monuments, and where they were place. Last fish points were not routinely marked; when points were marked they were labeled with flagging, noting last fish. Occasionally, date, organization, and surveyors names were also noted on last fish flagging. Break points were marked with one Aluminum tag and flagging placed on a tree on both sides of the stream, Water Type Breaks, Date, Organization, and Surveyors names were noted on the flagging, only water type breaks were noted on the tags.

5) Were channels subjected to mass wasting in the past decade excluded from sampling or identified in the field data? If they were identified, how were they identified?
Channels subjected to mass wasting were not excluded from the sampling, however, Mass wasting is addressed in the field form and Last Fish/Last Habitat points within these drainages could be easily eliminated. It is possible that some drainages whose geomorphology has been changed over time may have been missed during the survey process.

6) In situations where surface flows ended, did samplers make a determination as to

/hether there was a break in channel gradient or other feature (headwater lake or wetland) that would cause surface flow to re-emerge up-stream?

Yes

7) In situations where last fish was determined to be below a culvert, how was this information recorded?

Culvert barriers were noted on the field form and in the database.

Where these situations discarded from the dataset?

No

Were these situations uniquely coded so that these data points could be easily pulled out of the dataset? These situations are not uniquely coded,however, this data can be extracted from the dataset in the database if a culvert barrier was identified.

Was the last habitat protocol applied above the culvert? Yes

E) Validation of Field Data.

1) Has the any of the data in this dataset been subjected to replicate sampling or verification, either within the same year or in a different year? If the replicate sample is in a different dataset, describe the location of this dataset. (Replicate sampling is not a requirement for dataset consideration.)

YES or NO____Yes

If yes, please explain how the duplicate samples can be found in the dataset, or where to find the replicate dataset if they are not included in this dataset.

Replicate samples where not systematically duplicated,however, occasional duplication occurred while conducting culvert assessments or upon request. The replicate dataset is attached or following the original dataset on the raw data forms.

If yes, Did comparisons with the replicate dataset raise any concerns? Please explain.

___Yes, as expected, habitat boundaries were extended on systems revisited after the emergency ruling was implemented. In addition, occasionally a last fish point was extending further up the system.

F) Data Management.

1) Attach sample of field data sheet.

2) Where is the raw (paper copy) data or paper map being kept?

At the Washington Trout Office

3) In what structure is the electronic data being kept (spreadsheet, tabular database, GIS)? Describe the software, including the version of the software. If none, write "none'.

Microsoft Access 2000 Table.

4) Attach details of data fields and data codes used in the electronic database.

DETAILED ITEM DEFINITION AND CODE EXPLANATION

ITEM: Twp

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION: TOWNSHIP AND RANGE THE POINT IS IN. EXAMPLES: T15R05W; T04R15E (NOTE: THE USE OF "N" (NORTH) IS NOT NECESSARY. THIS FORMAT COMPLIES WITH DNR DATA STANDARD FOR TOWNSHIP/RANGE). IF THE TOWNSHIP IS A "HALF TOWNSHIP, THEN PLACE THE "5" ON THE END (E.G., T39R41E5)

ITEM: Sect

FORMAT: TYPE: CHARACTER; LENGTH 2

DESCRIPTION:
THE TOWNSHIP SECTION THAT THE POINT IS IN. EXAMPLES: 05, 01, 15, 32.
(NOTE: PLEASE ADD THE ZERO (0) BEFORE A ONE DIGIT NUMBER).

ITEM: Survey_no

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION:
UNIQUE CODE FOR A PARTICULAR SURVEY OR HYDRO UPDATE MAP.
(EXAMPLES: HU12, SW23, WT23).

ITEM: Pt_id

FORMAT: TYPE: NUMERICAL, LENGTH 4

DESCRIPTION: USER-DEFINED POINT IDENTIFICATION NUMBER; WE SUGGEST THAT THE USER NUMBER THE POINTS INCREMENTALLY WITHIN A SPECIFIC SURVEY, SURVEY FORM OR HYDRO UPATE FORM.

ITEMS: SPONSOR

FORMAT: TYPE: CHARACTER, LENGTH: 16

DESCRIPTION: THE NAME OF AGENCY, GROUP, TRIBE OR COMPANY THAT IS CONDUCTING THE SURVEY. (EXAMPLES: WEYCO; DNR; WATROUT; WF&W; ETC.)

ITEMS: Date

FORMAT: TYPE: DATE: YYYYMMDD, LENGTH: 8

DESCRIPTION: DATE THE SURVEY WAS CONDUCTED.

Note: spreadsheets and info may use a different date format.
Please check and make sure any arcview conversions conform to above format.

THE FOLLOWING ITEMS (FIELDS) HAVE CODES AND CODE DESCRIPTIONS

ITEM: Protocol

FORMAT: TYPE: CHARACTER, LENGTH 4

DESCRIPTION: PROTOCOL OF FISH SURVEY

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID
PRE	PRE-EMERGENCY RULE PROTOCOLS
UNK	UNKNOWN

ITEM: Pt_type

FORMAT: TYPE: CHARACTER, LENGTH: 4

DESCRIPTION: THE TYPE OF POINT REPRESENTED UNDER THE SPECIFIED PROTOCOL.

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID

ITEM: Bnd_type

FORMAT: TYPE: CHARACTER, LENGTH: 2

DESCRIPTION: PHYSICAL PLACEMENT OF POINT (NEEDED FOR MODELING PURPOSES).

CODE	CODE DESCRIPTION
A	MID-CHANNEL END OF HABITAT
B	CONFLUENCE POINT (NON-FISH-BEARING STREAM LATERALLHY INTERSECTING A FISH-BEARING STREAM)
C	TRIBUTARY JUNCTION (TWO OR MORE NON FISH-BEARING STREAMS JOIN TO FORM A FISH-BEARING STREAM

ITEM: End_type
TITLE: END TYPE OF FISH POINT

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: THE REASON FOR THE PLACEMENT OF END POINT.

CODE CODE DESCRIPTION

1	NATURAL END (BND_TYPE B,C OR SIZE RELATED, (WIDTH/BASIN SIZE)
2	GRADIENT RELATED (e.g., WATER FALLS)
3	LARGE WOODY DEBRIS (LWD)
4	ROAD CULVERT
5	MASS WASTING EVENT (LANDSLIDE)
6	BEAVER DAM or other NON-PERMANENT DAM
7	OTHER DAM (PERMANENT)
8	WATER QUALITY LIMITER
9	NONE
10	UNKNOWN

ITEM: Det_met

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: METHOD USED TO DETECT POINT

CODE	CODE DESCRIPTION
1	ELECTRO-SHOCKING
2	DAY SNORKELING
3	NIGHT SNORKELING
4	VISUAL OBSERVATION

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION5)

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION

5) Where is the electronic copy being kept?

On Washington Trout's Document Server.

Curriculum Vitae

Stephen C. Conroy, Ph.D

Address: 10624 165th St.
Renton WA 98055

Telephone: (425) 277 7868 (home)
(425) 788 1167 (work)

email: watrout@eskimo.com

Undergraduate Degree: B.Sc. with Honours, 1980. University of Aberdeen, Scotland, U.K. Major: Biochemistry

Graduate Degree: Ph.D. 1984. University of Aberdeen, Scotland, U.K. Field of study: Enzymology

Employment History:

University of Aberdeen, Scotland, U.K.	Research Assistant.	1980-1984
University of Colorado, Denver, CO.	Research Fellow.	1984-1985
Case Western Reserve University, Cleveland, OH.	Research Associate.	1985-1987
University of Washington, Seattle, WA.	Senior Fellow.	1987-1992
Fred Hutchinson Cancer Research Center, Seattle, WA.	Staff Scientist.	1992-1995
Washington Trout, Duvall WA.	Science/Research Director	1996-present

Editorial Positions

Manuscript reviewer, "The Journal of Biological Chemistry" 1985-1987.
Manuscript reviewer, "Biochemistry" 1987-1994.
Manuscript reviewer, "Washington Trout Report" 1996-present

Grant Awards

Weiss Creek Restoration and Deer Creek Stream Typing. $300,000 from Washington Jobs For The Environment Program (JFE 9809)

North Fork Stillaguamish Engineered Log Jam Project. $160, 127 from Washington Department of Fish & Wildlife.

Griffin Creek Restoration. $49,600 from National Fish and Wildlife Foundation.

Skykomish Culvert Inventory & Analysis. $44,500 from Washington Department of Transportation.

Weiss Creek Demonstration Project. $40,000 from Snohomish Watershed Basin Work Group.

Salmonid habitat identification/stream typing project. $33,200 from King County Water Quality Block Grant.

Stream Typing and Culvert Analysis. $30,000 from the Bullitt Foundation.

Stream Typing and Culvert Analysis. $10,000 from the General Services Foundation.

Stream Typing and Culvert Analysis. $10,000 from the Horizons Foundation.

Stream Typing and Culvert Analysis. $5,000 from The Trout and Salmon Foundation.

Cherry Creek Riparian Restoration. $3,000 from Stilly-Snohomish Regional Fisheries Enhancement Group.

Tolt steelhead molecular genetics project. $250 from Puget Sound Flyfishers

Tolt summer steelhead monitoring project. $250 from Puget Sound Flyfishers

Typical Responsibilities

Supervised up to eight field biologists performing stream typing across the Western Cascades and in the Lower Columbia. Obtained grants and contracts for stream typing and in-stream restoration projects, published technical reports, supervised budgetary requirements, participated in TFW technical committees. Taught stream typing courses to TFW partners and consultants. Participated in snorkel surveys and electrofishing surveys. Experienced in non-lethal tissue sampling from fish for DNA analysis.
Coordinated culvert inventory and analysis projects, analyzed data, maintained databases and prioritized projects for restoration. Participated in formal training courses regarding culvert assessments and helped refine class materials and content.
Project manager for in-stream restoration in Weiss Creek and Griffin Creek. Projects involve permit acquisition, channel construction, LWD placement, riparian planting and fencing, and public outreach and education. Delivered oral and written reports to grantors and agencies.

Published Essays (Fisheries/Ecology)

Conroy, S.C. "Genetic Diversity in *Salmonidae*" The Osprey, 12: 5 (1991).

Conroy, S.C. Habitat Lost and Found; Part 1. Washington Trout Report (1996)

Conroy, S.C. Molecular Biology Comes to the Tolt. Washington Trout Report (1996)

Conroy, S.C. Habitat Lost and Found; Part 2. Washington Trout Report (1997)

Conroy, S.C. Stream Typing. Northwest Fishing Holes, (1996)

Conroy, S.C. Atlantic Salmon; Friend or Foe? Northwest Fishing Holes, (1997)

Conroy, S.C. Genetic Diversity in Salmon. Washington Wildlife Magazine, volume I, number II, 1997

Conroy, S.C. Habitat Identification and Development: The Need For Streamside Buffer Zones. Washington Trout Technical Report TR-98-1 (1998).

Scientific Publications (Peer Reviewed)

Conroy, S.C.; Adams, B.; Pain, R.H.; Fothergill, L.A. "3-Phosphoglycerate Kinase Purified by Affinity Elution has Tightly Bound 3-Phosphoglycerate." FEBS Letts. 128 353-355 (1981).

Dobson, M.J.; Tuite, M.F.; Roberts, N.A.; Kingsman, A.J.; Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A. "Conservation of High Efficiency Promoter Sites in *Saccharomyces cerevissiae*." Nucleic Acids Research 10 2625-2637 (1982).

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Scatena, M., Conroy, S.C., Tedford, K. & McDougall, J.K. "Increased ubiquitin expression in human atherosclerotic plaque-derived smooth muscle cells." FASEB J. 1996.

Conroy, S.C. "Habitat Lost and Found" 1st Annual Wildlife Congress. Washington Department of Fish and Wildlife. January 1997.

Mary Lou White
2905 Birchwood
Bellingham, WA 98225
(360) 671-8839

Experience:

1994-Present

Field Biologist/Project Manager
Washington Trout • Duvall, Washington

- Crew leader and field biologist for fish habitat assessments, stream typing, scientific data collection, culvert assessments, riparian planting and monitoring, 1994-present.

- Project manager for culvert replacement, stream channel restoration, road abandonment, and riparian revegetation grant projects completed in 1996 & 1997; combined worth of grants over $500,000. Supervised 30 people, including five contractors working simultaneously on six road abandonment and three restoration projects.

- Additional responsibilities include the following: (1) documenting and entering data; (2) preparing contracts; (3) obtaining permits; (4) writing quarterly and final reports; (5) instructing restoration and culvert assessment workshops.

1992-Present

Owner/Hydrologic Technician & Environmental Consultant • Bellingham, Washington

Representative clients: Washington Trout, Water Resource Consulting, Puget Power, Joanne Greenberg (N-SEA).

Assist hydrologic consultants in gathering, documenting and presenting information for impending watershed projects.

- Determine flow line estimates for application in determining time-of concentration.

- Research private landowner water rights.

- Using S.C.S. method, time-of-concentration and curve number assignments, calculate runoff flow from an urban watershed.

- Utilize aerial photos to determine land use activities.

- Measure lateral movement of channels based on aerial photo interpretation.

- Planimeter or digitize basins and sub-basins.

- Use maps, Quattro Pro, Excel, WordPerfect, Microsoft Word, or R-base, to document data or assemble reports.

- Conducted Wellhead Protection Program for Everson, WA.

1991-1992 • **Fisheries Technician** • Center for Streamside Studies • University of Washington, Seattle, Washington.

- Timber/Fish/Wildlife ambient monitoring; collected data on stream discharge, bankfull width and depth, gradient, fish habitat, mass wasting, valley bottom and riparian characteristics.
- Established photo points for long-term monitoring of stream channel changes.
- Used scantron for data documentation.

1989-1990 **Hydrologic Technician** • U.S.F.S. Mount Baker Ranger District • Sedro Woolley, WA.

- Assisted in layout and preparation of watershed/fisheries habitat improvement projects; monitored completed projects by recording graphics and establishing photo points.
- Created a stream file monitoring guide.
- Assisted in spotted owl surveys.

1984-1989 **Forestry Technician** • U.S.F.S. Fernan Ranger District • Coeur d'Alene, Idaho.

- Project supervisor - Fish habitat improvement structure installations; watershed inventories; coring and embeddedness surveys.
- Inventoried system and non-system roads; updated drainage map with culvert and road erosion site locations; documented problems and prescribed solutions.
- Arranged and assembled district watershed atlas for 62 stream drainages.
- Collected water samples and stream flow measurements; electrofished and snorkeled.
- Created a Future Fish Habitat Improvement Guide.
- Conducted field studies and documented data for fish habitat, elk browse, piliated woodpecker range management and watershed inventories.
- Assembled historical information for G.I.S. input.
- Served on initial attack crew for wild fire suppression.

Skills:

- **Computer**: Microsoft Word, WordPerfect, Excel, Quattro Pro and Quicken.
- **Habitat Assessments**: All modules of TFW methodology, or Hankin & Reeves. TFW quality assurance qualified.
- **Stream typing**: DNR certified.
- **Surveying**: Stream profiles (longitudinal or cross section), culvert assessments, or road abandonment.
- **Aerial Photo Interpretation.**
- **Equipment**: Compass, clinometer, planimeter, McNeil sampler, electroshocker, increment borer, flow meter.

Training:

- Timber Fish Wildlife Ambient Monitoring Workshops 1994-97
- Stream Typing Emergency Ruling workshop, DNR 1997
- 319 Grant Request Workshop, 1997
- Culvert College, Washington Trout, 1995
- CPR, 1993, 1994
- Effective management, U.S.F.S. 1988
- Defensive Driving - U.S.F.S. 1984-89
- Baci to Basics - Compass & First Aid Training, 1989
- Fire Suppression & Saw Training, 1984, 1985.

Awards:

- Recognized for significant contribution to the success of the Mt. Baker Ranger District Fisheries & Watershed Program during the 1989 field season.
- Awarded Certificate of Merit and Cash Award for extra effort and positive attitude in data base input and maintenance of fisheries, habitat database on Fernan District and for outstanding effort and high quality road condition inventories and work on the watershed road inventory database.

Education:

June 1994 — **Bachelor of Science**
Western Washington Univeristy, Bellingham, WA
Major: Watershed Studies; Minor: Biology.

May 1979 — **Associate of Arts**
Lincoln Land Community College, Springfield, IL.

Relevant courses:
Water resources, soils, stream ecology, hydrology, water quality, fluvial geomorphology, ichthyology, watershed management, limnology, entomology, botany, biometrics and biology.

References:

Kurt Beardslee, Executive Director
Washington Trout, Duvall, WA (425) 788-1167

Steve Conroy, Ph.D. Science/Research Director
Washington Trout, Duvall, WA (425) 78-1167

Karen F. Welch, M.S., or Peter Willing, Ph.D., Hydrologist
Water Resource Consultants
1903 Broadway, Bellingham, WA (360) 734-1445

Robin Sanders, Hydrologist
Olympic National Forest, 1835 Black Lake Blvd. SW, Olympia, WA (360) 956-2433

Ed Lider, Fisheries Biologist
Fernan Ranger District, Coeur d'Alene, Idaho (208) 752-1221, 664-2318

Caroline Hidy, Fisheries Biologist
2695 Highway 200, Box 212
Trout Creek, MT 59874, (406) 599-2714.

David Crabb
17425 Turtle Lane
Bow, WA 98232
phone: (360) 724-4902

Education:	Master of Science in Geography with Planning Western Washington University, Bellingham, Washington 1985.
	Secondary Teacher Certification (Social Studies) Western Washington University, 1982
	Fifth Year History, San Diego State University, San Diego CA, 1973
	Bachelor of Arts in History, Grove City College, Grove City PA, 1971
Teaching Experience	Graduate Teaching Assistant in Physical and Human Geography, Western Washington University, Bellingham, WA 1984-1985
	Substitute Teacher grades 7-12 in Sedro-Wooley, Burlington-Edison, Mt. Vernon and Arlington school districts 1982-83
Work History	1994-present: Washington Trout, Cuvall, WA. Watershed analysis water typing, fish habitat restoration, riparian protection and revegetation.
	1976-present: Forest Contractor, providing tree planting and inventory survey skills for reforestation, forest management plans.
	1977-1978: Scott Paper Company, Hamilton, WA . Reforestation, pre-commercial thinning.
	1974: Whatcom Falls Park Fish Hatchery, Bellingham, WA. Hatchery maintenance, landscaping and rockeries.
Skills	All aspects of reforestation, crew leadeership and training, culvert analysis, stream typing, rockeries.

Training	Culvert assessment, water typing methodology, electrofishing, habitat surveying, spawning surveys, riparian revegetation, salmonid identification.
Personal Data	Born 1949, married, two children, health excellent, take pleasure in all family-oriented activities, especially backpacking and camping, gardening and basketball. Interested in reading and stewardship of the environment.

Bill McMillan

Perhaps best known as an author and master of fishing for steelhead trout using dry lines, Bill McMillan has devoted the greater part of a lifetime to fishing Northwestern rivers and sharing the enchantment of the experience through the written word and public speaking.

McMillan has authored numerous articles in *Salmon Trout Steelheader* magazine, *Wild Steelhead and Atlantic Salmon* magazine, and many others. His book *Dry Line Steelhead* has been described as "a graduate course in steelhead fly fishing." Most recently, McMillan spent two seasons on Russia's Kamchatka Peninsula as resident camp director for the joint Russian/American scientific expedition coordinated by the Wild Salmon Foundation.

For 40 years, McMillan's attention has been focused on the plight of wild salmonids, particularly regarding competition with hatchery-raised fish and the decline of their habitat's quality and availability. Concerns he raised decades ago regarding threats to wild salmonids have all been substantiated and vindicated. His extensive and precise field journals have filled a gap in statistics that the Washington State Department of Fish & Wildlife never kept, and he is widely quoted in academic fisheries papers.

An internationally esteemed author on conservation, fish, flyfishing and nature topics, he served on the Gifford Pinchot Forest's Spotted Owl Citizen's Advisory Board from 1989-1990 and on the Washington Department of Wildlife's Fishery Policy Task Force from 1990-1993.

McMillan, a founding board member and past President who has served on Washington Trout's board for all but two years, studied fisheries, English and philosophy at Clark College, University of Washington, Portland State and Central Washington. He co-founded the Clark-Skamania Flyfishers in 1975 and initiated spawning surveys in 1979 and snorkel surveys in 1983 on several rivers in Southwest Washington. An early and ardent conservationist, he has spent a lifetime advocating for the wild fish.

Frank Staller
16 Malone Hill Branch Road
Elma, Washington 98541
(360) 482-2960

Education & Training

St. Benedict's High School, Chicago, Illinois, 1974 diploma.

DeVry Institute of Technology, Chicago, Illinois, Electronics Technician degree, 1976.

Grays Harbor College, Aberdeen, Washington, Environmental Services Contracting Certificate 1996.

Northwest Indian Fisheries Commission, TFW Monitoring Training Workshop, 1997.

Department of Natural Resources & Quinault Nation: DNR Stream Typing Updated Rulings & Electroshocking Workshop, 1997.

Specialized Training

Power Squadron boating course; U.S. Forest Service forest fire training; defensive driving certificate; First Aid and CPR; Hazmat Awareness Level; Swiftwater First Responder; Swiftwater Boat Rescue; Wilderness Survival; Wilderness First Aid; Helicopter I evacuation, safety and man-tracking, and culvert analysis.

Streamtyping Experience

Washington Trout, P.O. Box 402, Duvall, WA 98019
Scientific Field Technician: Three years of stream surveying, using maps and compass to report on condition of streams related to fish presence, barriers and condition for re-typing classification. I submitted reports and upgraded maps after streamtyping. I also did culvert analysis on Type 3 waters. I worked on road closure and culvert replacement projects, operated pumps, assisted in surveying and stream monitoring.

Washington Department of Fish & Wildlife, Montesano:
Stream surveyor using maps and compass to collect information on streams related to fish presence and barriers for stream type verification.

Self-employed timber salvage contractor: Eight years subcontracting cedar salvage through Weyerhaeuser and other private landowners to salvage down and dead cedar logs for roofing material. I ran chainsaw, graded blocks and partook in helicopter logging operations. We cut down dead fir logs into cants with portable chainsaw mill and flew them out with helicopter assistance.

Timber Faller: For six months I felled and bucked timber for private landowners for partial and clear-cut operations.

Forestry technician for USDA Forest Service, Quinault, WA for four nine-month seasons: set up logging areas by traversing boundaries, surveyed for new roads, prepared profile surveys, assisted in cruise plots and marked trees, plus assisted in transient

survey of national forest boundaries, placing section corner markers and marking bearing trees.

Other work has included two seasons as a fire crewman, three years in horticulture/landscaping, experience planting and thinning trees, building and maintaining the Quinault trail system plus two years as electronic technician.

Volunteer Activities

Grays Harbor Search & Rescue, Chehalis Valley Restoration wood Duck Project, Washington Department of Fish & Wildlife elk relocation project plus oak habitat mapping.

Gregory Ericksen
2832 Pacific
Hoquiam, Washington 98550
360-533-2058

General Summary

20 years' experience in positions requiring coordinated mental and physical skills to ensure productivity and safety.

Work equally well in a teaming environment or with minimal supervision. My varied work experiences indicate willingness and ability to learn.

Streamtyping Experience

Washington Trout, Duvall, WA.: I have taught stream typing to crews and TFW partners and participated in restoration projects including road closures, culvert surveys and replacement, and collected scientific data for Washington Trout and for Thomas Travis Young, Olympia (consultant).

I have performed streamtyping for the Washington Department of Natural Resources, Olympic Peninsula Office, Aberdeen, WA, the Department of Fish & Wildlife at Montesano, WA and stream typing plus tree planting for Weyerhaeuser. I have more than three years' experience in streamtyping.

Other Experience

Heavy equipment operator
Rigging operator
Mechanic
Carpenter
Landscaping
Supervisory
Watershed Restoration

Education

Washington State University survey class, Adopt-A-Stream, Everett WA.

Grays Harbor College, Aberdeen, Washington: Watershed analysis/data collection.

Department of Natural Resources wetland verification class, Forks, WA.

Hoquiam High School, Hoquiam, Washington.

References

Available upon request.

ITT Rayonier Pulp Mill 1977-1982
Yard Crew Run Equipment Fork lifts all sizes, Front End-loader, Back Hoe, Bob Cats, Riggin Slinger for lifting + Replacing Equipment Motor's, Pumps, Steam lines ect. Basically Anything in mill. Leadman for Crews + Work Alone. Take care of all safety equipm in the entire mill + Order + Replace.

2 Earley tire Co. 1983-1988
Auto Mech. Certified in Diagnostic Scope, Brake's, Air Cond. Tune-ups + Brakeman + Service A/C systems was work Done Schooling to Be Certified for all Area's.

3 Weyco. 1989-90 Plant trees for them + contract Work for them in tree planting Area of Work and Some Cedar Block cutting for them contract cutting

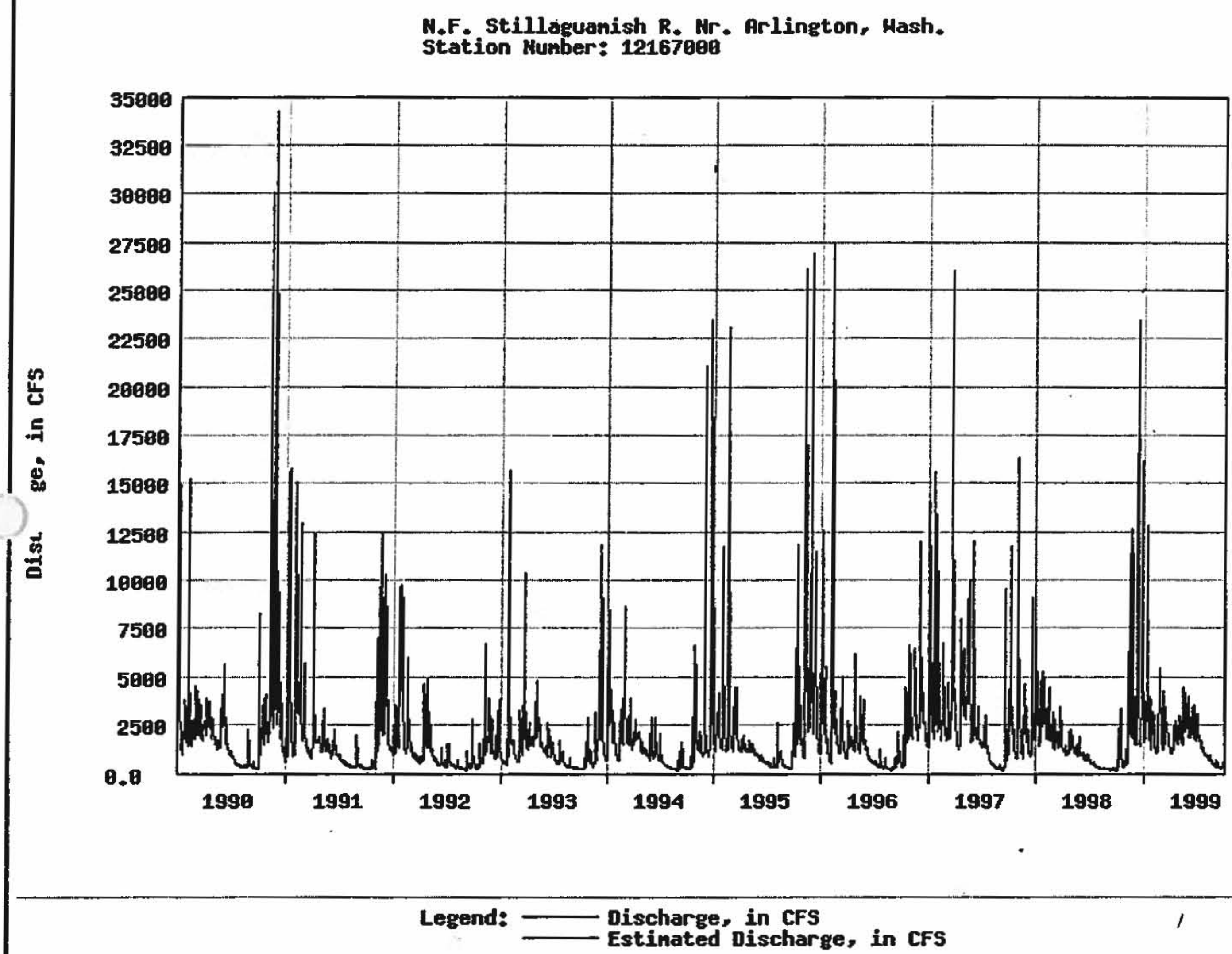
4 Work for Quality Homes const. Clark + Son + Locke Const. Building houses from ground up + foundation's also with Clark + Son was all commercial Building's
From 89-1994

5 Washington dept. fish + Wildlife 1995
Stream Retyping + Mapping of Stream's + Restoration Work

Greg Ericksen

USGS science for a changing world

Historical Streamflow Daily Values Graph for N.F. Stillaguamish R. Nr. Arlington, Wash. (12167000)

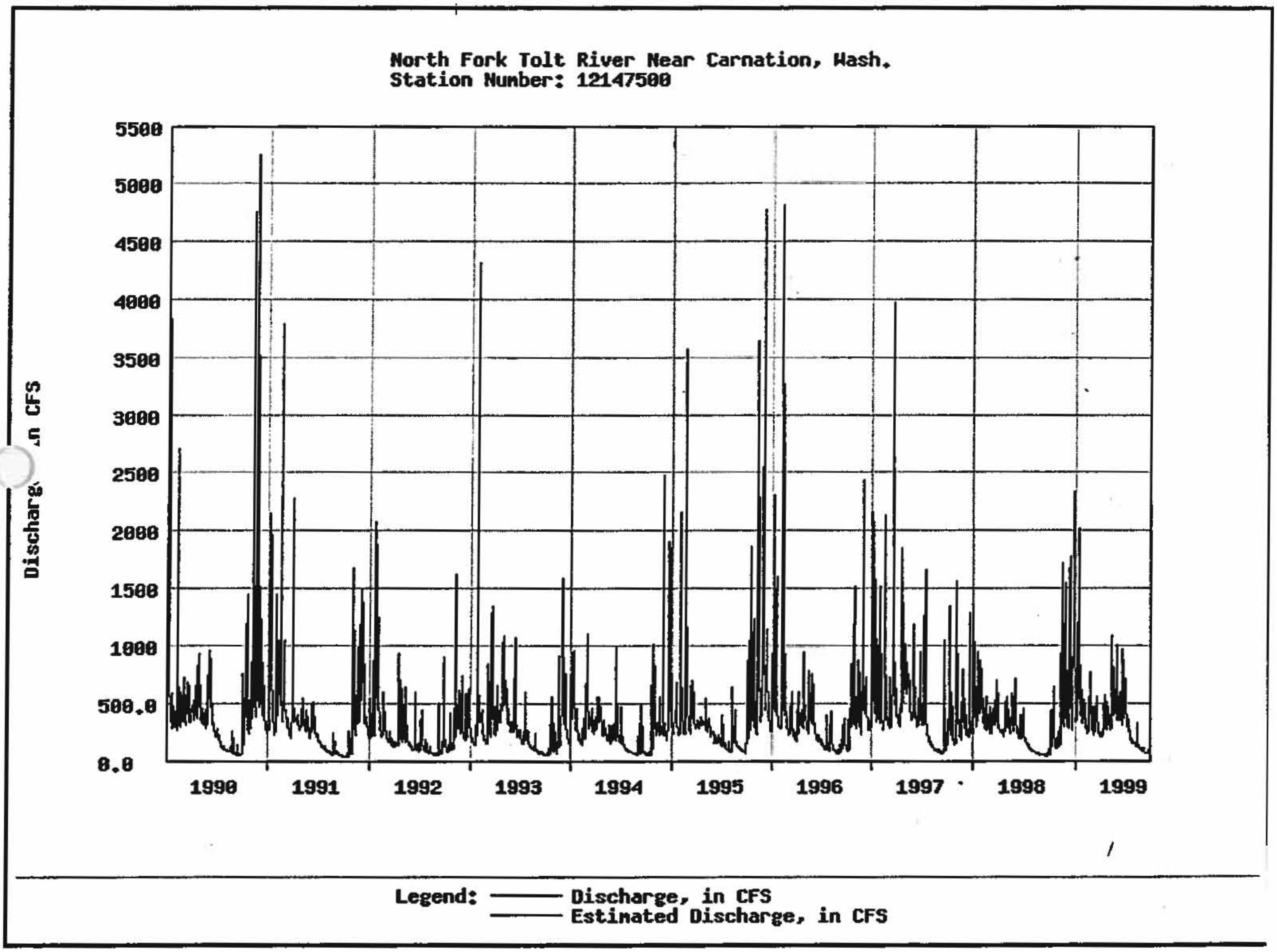


Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn [Why you might press this button]

USGS science for a changing world

Historical Streamflow Daily Values Graph for North Fork Tolt River Near Carnation, Wash. (12147500)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn Why you might press this button

Stillaguamish (Deer Creek / WRIA 050201)

Basin Discription – Washington trout crews surveyed all of the upper Deer Creek Watershed owned by the United States Forest Service and a large portion of the middle watershed owned primarily by Hancock Insurance company with intermittent parcels owned by Washington Department of Natural Resources. The lower portion of the Deer Cr. watershed owned by Washington department of Natural Resources, MRGC and private landowners was water typed by Washington Trout Crews and Tulalip Tribes. The water typing consolidation data submitted by Washington Trout does not include the water typing data collected by the Tulalip Tribes. A very small portion of the watershed < 5%, owned by Port Blakley was not water typed to my knowledge.

Deer Creek is a major salmonid spawning tributary of the NF Stillaguamish located north of Hwy 530, near the town of Oso, Wa. The mainstem is approximately 24 miles long with over 20 individual tributaries entering it. The middle and upper portions of the watershed, composed primarily of the Higgins and Little Deer drainages are undeveloped and could be considered unspoiled if not for the logging roads and clear-cuts evident throughout the Little Deer drainage, which has been heavily logged, contributing to the significant silt loading and flooding tendancies in the mainstem.

A collaborative watershed restoration effort has been ongoing in the North Fork since 1985 in response to a massive land slide in the Little Deer Watershed. This effort includes state, federal, and local agencies, Indian tribes, conservation groups, educational institutions, small and large private landowners and interested citizens.

A very narrow valley floor constricted by a canyon encompasses much of the lower five miles of the watershed; the remaining 21 miles of mainstem valley bottom are narrow with intermittent broad sections. In general, tributary gradients are steep, in the lower reaches due to the ravine or canyon, and in the upper reaches due to mountain terrain. The riparian areas, with the exception of the uppermost headwaters and areas influenced by logging, are dominated by moderate to heavy forest cover composed of Douglas-fir, western hemlock, silver fir, western red cedar and intermittent stands of old growth spruce.

Salmonid Utilization – Although the Washington Department of Fish and Wildlife was unaware of a cutthroat population in the Deer Creek Tributaries. Washington Trout crews identified cutthroat (Oncorhynchus clarki), along with rainbow (Oncorhynchus mykiss), coho (Oncorhynchus kisutch), and native char (Salvelinus malma, during their surveys of the Deer Creek tributaries.

DEER CREEK DRAINAGE

This stream section covers the entire Deer Creek drainage from its mountainous headwaters north of the Stillaguamish Valley downstream to its confluence with the North Fork Stillaguamish River at the town of Oso. It includes approximately 24 miles of mainstem stream plus 23 individual tributaries adding a total of nearly 56 additional stream miles.

Stream Description

From its headwaters Deer Creek courses generally west about 16 miles, then south 8 miles to its confluence with the North Fork. Its major tributaries are Higgins Creek and Little Deer Creek. These, along with the majority of smaller tributaries, exhibit steep gradient characteristics common to mountain streams.

Throughout the drainage the valley floor is quite narrow, with only a few intermittent broad sections. Adjacent hillsides rise quickly away from the streambed and, except where logging has occurred, are densely forested. Very narrow, ravine and sometimes canyon-like conditions predominate in the lower 5 miles. The upper watershed is almost entirely undeveloped. The major portion of all tributaries entering above mile 13, plus the remainder of upper Deer Creek drainage above mile 17, are located within Mt. Baker National Forest. Clear-cut logging is evident throughout much of the upper drainage, and is especially heavy in the Little Deer Creek watershed. Logging roads provide the principal access throughout most of the area. There are a few rural residences in the lower reaches, with Oso the only community development. The watershed receives relatively heavy recreation use, especially in the summer and early fall months.

Stream gradient is moderately steep throughout most of the drainage, with some very steep sections in the canyon between mile 1.5 and 5.0. A number of channel sections exhibit flood plain characteristics, particularly where a somewhat broader valley floor exists. In such areas, channel splitting and extensive broad gravel riffles and gently sloped gravel beaches predominate. For most of the stream length, however, bottom composition is mainly boulder-strewn, interspersed with rubble, and only a few riffle and patch gravel sections. In spite of apparent flooding effects, the major portion of the channel appears quite stable. Stream widths throughout most of the upper drainage range from 5 to 12 yards. In the lower 1.5 miles, below the ravine and canyon-like area, widths range from 12-20 yards. Natural, stable stream banks prevail throughout the drainage, most of them relatively low earth cuts or boulder-strewn beaches. Steep slopes with some vertical walls exist in the lower canyon section. Except where logging has approached the immediate stream bank, cover is moderate to dense, composed mainly of conifers and mixed deciduous trees and underbrush.

Salmon Utilization

Deer Creek is accessible to anadromous fish runs nearly to its headwaters. It serves spawning and rearing fall chinook, spring chinook, and coho with some pink and an occasional chum observed. Most tributaries provide relatively short access; however, a number received heavy spawning concentrations of coho. Since most of the tributaries are quite small and provide limited rearing area, most salmon juveniles spend the major portion of their fresh-water life in Deer Creek proper.

Limiting Factors

One of the principal factors limiting salmon production in the Deer Creek drainage is its flash flooding tendency, with consequential heavy silt loading of the stream. This condition is aggravated by extensive clear-cut logging practices in the upper watershed. Steep gradient conditions in the lower canyon, particularly between miles 1.5 and 3, may present at least a partial barrier to salmon migration, probably blocking most pink and chum salmon. The heavy silt deposition existing over riffle areas in the lower 2 miles would affect pink and chum the most. In the upper watershed, stream sections exhibiting considerable channel splitting have a definite lack of adequate shade and cover. Also, during low summer flow periods, water in these stretches tends to spread out, often forming potholes, trapping juvenile fish. Increasing stream gradient above R.M. 17 may present obstacles to migration. Also, considerable logging debris along the stream course could intermittently create barriers at some locations.

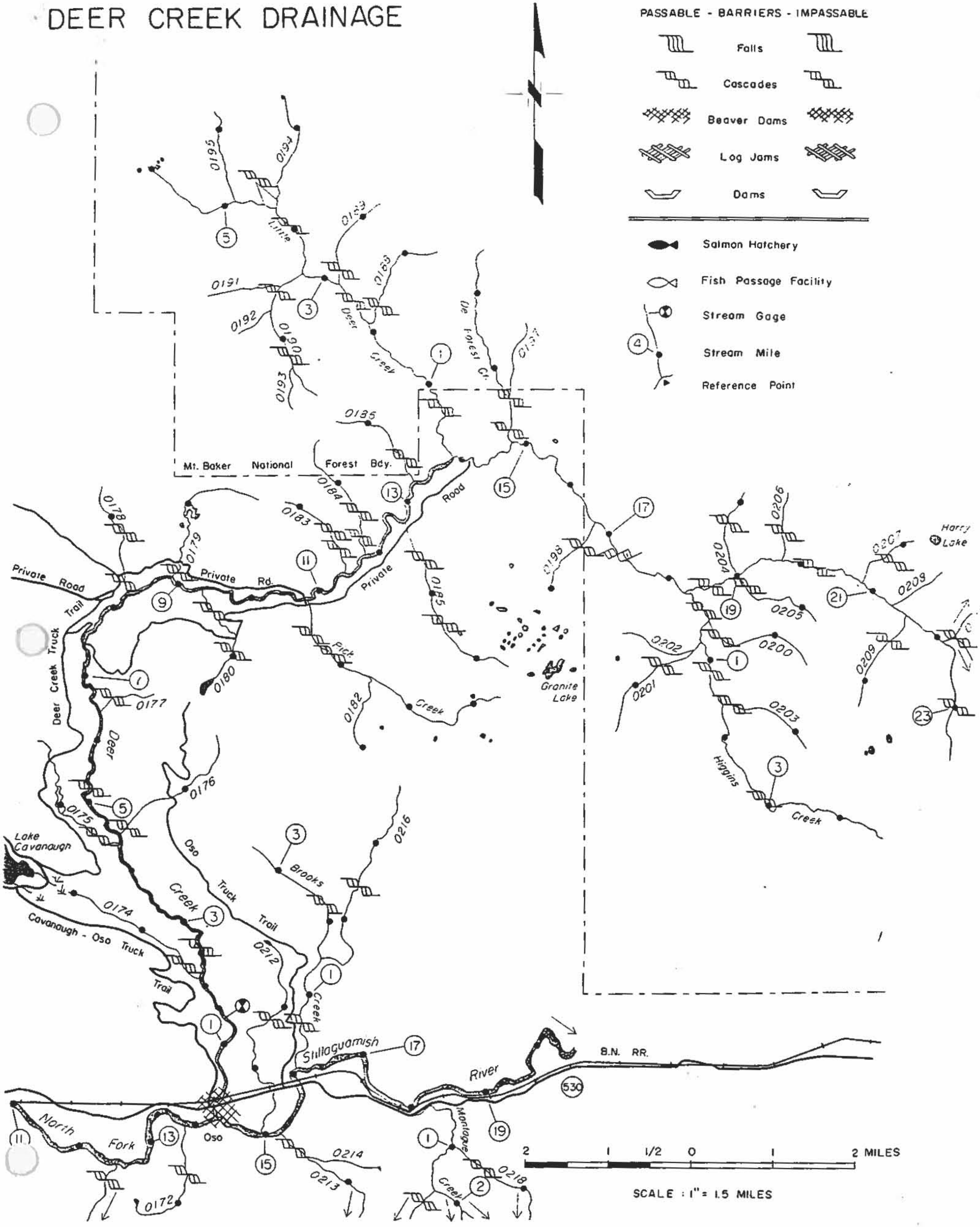
Beneficial Developments

No facilities or programs have been undertaken in this drainage area to specifically benefit salmon production.

Habitat Needs

A major requirement to maintain fish production in this section is to insure that forest logging activities are performed in accordance with the Forest Practices Act protecting the natural stream habitat. In addition, cleaning of streambed gravel over the lower 2 miles would be of considerable benefit.

DEER CREEK DRAINAGE



DEER CREEK DRAINAGE
Stillaguamish River Basin — WRIA 05

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Stillaguamish River				
0135	N. F. Stillaguamish R.				Chin., Coho, Pink, Chum
0173	Deer Creek	RB-14.3	23.7	—	Chin., Pink, Coho
0174	Unnamed	RB-2.1	2.6	—	Unknown
0175	Unnamed	RB-4.3	1.8	—	Unknown
0176	Unnamed	LB-4.4	1.9	—	Coho
0178	Unnamed	RB-8.2	1.4	—	Unknown
0179	Unnamed	RB-8.8	1.9	—	Unknown
	Unnamed Pond	Outlet-0.8	—	—	
0180	Unnamed	LB-9.3	1.3	—	Coho
	Unnamed Lake	Outlet-1.3	—	—	
0181	Rick Creek	LB-10.7	3.3	—	Coho
0182	Unnamed	LB-1.4	1.0	—	None
0183	Unnamed	RB-11.4	1.1	—	Unknown
0184	Unnamed	RB-11.8	1.7	—	Unknown
0185	Unnamed	LB-12.8	2.4	—	Coho
0186	Unnamed	RB-13.3	1.3	—	Unknown
0187	Little Deer Cr.	RB-13.9	6.0	—	Coho
0188	Unnamed	LB-2.1	1.4	—	None
0189	Unnamed	LB-2.8	1.2	—	None
0190	Unnamed	RB-3.3	1.9	—	None
0194	Unnamed	LB-4.4	1.5	—	None
0195	Unnamed	LB-4.9	1.2	—	None
0196	DeForest Creek	RB-14.9	2.6	—	Unknown
0198	Unnamed	LB-16.8	1.0	—	Unknown
0199	Higgins Creek	LB-18.4	4.6	—	Coho
0200	Unnamed	RB-0.5	1.5	—	Unknown
0201	Unnamed	LB-0.8	1.6	—	Unknown
0203	Unnamed	RB-1.6	1.2	—	None
0204	Unnamed	RB-19.0	1.1	—	Coho
0205	Unnamed	LB-19.05	1.2	—	Unknown
0207	Unnamed	RB-20.9	1.2	—	Unknown
0209	Unnamed	LB-21.55	1.3	—	Unknown
0210	Unnamed	RB-22.1	1.4	—	Unknown
	Segelsen Lake	Outlet-1.4	—	—	

DEER CREEK DRAINAGE

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Throughout the drainage the valley floor is quite narrow, with only a few intermittent broad sections. Adjacent hillsides rise quickly away from the streambed and, except where logging has occurred, are densely forested. Very narrow, ravine and sometimes canyon-like conditions predominate in the lower 5 miles. The upper watershed is almost entirely undeveloped. The major portion of all tributaries entering above mile 13, plus the remainder of upper Deer Creek drainage above mile 17, are located within Mt. Baker National Forest. Clear-cut logging is evident throughout much of the upper drainage, and is especially heavy in the Little Deer Creek watershed. Logging roads provide the principal access throughout most of the area. There are a few rural residences in the lower reaches, with Oso the only community development. The watershed receives relatively heavy recreation use, especially in the summer and early fall months.

Stream gradient is moderately steep throughout most of the drainage, with some very steep sections in the canyon between mile 1.5 and 5.0. A number of channel sections exhibit flood plain characteristics, particularly where a somewhat broader valley floor exists. In such areas, channel splitting and extensive broad gravel riffles and gently sloped gravel beaches predominate. For most of the stream length, however, bottom composition is mainly boulder-strewn, interspersed with rubble, and only a few riffle and patch gravel sections. In spite of apparent flooding effects, the major portion of the channel appears quite stable. Stream widths throughout most of the upper drainage range from 5 to 12 yards. In the lower 1.5 miles, below the ravine and canyon-like area, widths range from 12-20 yards. Natural, stable stream banks prevail throughout the drainage, most of them relatively low earth cuts or boulder-strewn beaches. Steep slopes with some vertical walls exist in the lower canyon section. Except where logging has approached the immediate stream bank, cover is moderate to dense, composed mainly of conifers and mixed deciduous trees and underbrush.

Salmon Utilization

Deer Creek is accessible to anadromous fish runs nearly to its headwaters. It serves spawning and rearing fall chinook, spring chinook, and coho with some pink and an occasional chum observed. Most tributaries provide relatively short access; however, a number received heavy spawning concentrations of coho. Since most of the tributaries are quite small and provide limited rearing area, most salmon juveniles spend the major portion of their fresh-water life in Deer Creek proper.

Limiting Factors

One of the principal factors limiting salmon production in the Deer Creek drainage is its flash flooding tendency, with consequential heavy silt loading of the stream. This condition is aggravated by extensive clear-cut logging practices in the upper watershed. Steep gradient conditions in the lower canyon, particularly between miles 1.5 and 3, may present at least a partial barrier to salmon migration, probably blocking most pink and chum salmon. The heavy silt deposition existing over riffle areas in the lower 2 miles would affect pink and chum the most. In the upper watershed, stream sections exhibiting considerable channel splitting have a definite lack of adequate shade and cover. Also, during low summer flow periods, water in these stretches tends to spread out, often forming potholes, trapping juvenile fish. Increasing stream gradient above R.M. 17 may present obstacles to migration. Also, considerable logging debris along the stream course could intermittently create barriers at some locations.

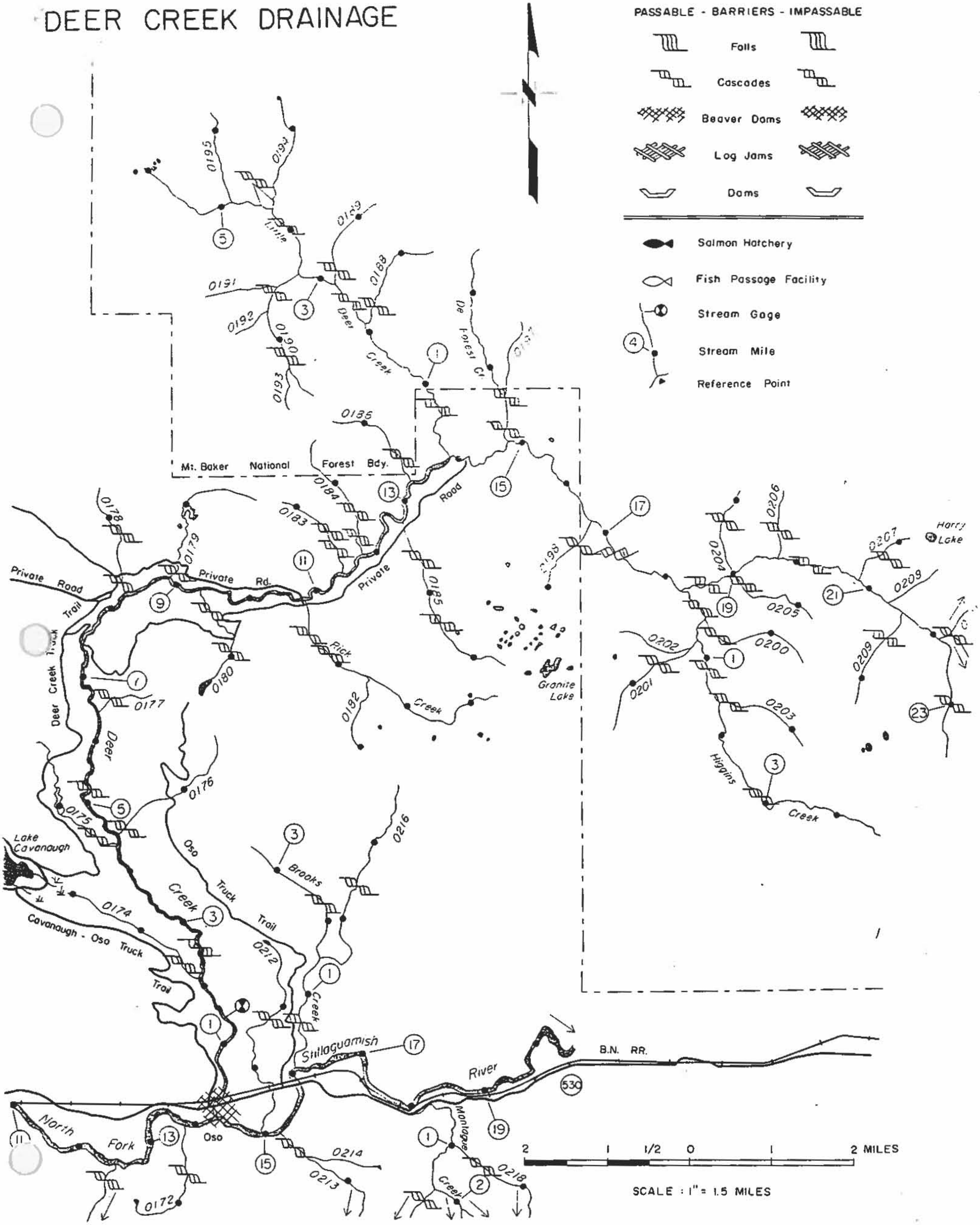
Beneficial Developments

No facilities or programs have been undertaken in this drainage area to specifically benefit salmon production.

Habitat Needs

A major requirement to maintain fish production in this section is to insure that forest logging activities are performed in accordance with the Forest Practices Act protecting the natural stream habitat. In addition, cleaning of streambed gravel over the lower 2 miles would be of considerable benefit.

DEER CREEK DRAINAGE



DEER CREEK DRAINAGE
Stillaguamish River Basin — WRIA 05

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Stillaguamish River				
0135	N. F. Stillaguamish R.				Chin., Coho, Pink, Chum
0173	Deer Creek	RB-14.3	23.7	—	Chin., Pink, Coho
0174	Unnamed	RB-2.1	2.6	—	Unknown
0175	Unnamed	RB-4.3	1.8	—	Unknown
0176	Unnamed	LB-4.4	1.9	—	Coho
0178	Unnamed	RB-8.2	1.4	—	Unknown
0179	Unnamed	RB-8.8	1.9	—	Unknown
	Unnamed Pond	Outlet-0.8	—	—	
0180	Unnamed	LB-9.3	1.3	—	Coho
	Unnamed Lake	Outlet-1.3	—	—	
0181	Rick Creek	LB-10.7	3.3	—	Coho
0182	Unnamed	LB-1.4	1.0	—	None
0183	Unnamed	RB-11.4	1.1	—	Unknown
0184	Unnamed	RB-11.8	1.7	—	Unknown
0185	Unnamed	LB-12.8	2.4	—	Coho
0186	Unnamed	RB-13.3	1.3	—	Unknown
0187	Little Deer Cr.	RB-13.9	6.0	—	Coho
0188	Unnamed	LB-2.1	1.4	—	None
0189	Unnamed	LB-2.8	1.2	—	None
0190	Unnamed	RB-3.3	1.9	—	None
0194	Unnamed	LB-4.4	1.5	—	None
0195	Unnamed	LB-4.9	1.2	—	None
0196	DeForest Creek	RB-14.9	2.6	—	Unknown
0198	Unnamed	LB-16.8	1.0	—	Unknown
0199	Higgins Creek	LB-18.4	4.6	—	Coho
0200	Unnamed	RB-0.5	1.5	—	Unknown
0201	Unnamed	LB-0.8	1.6	—	Unknown
0203	Unnamed	RB-1.6	1.2	—	None
0204	Unnamed	RB-19.0	1.1	—	Coho
0205	Unnamed	LB-19.05	1.2	—	Unknown
0207	Unnamed	RB-20.9	1.2	—	Unknown
0209	Unnamed	LB-21.55	1.3	—	Unknown
0210	Unnamed	RB-22.1	1.4	—	Unknown
	Segelsen Lake	Outlet-1.4	—	—	

SNOQUALMIE RIVER
Lower Mainstem

This drainage section includes the lower 12 miles of Snoqualmie River from a few miles above Duvall downstream to the confluence with the Skykomish River (R.M. 20.5). Eleven tributaries enter in this section, adding more than 83 total stream miles. Principal access in this northwest King-southwest Snohomish counties section is provided by State Highway 203 running south from Monroe.

Stream Description

From stream mile 12.0 the Snoqualmie River meanders northeast approximately five miles to Cherry Creek, then northwest to the confluence with the kykomish River. Principal tributaries include Tuck, Cherry, and Peoples creeks.

The flat valley floor is two miles wide and is cleared with only occasional strips or small thickets of deciduous trees and underbrush. The low, rolling hills bordering the valley are moderately steep-sloped with deciduous and some mixed conifer cover. Land use is almost exclusively agricultural pasture land. Recreation use is heavy, consisting of both fishing and hunting. The only community development is Duvall; however, there are a few widely scattered rural residences within this section. Some logging occurs in the upper Cherry Creek watershed.

Through this section, the Snoqualmie River is contained within a broad channel ranging from 30 to 45 yards during fall months. The gradient is gentle with a few nearly flat stretches. The channel meanders back and forth across the valley, forming oxbows. Stream flow is sluggish in many stretches, with numerous long, deep pools and slow-moving glides predominating. Stream bottom is primarily sand and silt, with only a few short, scattered gravel-riffle sections, generally heavily silted. Most banks are moderately high, sharply sloped earth cuts, with a few gently sloped sand-gravel beaches. Some bank protection work has taken place at certain locations within this stretch of river in the form of artificial contour and rock riprap, cabled logs, and discarded car bodies or other large debris to divert flow from easily eroded banks.

Bank cover is sparse to moderately dense, consisting almost entirely of intermittent strips or small thickets of deciduous trees and underbrush. In many areas this growth actually overhangs the banks, and with numerous logs and accumulated debris extending out from the shore, provides favorable protective cover for fish life.

Tributaries in this section exhibit gentle to moderate gradients over their lower reaches as they course across the valley floor. Their upper slopes, however, are quite steep and generally offer limited access to salmon. Through their accessible reaches, most of these streams contain good pool-riffle conditions within relatively narrow stream channels. Stream bottoms are predominantly gravel and sand over the lower reaches, with gravel and some rubble materials above. Tributary cover is usually moderate to dense growth of mainly deciduous trees and underbrush.

Salmon Utilization

This lower Snoqualmie River section provides transportation for all salmon utilizing the upper drainage. Chinook, coho, pink, and chum salmon inhabit these waters. Only limited spawning habitat is available in the Snoqualmie; however, tributaries, including Cherry, Peoples, and Tuck creeks, support good to excellent spawning populations. These tributaries as well as this section of mainstem river provide important rearing habitat for juvenile salmon.

Limiting Factors

One factor limiting salmon production is low summer stream flow in some of the smaller tributaries. This restricts rearing potential and, when continuing into the fall months, can inhibit adult salmon access. One activity which could potentially limit production is clear-cut logging over some reaches of upper tributary drainages. Such logging can influence the productive capacity of streams emerging from such areas, as well as affect production in their drainagesbelow. Another potential limiting condition involves water quality throughout the lower mainstem Snoqualmie. The slow-moving water lacks cover and is more easily warmed, and offers the potential for concentrating pollutants that could severely affect the natural production capabilities. Occasionally, heavy poaching activity occurs on adult salmon in some of the smaller tributaries.

Beneficial Developments

No facilities or programs have been undertaken in this drainage section to specifically benefit salmon production. Occasionally, stream maintenance activities involving removal of minor jams are undertaken on small streams.

Habitat Needs

The major requirement to maintain salmon production potential in this section is to protect the natural conditions that presently exist, i.e. natural stream cover, pool-riffle character, quantity and quality of stream gravel, good water quality, etc. Restoration of natural stream cover where it has already been eliminated is highly desirable, particularly on the tributary drainages.

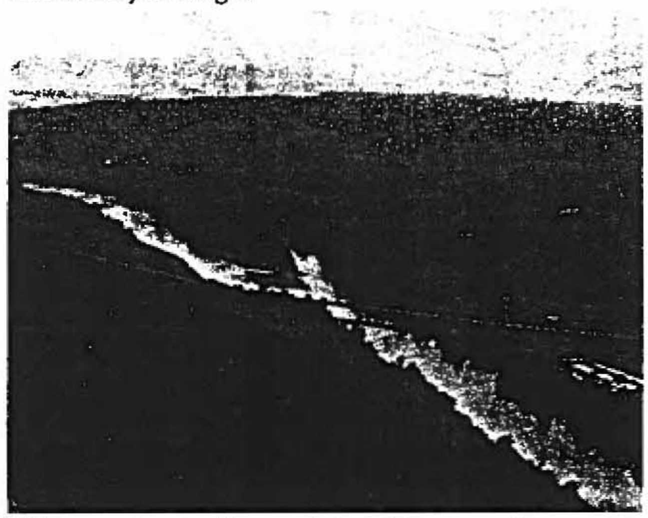
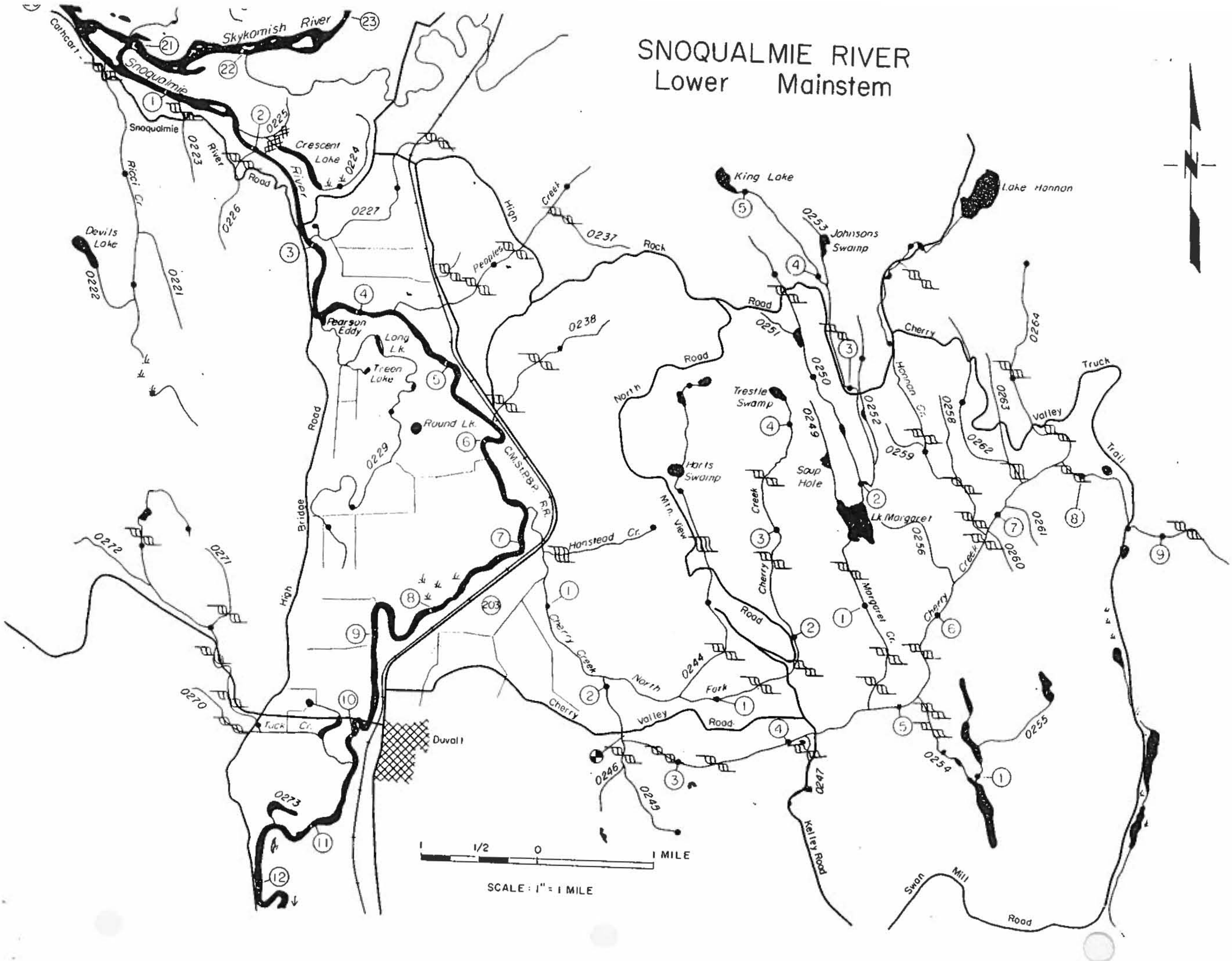


PHOTO 07-19. Confluence of the Skykomish and Snoqualmie Rivers.

SNOQUALMIE RIVER
Lower Mainstem



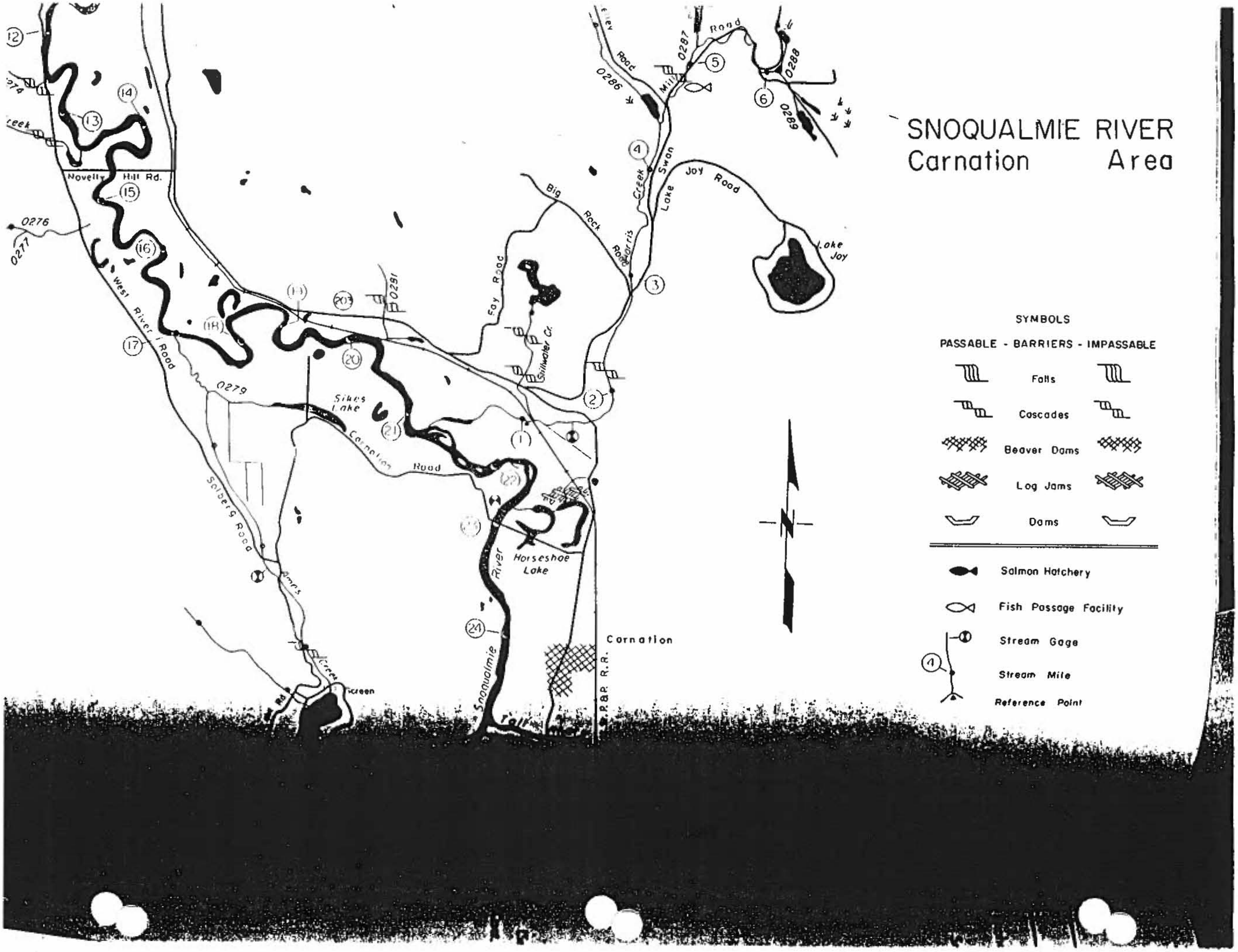
SNOQUALMIE RIVER — LOWER MAINSTEM

Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho Pink, Chum
0219	Snoqualmie River	LB-20.5	84.55	693.0	Chin., Coho, Pink, Chum
0220	Ricci Creek	LB-0.4	3.5	—	(Coho)
0224	Unnamed	RB-1.7	1.7	—	Unknown
	Crescent Lake	Outlet-0.35	—	—	
0227	Unnamed	RB-2.9	1.9	—	(Coho)
	Drainage Ditch	LB-0.2	~ 2.1	—	Unknown
0229	Pearson Eddy Creek	LB-3.6	4.35	—	Unknown
	Long Lake	Outlet-1.0	—	—	
0233	Drainage Ditch	RB-3.85	~ 1.3	—	Unknown
0236	Peoples Creek	RB-4.3	2.3	—	Coho
0238	Unnamed (Duvall Cr)	RB-5.7	1.5	—	(Coho)
0240	Cherry Creek	RB-6.7	9.9	—	Chin., Coho, Pink, (Chum)
0241	Hanstead Creek	RB-0.5	1.0	—	Unknown
0242	Drainage Ditch	LB-0.75	~ 3.5	—	Unknown
0243	N. Fk. Cherry Cr.	RB-1.9	4.2	—	Coho, (Pink), (Chum)
0244	Unnamed	RB-0.7	3.1	—	(Coho)
	Harts Swamp	Outlet-2.15	—	—	
	Unnamed Lk.	Outlet-2.8	—	—	
	Unnamed Lk.	Outlet-3.1	—	—	
	Trestle Swamp	Outlet-4.2		—	
0245	Unnamed	LB-2.5	1.0	—	Unknown
0248	Margaret Creek	RB-4.7	5.1	—	(Coho)
	Margaret Lk.	Outlet-1.55	—	—	
0250	Unnamed	RB-2.0	2.4	—	None
	Roth's Sw.	Outlet-0.45	—	—	
	Unnamed Lk.	Outlet-1.35	—	—	
0252	Unnamed	LB-2.2	1.3	—	
	King Lake	Outlet-5.1	—	—	
0254	Unnamed	LB-5.2	1.6	—	Unknown
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-0.85	—	—	
	Unnamed Lk.	Outlet-1.15	—	—	
	Unnamed Lk.	Outlet-1.6	—	—	
0257	Hannan Cr.	RB-6.8	3.55	—	(Coho)

SNOQUALMIE RIVER — LOWER MAINSTEM
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
	Unnamed Lk.	Outlet-2.65	—	—	
	Lake Hannan	Outlet-3.55	—	—	
0262	Unnamed	RB-7.4	1.9	—	None
0264	Unnamed	RB-7.8	2.0	—	(Coho)
	Cherry Lake	Outlet-9.9	—	—	
0267	Tuck Creek	LB-10.3	4.05	—	Coho, (Chum)
0268	Drainage Ditch	LB-0.4	~ 1.1	—	Unknown
	Unnamed Lake	Outlet-3.25	—	—	
	(Cont. Snohomish 703)				


SNOQUALMIE RIVER
Carnation Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Novelty Hill Rd.
West River Road
Solberg Road
Carnation Road
Sikes Lake
Horseshoe Lake
Snoqualmie River
Carnation
P.S.&P. R.R.
Big Rock Road
Fay Road
Stillwater Cr.
Harris Creek
Lake Joy Road
Lake Joy
Swan Lake
Mill Road
Screen
0276
0277
0279
0286
0287
0288
0289
0291

SNOQUALMIE RIVER — CARNATION AREA
Snohomish River Basin — WRIA 07

Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
[illegible]omish River				Chin., Coho, Pink, Chum
[illegible]oqualmie River				Chin., Coho, Pink, Chum
Adair Creek	LB-13.35	1.65	—	Unknown
Unnamed	LB-15.1	1.05	—	Unknown
Ames Creek	LB-17.0	5.2	—	Coho, (Chum)
Unnamed	RB-0.55	0.7	—	Unknown
Drain. Ditch	LB-0.25	~ 1.6	—	Unknown
Sikes Lake	Outlet-0.7			
Ames Lake	Outlet-3.5	—	—	
Harris Creek	RB-21.3	6.45	—	Coho, (Chum)
Unnamed Lake	Outlet-0.2	—	—	
Stillwater Cr.	RB-1.11	1.1	—	Coho
Unnamed	RB-4.45	1.1	—	Coho
Unnamed Lake	Outlet-6.1	—	—	
Unnamed Lake	Outlet-6.45	—	—	
Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)

(See Snohomish 803)
([illegible] Snohomish 1003)

This section includes the lower 9.0 miles of Tolt River with nine tributaries, excluding the South Fork, providing an additional 13.2 stream miles. The Tolt River originates in the range of mountains including Mt. Index, Red Mountain, and Mt. Phelps east of the Snoqualmie River, then flows southwest to its confluence with the Snoqualmie (R.M. 24.9) near the town of Carnation. The entire watershed lies within King County and road access to the lower river is provided by the Tolt River Road along the north bank, upstream from about six miles, and by the Bunker Road on the south bank from the mouth to river mile 1.8. Stossel Creek is the principal tributary and is accessible from the Tolt Truck Trail. The upper watershed will be discussed with Map 901.

Stream Description

The lower Tolt River includes the 9.0 miles below the confluence of the North and South forks. Flows are controlled by the spillway releases from the Seattle Water Supply Reservoir on the South Fork. The peaks of the upper watershed mountain range extend to 5,000-foot elevation and drop rapidly from steep canyon boulder zones to the 450 -foot elevation near the forks. The Tolt River Valley broadens below this point and becomes predominantly of floodway character. Stream width varies from 45 to 75 feet above river mile 5.0 and extends to 90 feet in the lower river. Channel splitting and overflow side channels occur below river mile 4.0. Above river mile 5.0 the streambed is comprised mostly of rubble and boulders with few patch gravel areas. Flows are mostly of fast riffle character with a few rapids. Below river mile 5.0 the bottom composition changes, with the streambed exhibiting rubble and gravel with a few boulder-strewn sections. Proceeding downstream from R.M. 5.0 there are increasing sections of gravel riffles and generally good pool-riffle balance.

Land use is confined to a few permanent small rural farms in the lower 2 miles, with heavy recreational use up to river mile 6.0 at the end of the Tolt River Road. Some logging occurs in the upper section near the forks. Stossel Creek is the principal tributary providing 4.45 miles of accessible stream. This tributary contains several reaches of beaver ponds. There are 8 short tributaries that also provide considerable drainage runoff to this system. These contain good shade cover and some sections suitable for salmon production.

Salmon Utilization

Chinook, coho, chum and pink inhabit the lower Tolt River with chinook and coho ascending this entire section and chum and pink utilizing the lower 4.0 miles, particularly the channel splits and overflow channels. Coho ascend all of the accessible portions of the tributaries, particularly Stossel Creek and Langlois Creek.

Limiting Factors

Steep gradients, cascades and falls restrict some fish use in the smaller unnamed tributaries. Gravel removal, particularly in the lower river, has altered the streambed conditions. Riprapping and other flood control measures below river mile 4.0 has tended to eliminate natural overflow channels and construct the main channel in some cases. Cleared logged-off slopes in the upper watershed contribute to the flash flooding and silting in the basin. Large boulders in the streambed limit the spawning areas. The Seattle-Tolt Water Reservoir controls the flows from the South Fork, reducing summer rearing capacity.

Beneficial Developments

A U.S.G.S. gaging station, located about 0.5 mile downstream of the confluence of the South Fork, has continuously recorded stream flow measurements from the Seattle Water Reservoir since 1952. Another U.S.G.S. gaging station, with records dating back to 1928, is located near the mouth of Stossel Creek. Negotiations for minimum flow releases for fish use were initiated in 1957 but have never been consummated into a formal agreement. Based on average flows of 200 cfs from September 15 to June 1, and 125 cfs from June 1 to September 15, as measured below Stossel Creek, releases from the Seattle Storage Dam would amount to 38 cfs in the winter period and 24.5 cfs in the summer period. In critical water years, which occur one out of ten, the reduction of 30% in these quantities would be made in the monthly release schedule.

Habitat Needs

A firm minimum flow agreement should be negotiated through the Department of Ecology with Seattle Water Department for Tolt River Reservoir releases for fish use. Gravel removal operations in the lower Tolt River should be prohibited as recruitment of gravel is minimal in this river.

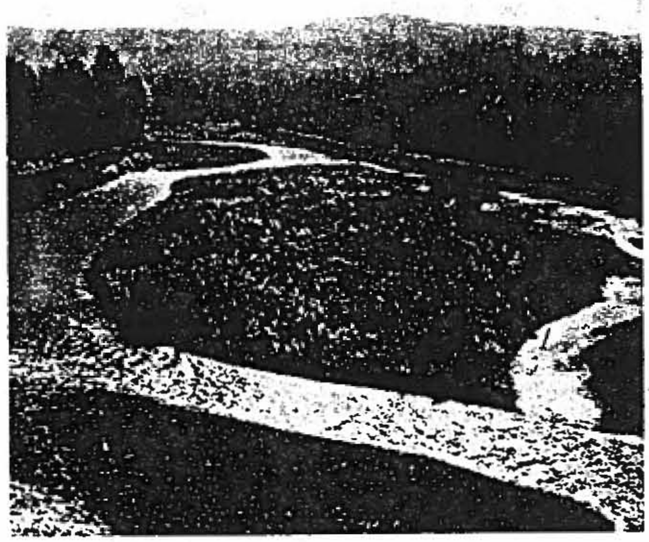
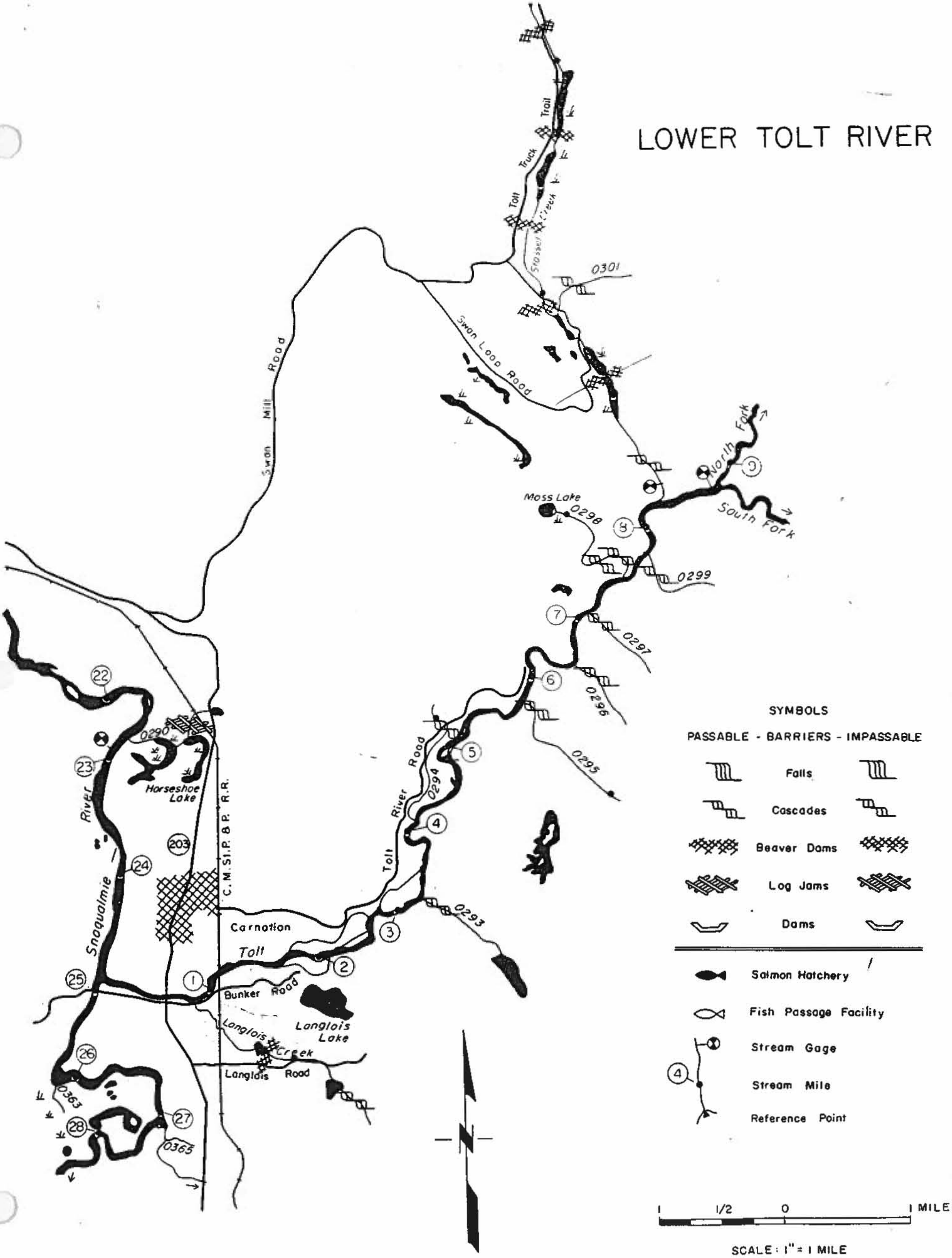


PHOTO 07-21. Set back levees on lower Tolt River allows the river to meander.

LOWER TOLT RIVER



LOWER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)
0292	Langlois Creek	LB-0.85	1.85	—	Coho
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-1.4	—	—	
0294	Unnamed	RB-4.1	1.1	—	(Chin), Coho
0295	Unnamed	LB-5.8	1.1	—	Unknown
0298	Unnamed	RB-7.5	1.15	—	(Coho)
0300	Stossel Cr.	RB-8.3	4.45	—	Coho
	Unnamed Lk.	Outlet-0.8	—	—	
	Unnamed Lk.	Outlet-1.2	—	—	
	Unnamed Lk.	Outlet-1.56	—	—	
	Unnamed Lk.	Outlet-2.9	—	—	
	Unnamed Lk.	Outlet-3.4	—	—	
	Unnamed Lk.	Outlet-4.45	—	—	
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
	(See Snohomish 903)				
	Tolt R. cont. as No. Fk. Tolt R.	@ mi. 8.81)	—	—	
	(Cont. Snohomish 903)				

This section covers the upper Tolt River basin. Above the South Fork (R.M. 8.8) it continues as North Fork more than 17 miles. Some 22 tributaries and 50 stream miles. The South Fork is also about 17 miles long, with 15 tributaries adding 30 stream miles. The area is located six miles east of Carnation, in north-central King County. Access is via logging roads from the town of Snoqualmie. The North Fork and tributaries above R.M. 18 are within Snoqualmie National Forest. Also, much of the area is managed as watershed by the City of Seattle.

Stream Description

From the northwest slopes of Red Mountain the North Fork flows first northwest, then west about eight miles, then southwest nine miles to the South Fork confluence. The only large tributary other than the South Fork is North Fork Creek.

Over its upper 6-7 miles the North Fork cuts through a narrow, steep-sloped valley. The upper three or so miles hold dense conifer forest, the lower slopes mostly clear-cut. Downstream from Titicaca Creek (R.M. 20.6) the valley shallows and broadens for six miles, showing many clear-cuts and various stages of reforestation. The lower six miles cut through deep ravine-canyon terrain, where most side slopes are thickly forested. Similar mountain terrain exists over the South Fork; however, most slopes here hold dense forest cover. Little development has occurred in the upper drainage. Principal activity is logging, with some recreation.

The North Fork's upper six miles are mostly steep, the stream's narrow channel holding some falls, numerous cascades, a few short pool-riffle stretches. Widths range 2-6 yards, the bottom mainly boulder and rubble, little gravel.

The gradient over the next six miles is mostly moderate. Fall widths range 5-10 yards, with some channel splitting. There are a number of good pool-riffle stretches, with the bottom being mainly rubble and gravel, and a few boulder areas. Banks are mostly low earth or rock cuts, with a few gravel-rubble beaches. Cover consists of patches or strips of mainly deciduous growth and some mixed conifer.

Over the next 3-4 miles, the ravine-canyon area presents mostly steep gradient, with numerous falls, cascades, and rapids, and only a few deep pools and short riffles. One large falls, exceeding 25 feet, is located about R.M. 10.8. Stream widths above the falls range from 4 to 9 yards. The bottom is mostly large rock and boulders, with some bedrock and a few rubble-patch gravel stretches.

The lower two miles of the reach present moderately steep gradient. The channel remains confined, ranging 5-12 yards in width in the fall, exhibiting numerous cascades and rapids, and occasional pools and short riffles. The bottom is boulder and rubble, with some patch gravel. Banks are steep -sloped, maintaining moderate to dense deciduous/conifer cover where logging has not occurred.

The South Fork's upper three miles is steep gradient stream, with conditions much the same as in the upper North Fork. For the next three miles, the gradient is moderately steep, with the stream presenting mostly fast riffles, a few cascades, and some short pool-riffle stretches. Here, fall widths range 3-5 yards, with the bottom composed mostly of rubble and scattered boulders, and some patch gravel areas. Cover is mostly conifer timber, with some mixed deciduous growth. Seattle's South Fork Tolt Reservoir encompasses the next 3.5 miles (R.M. 8.5-12.0). A large falls is located just downstream from the dam. Over the remaining eight or so miles the South Fork presents moderately steep to steep gradient, with mostly fast riffles and some cascades, particularly in a short canyon (R.M. 2.5-3.5). Stream widths range from 5 to 14 yards. Some deep pools, with a few short riffles, exist along this lower stretch. The bottom is mainly rubble and boulders, with a few short gravel riffles and patch gravel strips. The South Fork banks are generally sharp earth or rock cuts holding dense cover, except for the lower river stretches where clear-cut logging has occurred.

Nearly all smaller tributaries exhibit steep mountain stream character, with numerous cascades and rapids, and mostly boulder and rubble bottoms.

Salmon Utilization

This section receives limited salmon use, some chinook and coho ascending the North Fork about a mile, the South Fork as far as eight miles. Chinook juveniles rear for a short time in these waters, coho having year-round habitation.

Limiting Factors

Natural salmon production limitations include the North Fork and South Fork falls, plus the steep gradient restricting spawning habitat within accessible stream reaches. Additional factors include low flows during critical dry seasons, and occasional heavy siltation from a South Fork slide.

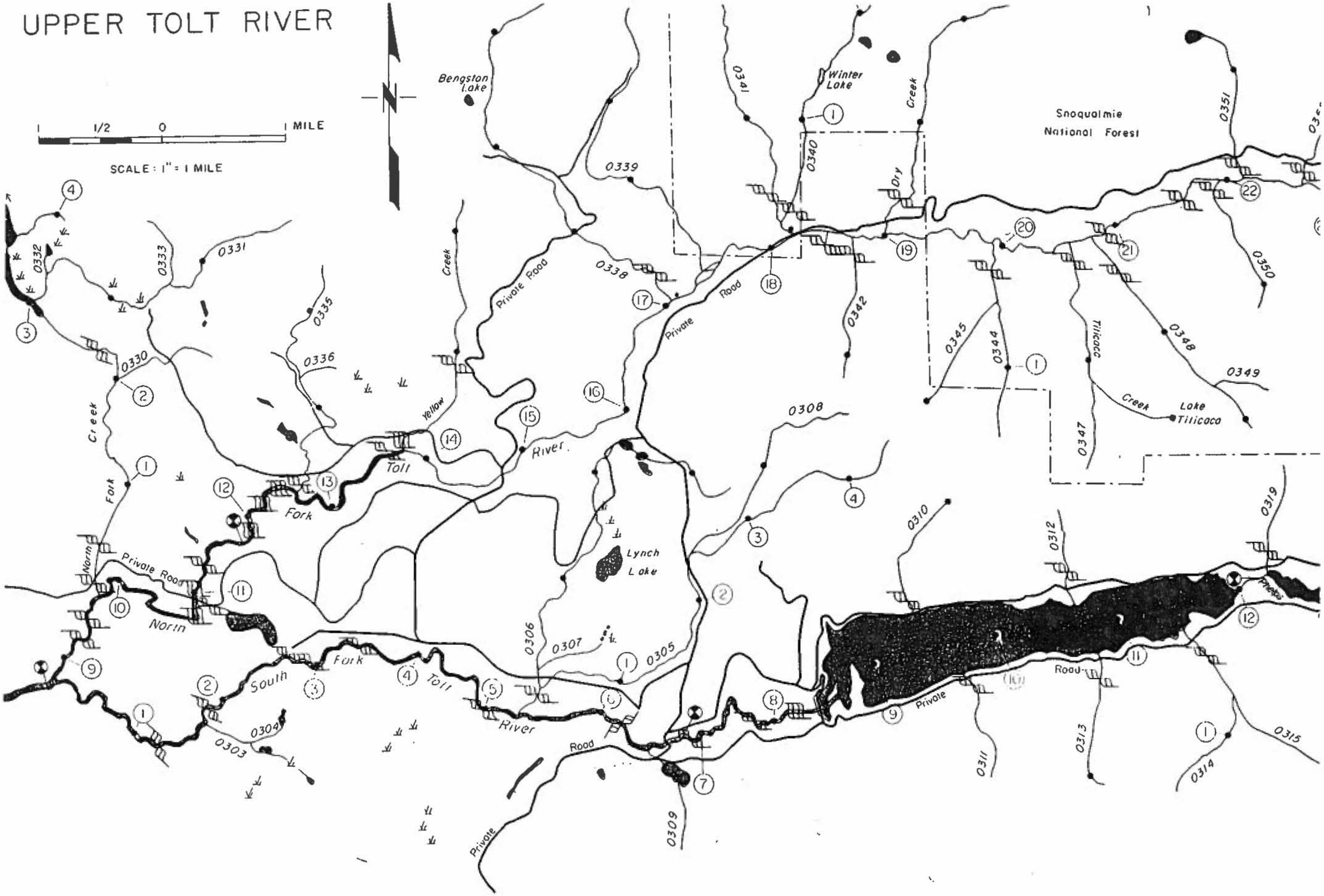
Beneficial Developments

The only programs to benefit salmon production is a minimum flow agreement with the City of Seattle to insure against severe flow reductions.

Habitat Needs

Requirements to maintain production habitat include preserving stream side cover, and maintaining stream conditions in a near natural state. Containment of the South Fork slide would benefit the more productive areas downstream.

UPPER TOLT RIVER



UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River				Chin., Coho, Pink, (Chum)
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
0305	Unnamed	RB-5.3	4.5	—	Unknown
0306	Unnamed	RB-0.3	3.4	—	None
	Unnamed Lake	Outlet-2.3	—	—	
	Unnamed Lake	Outlet-2.5	—	—	
0308	Unnamed	RB-2.45	1.9	—	None
	Tolt-Seattle Water Sup. Res.	Outlet-8.4	—	—	
0310	Unnamed	RB-9.4	1.0	—	None
0313	Unnamed	LB-10.8	1.1	—	None
1314	Unnamed	LB-11.5	1.6	—	None
0315	Unnamed	RB-0.7	1.0	—	None
0316	Phelps Cr.	LB-12.3	2.2	—	None
0320	Unnamed	RB-12.9	1.0	—	None
0323	Unnamed	RB-14.5	1.0	—	None
	Tolt R. cont. as N. F. Tolt R.	@ mi. 8.81	—	49.3	
0329	N. Fork Creek	RB-9.7	4.1	7.53	Unknown
	Unnamed Lake	Outlet-2.85	—	—	
0331	Unnamed	LB-3.0	2.8	—	None
	Unnamed Lake	Outlet-3.55	—	—	
0335	Unnamed	RB-12.6	2.5	—	None
0337	Yellow Creek	RB-13.8	2.2	—	None
0338	Unnamed	RB-17.05	3.7	—	None
0339	Unnamed	RB-17.4	2.9	—	None
0340	Unnamed	RB-18.25	3.0	—	None
0341	Unnamed	RB-0.15	2.7	—	None
	Winter Lake	Outlet-1.35	—	—	
0342	Unnamed	LB-18.7	1.2	—	None
0343	Dry Creek	RB-19.0	2.4	—	None
0344	Unnamed	LB-19.9	1.6	—	None
0345	Unnamed	LB-0.5	1.0	—	None

UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0346	Titacaca Creek	LB-20.6	1.9	—	None
	Lk. Titicaca	Outlet-1.9	—	—	
0348	Unnamed	LB-20.8	2.1	—	None
0350	Unnamed	LB-21.9	1.2	—	None
0351	Unnamed	RB-22.1	1.4	—	None
0352	Unnamed	RB-22.6	1.1	—	None
0353	Unnamed	RB-23.1	1.2	—	None
0354	Unnamed	RB-23.39	1.4	—	None
0355	Titicaed Cr.	LB-23.4	1.65	—	None
	Titicaed Lk.	Outlet-1.65	—	—	
0358	Unnamed	RB-23.55	1.1	—	None

SNOQUALMIE RIVER
Tolt Area

Thirteen miles of main Snoqualmie River are covered in this section from Tolt River upstream to Tokul Creek, plus fourteen tributaries exclusive of the Raging River, providing an additional 51.0 stream miles. The principal town in this valley section is Fall City located near the confluence of the Raging River with the Snoqualmie River at mile 36.0. Access along this stretch of river is by the Fall City to Monroe State Highway 203 on the east valley, and by the west valley road which connects to the Redmond-Fall City State Highway 522 two miles northwest of Fall City. This portion of the Snoqualmie River lies within King County. The Raging River will be presented in Map 1101.

Stream Description

This section of the Snoqualmie River from river mile 25.0 at the mouth of the Tolt River upstream to river mile 39.3 near Tokul Creek, about a mile below Snoqualmie Falls, provides the floodway for the extensive mountainous headwaters of this watershed above the falls. The Snoqualmie River winds in shallow bends downstream to river mile 33.5, below which it forms extensive oxbows and zigzags across the valley floor in serpentine fashion downstream to the town of Carnation. The valley averages about 1.5 miles in width with hillsides rising to the 400-foot elevation, forming valley walls on either side. Many large side sloughs formed by overflow waters are located in this stretch, with the largest group located on the east valley side between river mile 36.0 and 33.0 below Fall City. The mainstem Snoqualmie varies in width from 150 to 400 feet, averaging about 250 feet over much of the distance. Gradient is extremely shallow, descending from 100-foot elevation to 55-foot elevation within this 13.8 mile distance, with only a five-foot drop in the lower 6 miles. Below river mile 33.0 the river becomes a slow, deep slough, confined within diked banks with heavy mud and silt bottoms. Few patch gravel shoreline bars are present even on inside curves. Long gravel riffles with goo gravel composition occur between river mile 34.0 and 35.0. Above this point, the river again becomes deep and slow moving. Good tree cover with brush-covered banks occurs throughout this section. Land use is essentially agricultural and pastural. Due to annual flooding in the valley, there are only scattered rural homes.

Griffin Creek is a major tributary providing some 13 stream miles of drainage. The creek ranges from 10 to 25 feet in width with fair gravel composition. The average flow from 20 years of record is 42.3 cfs. Many beaver dams and swamps occur above stream mile 5.0 and much of the upper watershed has been logged off. Many summer homes are located on the lower stream.

Patterson Creek is 9.25 miles in length with an additional 9.7 miles of tributaries. It is a typical lowland-type stream with fair to good gravel, good pool-riffle balance and excellent shade and cover. Average discharge for 19 years of record is 32.2 cfs.

Salmon Utilization

Chinook, coho, chum and pink salmon utilize the mainstem Snoqualmie within this section for transportation, spawning and rearing. Chinook spawning is intense between river mile 34.0 and 35.0 with some chum and pink utilizing this same area as well as the mouth of the Raging River. Below R.M. 33.5 there is minimal spawning area with only a few shoreline gravel sections. Coho utilize mainly the tributaries; especially Griffin Creek, Patterson Creek, Skunk Creek, and the lower accessible portions of the other small unnamed tributaries. In Griffin Creek the main coho spawning occurs between R.M. 3.0 and 5.1 at the outlet of the lower swamp lake.

Limiting Factors

Heavy snowmelts and runoffs from above Snoqualmie Falls create heavy flooding in the valley. The I-90 road construction on Snoqualmie Pass Highway causes heavy silt loads in the lower river. Heavy deposits of silt and mud are found throughout the deep, slow oxbows of the lower river. Logging in the headwaters of Griffin Creek creates heavy runoff and gravel bed shifting in this stream. Steep gradients and cascades of the small independent tributaries reduce the streams to minimum salmon usage.

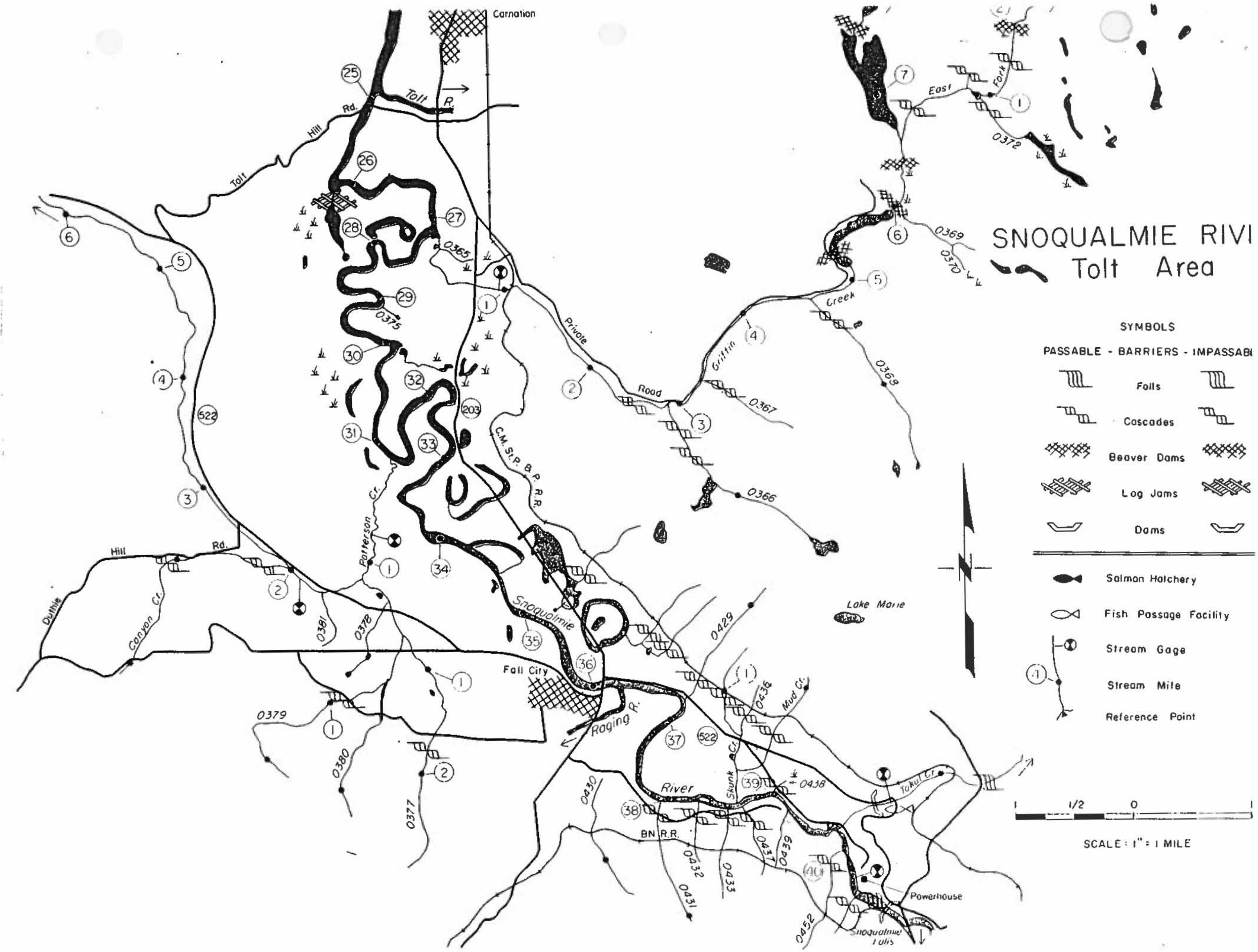
Beneficial Developments

No facilities or programs have been undertaken in this section to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production habitat in this section include: developing zoning laws preventing construction of permanent buildings within the flood plain; coordinating flood control activities with King County Flood Control; and the development of a good watershed management plan to preserve the environment.

PHOTO 07-22. Good chinook riffles on Snoqualmie River.


SNOQUALMIE RIVI
Tolt Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABI
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
1/2
0
1
SCALE: 1" = 1 MILE
Carnation
Tolt R.
Tolt Hill Rd.
Private Road
Griffin Creek
East Fork
C.M. St.P. & P. R.R.
Patterson Cr.
Hill Rd.
Duthie
Canyon Cr.
Fall City
Snoqualmie
Raging R.
River
Skunk Cr.
Mud Cr.
Tokul Cr.
Lake Marie
BN R.R.
Powerhouse
Snoqualmie Falls

SNOQUALMIE RIVER — TOLT AREA
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River			—	Chin., Coho, Pink, Chum
0219	Snoqualmie River	LB-20.5		—	Chin., Coho, Pink, Chum
0364	Griffin Creek	RB-27.2	11.4	—	Chin., Coho, Pink, (Chum)
0366	Unnamed	LB-2.9	1.75	—	(Coho)
	Unnamed Lk.	Outlet-0.75	—	—	
	Unnamed Lk.	Outlet-1.75		—	—
0368	Unnamed	LB-4.6	1.7	—	(Coho)
	Unnamed Lk.	Outlet-5.1	—	—	
0371	East Fork	LB-6.6	3.3	—	Coho
	Unnamed Lk.	Outlet-0.9	—	—	
	Unnamed Lk.	Outlet-2.6	—	—	
	Hull Lake	Outlet-3.05	—	—	
	Unnamed Lk.	Outlet-3.3	—	—	
	Unnamed Lk.	Outlet-6.75	—	—	
	Unnamed Lk.	Outlet-7.8	—	—	
	Unnamed Lk.	Outlet-8.9	—	—	
	Unnamed Lk.	Outlet-11.0	—	—	
0376	Patterson Creek	LB-31.2	9.25	—	Coho
0377	Unnamed	RB-1.2	2.9	—	Coho
0379	Unnamed	LB-0.6	2.2	—	Unknown
0380	Unnamed	RB-0.55	1.2	—	Unknown
0382	Canyon Creek	RB-2.0	2.1	—	(Coho)
0383	Unnamed	RB-6.5	1.3	—	Unknown
	Unnamed Lake	Outlet-9.25	—	—	
0384	Raging River	LB-36.2	15.2	—	Chin., Coho, Pink, (Chum)
	(See Snohomish 1103)				
0429	Unnamed	RB-36.8	1.2	—	Unknown
0430	Unnamed	LB-37.65	1.4	—	Unknown
0431	Unnamed	LB-37.95	1.0	—	Unknown
0434	Skunk Creek	RB-38.64	1.4	—	Coho
0435	Mud Creek	LB-0.3	1.1	—	(Coho)

(Cont. Snohomish 1303)

Appendix D

Quality Assurance Information Report Form

Please see cover letter for instructions. Answer as many of these questions as you can. This is not a test, and not all questions need to be answered affirmatively or in a certain way for a dataset to be included in the model. The Water Type Committee will review the information on a dataset-by-dataset basis.

A) Who collected the data?

1) Agency or company. Include address:

Washington Trout
PO Box 402
Duvall, Washington 98019

2) Principal investigator. Name, professional address, and short paragraph of qualifications and background.

Steve Conroy - Please see D-1 in Appendix D.

3) Field survey crews. Names, short paragraph of qualifications and training in last fish or last habitat field methodologies. Attach additional pages if necessary.
Please see D-1 in Appendix D

B) When and Where was the data collected?

1) Year in which the data was collected. Please use one year per dataset.
1999 - Last Salmonid Protocal

2) Months in which the data were collected.
February, March, April, May, June, July, August, November, and December

Was the data collected in the sampling protocol window (March 15 through July 15)? 26% - 3 Last Salmonid, and 14 Last Fish Habitat

ii) How would you characterize stream flow during the sampling period? (I.e., Higher than average flow conditions, Average, lower than average or mixed)

Average - Please see D-2 in Appendix D

3) What basins is the data from? (Use names, and WRIA codes).

Stillaguamish (Deer Cr. Tribs) - 050173
Snoqualmie (Tribs to Snoq.) - 070219

4) Describe the sampling area (basins, watersheds, ownerships, tribal U&As) in as much detail as possible.

Please see D-3 in Appendix D.

C) Sampling Objectives and Design.

1) Was this data collection effort exclusively for the purpose of collecting last fish or last habitat data? **No.**

If YES, what was the sampling design?

i) Complete sampling of watersheds, or basins?

ii) Complete or partial ownership sampling? ....

iii) Random sampling? .....

iv) Other? (Explain with attachment)...............

2) Was this data collection effort part of a last fish assessment associated with an FPA or prospective timber harvest site? No
If YES:
i) Did sampling extend beyond the boundary of the harvest site as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

ii) Did sampling consistently extend beyond the ownership boundary as necessary to carry the search 0.25 miles beyond the last fish or last habitat?

If you answer 'no' to either question above, do not submit dataset.

3) Was sampling incidental to other research or assessment objectives? Yes

If YES:
i) Were there aspects of the sampling design that would be considered non-random or potentially biased for the purposes of last fish or last habitat determination? Please specify at end of questionaire.

ii) Did sampling target a specific species, elevation, ownership, etc.?

D) What Field Methodology was Used?

1) Which field sampling protocol was used?
Forest Practice Board Manual Protocal (Last Salmonid) was utilized with the following modifications: 1) streams were not methodically surveyed beyound the break for a minimum of 12 pools or ¼ mile 2) Although Washington Trout crews typically utilize electroshockers in determining fish presence, visual determination of presence are also made without using electroshockers.

2) What field equipment was used to validate fish present or absence? Electroshocker? Snorkeling? Night-time snorkeling? Other?

Electroshocker, Visual identification, or visual, followed by Electroshocking in the absence of visual confirmation.

3) Was sampling for fish systematically carried a full 0.25 miles above the last fish or last habitat?
No

If you answer 'no', do not submit dataset.

4) How was the last fish or last habitat location marked in the field, i.e., monumented for future reference? Describe the appearance of the monuments, and where they were place. Last fish points were not routinely marked; when points were marked they were labeled with flagging, noting last fish. Occasionally, date, organization, and surveyors names were also noted on last fish flagging. Break points were marked with one Aluminum tag and flagging placed on a tree on both sides of the stream, Water Type Breaks, Date, Organization, and Surveyors names were noted on the flagging, only water type breaks were noted on the tags.

5) Were channels subjected to mass wasting in the past decade excluded from sampling or identified in the field data? If they were identified, how were they identified?
Channels subjected to mass wasting were not excluded from the sampling, however, Mass wasting is addressed in the field form and Last Fish/Last Habitat points within these drainages could be easily eliminated. It is possible that some drainages whose geomorphology has been changed over time may have been missed during the survey process.

6) In situations where surface flows ended, did samplers make a determination as to whether there was a break in channel gradient or other feature (headwater lake or wetland) that would cause surface flow to re-emerge up-stream?
Yes

7) In situations where last fish was determined to be below a culvert, how was this information recorded?

Culvert barriers were noted on the field form and in the database.

Where these situations discarded from the dataset?

No

Were these situations uniquely coded so that these data points could be easily pulled out of the dataset? These situations are not uniquely coded, however, this data can be extracted from the dataset in the database if a culvert barrier was identified.

Was the last habitat protocol applied above the culvert? Yes

E) Validation of Field Data.

1) Has the any of the data in this dataset been subjected to replicate sampling or verification, either within the same year or in a different year? If the replicate sample is in a different dataset, describe the location of this dataset. (Replicate sampling is not a requirement for dataset consideration.)

YES or NO__X__Yes_______

If yes, please explain how the duplicate samples can be found in the dataset, or where to find the replicate dataset if they are not included in this dataset.

Replicate samples where not systematically duplicated,however, occasional duplication occurred while conducting culvert assessments or upon request. The replicate dataset is attached or following the original dataset on the raw data forms.

If yes, Did comparisons with the replicate dataset raise any concerns? Please explain.

Yes, occasionally a last fish point was noted at a higher elevation.

F) Data Management.

1) Attach sample of field data sheet.

2) Where is the raw (paper copy) data or paper map being kept?

At the Washington Trout Office

3) In what structure is the electronic data being kept (spreadsheet, tabular database, GIS)? Describe the software, including the version of the software. If none, write "none'.

Microsoft Access 2000 Table.

4) Attach details of data fields and data codes used in the electronic database.

DETAILED ITEM DEFINITION AND CODE EXPLANATION

ITEM: Twp

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION: TOWNSHIP AND RANGE THE POINT IS IN. EXAMPLES: T15R05W; T04R15E (NOTE: THE USE OF "N" (NORTH) IS NOT NECESSARY. THIS FORMAT COMPLIES WITH DNR DATA STANDARD FOR TOWNSHIP/RANGE). IF THE TOWNSHIP IS A "HALF TOWNSHIP, THEN PLACE THE "5" ON THE END (E.G., T39R41E5)

ITEM: Sect

FORMAT: TYPE: CHARACTER; LENGTH 2

DESCRIPTION:
THE TOWNSHIP SECTION THAT THE POINT IS IN. EXAMPLES: 05, 01, 15, 32.
(NOTE: PLEASE ADD THE ZERO (0) BEFORE A ONE DIGIT NUMBER).

ITEM: Survey_no

FORMAT: TYPE: CHARACTER; LENGTH: 8

DESCRIPTION:
UNIQUE CODE FOR A PARTICULAR SURVEY OR HYDRO UPDATE MAP.
(EXAMPLES: HU12, SW23, WT23).

ITEM: Pt_id

FORMAT: TYPE: NUMERICAL, LENGTH 4

DESCRIPTION: USER-DEFINED POINT IDENTIFICATION NUMBER; WE SUGGEST THAT THE USER NUMBER THE POINTS INCREMENTALLY WITHIN A SPECIFIC SURVEY, SURVEY FORM OR HYDRO UPATE FORM.

ITEMS: SPONSOR

FORMAT: TYPE: CHARACTER, LENGTH: 16

DESCRIPTION: THE NAME OF AGENCY, GROUP, TRIBE OR COMPANY THAT IS CONDUCTING THE SURVEY. (EXAMPLES: WEYCO; DNR; WATROUT; WF&W; ETC.)

ITEMS: Date

FORMAT: TYPE: DATE: YYYYMMDD, LENGTH: 8

DESCRIPTION: DATE THE SURVEY WAS CONDUCTED.

Note: spreadsheets and info may use a different date format.
Please check and make sure any arcview conversions conform to above format.

THE FOLLOWING ITEMS (FIELDS) HAVE CODES AND CODE DESCRIPTIONS

ITEM: Protocol

FORMAT: TYPE: CHARACTER, LENGTH 4

DESCRIPTION: PROTOCOL OF FISH SURVEY

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID
PRE	PRE-EMERGENCY RULE PROTOCOLS
UNK	UNKNOWN

ITEM: Pt_type

FORMAT: TYPE: CHARACTER, LENGTH: 4

DESCRIPTION: THE TYPE OF POINT REPRESENTED UNDER THE SPECIFIED PROTOCOL.

CODE	CODE DESCRIPTION
LFH	LAST FISH HABITAT
LF	LAST FISH
LS	LAST SALMONID

ITEM: Bnd_type

FORMAT: TYPE: CHARACTER, LENGTH: 2

DESCRIPTION: PHYSICAL PLACEMENT OF POINT (NEEDED FOR MODELING PURPOSES).

CODE	CODE DESCRIPTION
A	MID-CHANNEL END OF HABITAT
B	CONFLUENCE POINT (NON-FISH-BEARING STREAM LATERALLHY INTERSECTING A FISH-BEARING STREAM)
C	TRIBUTARY JUNCTION (TWO OR MORE NON FISH-BEARING STREAMS JOIN TO FORM A FISH-BEARING STREAM

ITEM: End_type
TITLE: END TYPE OF FISH POINT

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: THE REASON FOR THE PLACEMENT OF END POINT.

CODE	CODE DESCRIPTION
1	NATURAL END (BND_TYPE B,C OR SIZE RELATED, (WIDTH/BASIN SIZE)

2	GRADIENT RELATED (e.g., WATER FALLS)
3	LARGE WOODY DEBRIS (LWD)
4	ROAD CULVERT
5	MASS WASTING EVENT (LANDSLIDE)
6	BEAVER DAM or other NON-PERMANENT DAM
7	OTHER DAM (PERMANENT)
8	WATER QUALITY LIMITER
9	NONE
10	UNKNOWN

ITEM: Det_met

FORMAT: TYPE: NUMBER; LENGTH: 2

DESCRIPTION: METHOD USED TO DETECT POINT

CODE	CODE DESCRIPTION
1	ELECTRO-SHOCKING
2	DAY SNORKELING
3	NIGHT SNORKELING
4	VISUAL OBSERVATION

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION5)

ITEM: Comment

FORMAT: TYPE: CHARACTER, LENGTH: 60

DESCRIPTION: FIELD FOR INPUTTING ANY IMPORTANT INFORMATION ABOUT THE DATA POINT OVER AND ABOVE THE CODING INFORMATION

5) Where is the electronic copy being kept?

On Washington Trout's Document Server.

Curriculum Vitae

Stephen C. Conroy, Ph.D

Address: 10624 165th St.
Renton WA 98055

Telephone: (425) 277 7868 (home)
(425) 788 1167 (work)

email: watrout@eskimo.com

Undergraduate Degree: B.Sc. with Honours, 1980. University of Aberdeen, Scotland, U.K. Major: Biochemistry

Graduate Degree: Ph.D. 1984. University of Aberdeen, Scotland, U.K. Field of study: Enzymology

Employment History:

University of Aberdeen, Scotland, U.K.	Research Assistant.	1980-1984
University of Colorado, Denver, CO.	Research Fellow.	1984-1985
Case Western Reserve University, Cleveland, OH.	Research Associate.	1985-1987
University of Washington, Seattle, WA.	Senior Fellow.	1987-1992
Fred Hutchinson Cancer Research Center, Seattle, WA.	Staff Scientist.	1992-1995
Washington Trout, Duvall WA.	Science/Research Director	1996-present

Editorial Positions

Manuscript reviewer, "The Journal of Biological Chemistry" 1985-1987.
Manuscript reviewer, "Biochemistry" 1987-1994.
Manuscript reviewer, "Washington Trout Report" 1996-present

Grant Awards

Weiss Creek Restoration and Deer Creek Stream Typing. $300,000 from Washington Jobs For The Environment Program (JFE 9809)

North Fork Stillaguamish Engineered Log Jam Project. $160, 127 from Washington Department of Fish & Wildlife.

Griffin Creek Restoration. $49,600 from National Fish and Wildlife Foundation.

Skykomish Culvert Inventory & Analysis. $44,500 from Washington Department of Transportation.

Weiss Creek Demonstration Project. $40,000 from Snohomish Watershed Basin Work Group.

Salmonid habitat identification/stream typing project. $33,200 from King County Water Quality Block Grant.

Stream Typing and Culvert Analysis. $30,000 from the Bullitt Foundation.

Stream Typing and Culvert Analysis. $10,000 from the General Services Foundation.

Stream Typing and Culvert Analysis. $10,000 from the Horizons Foundation.

Stream Typing and Culvert Analysis. $5,000 from The Trout and Salmon Foundation.

Cherry Creek Riparian Restoration. $3,000 from Stilly-Snohomish Regional Fisheries Enhancement Group.

Tolt steelhead molecular genetics project. $250 from Puget Sound Flyfishers

Tolt summer steelhead monitoring project. $250 from Puget Sound Flyfishers

Typical Responsibilities

Supervised up to eight field biologists performing stream typing across the Western Cascades and in the Lower Columbia. Obtained grants and contracts for stream typing and in-stream restoration projects, published technical reports, supervised budgetary requirements, participated in TFW technical committees. Taught stream typing courses to TFW partners and consultants. Participated in snorkel surveys and electrofishing surveys. Experienced in non-lethal tissue sampling from fish for DNA analysis.
Coordinated culvert inventory and analysis projects, analyzed data, maintained databases and prioritized projects for restoration. Participated in formal training courses regarding culvert assessments and helped refine class materials and content.
Project manager for in-stream restoration in Weiss Creek and Griffin Creek. Projects involve permit acquisition, channel construction, LWD placement, riparian planting and fencing, and public outreach and education. Delivered oral and written reports to grantors and agencies.

Published Essays (Fisheries/Ecology)

Conroy, S.C. "Genetic Diversity in *Salmonidae*" The Osprey, 12: 5 (1991).

Conroy, S.C. Habitat Lost and Found; Part 1. Washington Trout Report (1996)

Conroy, S.C. Molecular Biology Comes to the Tolt. Washington Trout Report (1996)

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Conroy, S.C. Stream Typing. Northwest Fishing Holes, (1996)

Conroy, S.C. Atlantic Salmon; Friend or Foe? Northwest Fishing Holes, (1997)

Conroy, S.C. Genetic Diversity in Salmon. Washington Wildlife Magazine, volume I, number II, 1997

Conroy, S.C. Habitat Identification and Development: The Need For Streamside Buffer Zones. Washington Trout Technical Report TR-98-1 (1998).

Scientific Publications (Peer Reviewed)

Conroy, S.C.; Adams, B.; Pain, R.H.; Fothergill, L.A. "3-Phosphoglycerate Kinase Purified by Affinity Elution has Tightly Bound 3-Phosphoglycerate." FEBS Letts. 128 353-355 (1981).

Dobson, M.J.; Tuite, M.F.; Roberts, N.A.; Kingsman, A.J.; Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A. "Conservation of High Efficiency Promoter Sites in *Saccharomyces cerevissiae*." Nucleic Acids Research 10 2625-2637 (1982).

Watson, H.C.; Walker, N.; Shaw, P.J.; Bryant, T.N.; Wendell, P.; Fothergill, L.A.; Perkins, R.E.; Conroy, S.C.; Dobson, M.J.; Tuite, M.F.; Kingsman, A.J.; Kingsman, S.M. "Sequence and Structure of Yeast 3-Phosphoglycerate Kinase." EMBO 1 1635-1640 (1982)

Conroy, S.C. "Sequence, Structure and Activity of Yeast 3-Phosphoglycerate Kinase" Ph.D Thesis, University of Aberdeen, Scotland, U.K. (1983).

Perkins, R.E.; Conroy, S.C.; Dunbar, B.; Fothergill, L.A.; Tuite, M.F.; Dobson, M.J.; Kingsman, S.M.; Kingsman, A.J. "The Complete Amino Acid Sequence of Yeast 3-Phosphoglycerate Kinase" Biochemical J. 211 199-218 (1983).

Conroy, S.C.; Dever, T.E.; Owens, C.L.; and Merrick, W.C. "Characterization of the 46,000-Dalton Subunit of eIF-4F." Arch. Biochem. Biophys. 282 363-371 (1990)

Merrick, W.C.; Dever, T.E.; Kinzy, T.G.; Conroy, S.C.; Cavallius, J.; Owens, C.L. "Characterization of Protein Synthesis Factors from Rabbit Reticuloctyes." Biochimica et Biophysica Acta 1050 235-240 (1990).

Hagen, F.S.; Arguelles, C.; Sui, L.; Zhang, W.; Seidel, P.R.; Conroy, S.C.; Petra, P.H. "Construction of a Full-Length cDNA for the Sex Steroid Binding Protein of Human Plasma or Androgen Binding Protein of Human Testis (SBP/ABP or SHBG/ABP). Expression and Preliminary Characterization of the Recombinant Protein." FEBS Letts. 299 23-27 (1992).

Conroy, S.C., Hart, C.E., Perez-Reyes, N., Giachelli, C.M., Schwartz, S.M., McDougall, J.K. "Characterization of Human Aortic Smooth Muscle Cells Expressing HPV16 E6E7 Open Reading Frames." American J. of Pathology, 147 753-762 (1995).

Conroy, S.C., Morales, T.H., Stuart, K. "Partial Purification and Characterization of a Terminal Uridyl Transferase from *Leishmania tarantolae*." Manuscript in preparation.

Bonin, L, Tedford, K., Perez-Reyes, N., McDougall, J.K. & Conroy, S.C. "Gene expression in extended life-span human smooth muscle cells derived from atherosclerotic plaque." In press.

Contributed Papers

Conroy, S.C. "Binding of Substrate to 3-Phosphoglycerate Kinase." Scottish Protein Society, Aberdeen, Scotland. 1982.

Conroy,S.C. "Sequence, structure and Activity of 3-Phosphoglycerate Kinase" Scottish Protein Society, Stirling, Scotland. 1983.

Merrick, W.C.; Conroy, S.C.; Dever, T.E.; Brabanec, A.M.; and Owens, C.L. "Protein Synthesis Factors That Interact With RNA And Nucleotides." FASEB J 1988, Washington, D.C.

Perez-Reyes, N., Conroy, S.C., Halpert, C.L., Smith, P.P., Benditt, E.P., McDougall, J.K. "Immortalization of Primary Human Smooth Muscle Cells." FASEB J 6:A1032, 1992.

Conroy, S.C., Hart, C.E., Perez-Reyes, N., McDougall, J.K. "Phenotypic Characterization of Immortalized Vascular Smooth Muscle Cells." FASEB J 7:A758, 1993.

Scatena, M., Conroy, S.C., Tedford, K. & McDougall, J.K. "Increased ubiquitin expression in human atherosclerotic plaque-derived smooth muscle cells." FASEB J. 1996.

Conroy, S.C. "Habitat Lost and Found" 1st Annual Wildlife Congress. Washington Department of Fish and Wildlife. January 1997.

Mary Lou White
2905 Birchwood
Bellingham, WA 98225
(360) 671-8839

Experience:

1994-Present

Field Biologist/Project Manager
Washington Trout • Duvall, Washington

- Crew leader and field biologist for fish habitat assessments, stream typing, scientific data collection, culvert assessments, riparian planting and monitoring, 1994-present.

- Project manager for culvert replacement, stream channel restoration, road abandonment, and riparian revegetation grant projects completed in 1996 & 1997; combined worth of grants over $500,000. Supervised 30 people, including five contractors working simultaneously on six road abandonment and three restoration projects.

- Additional responsibilities include the following: (1) documenting and entering data; (2) preparing contracts; (3) obtaining permits; (4) writing quarterly and final reports; (5) instructing restoration and culvert assessment workshops.

1992-Present

Owner/Hydrologic Technician & Environmental Consultant • Bellingham, Washington

Representative clients: Washington Trout, Water Resource Consulting, Puget Power, Joanne Greenberg (N-SEA).

Assist hydrologic consultants in gathering, documenting and presenting information for impending watershed projects.

- Determine flow line estimates for application in determining time-of concentration.

- Research private landowner water rights.

- Using S.C.S. method, time-of-concentration and curve number assignments, calculate runoff flow from an urban watershed.

- Utilize aerial photos to determine land use activities.

- Measure lateral movement of channels based on aerial photo interpretation.

- Planimeter or digitize basins and sub-basins.

- Use maps, Quattro Pro, Excel, WordPerfect, Microsoft Word, or R-base, to document data or assemble reports.

- Conducted Wellhead Protection Program for Everson, WA.

1991-1992 • **Fisheries Technician** • Center for Streamside Studies • University of Washington, Seattle, Washington.

- Timber/Fish/Wildlife ambient monitoring; collected data on stream discharge, bankfull width and depth, gradient, fish habitat, mass wasting, valley bottom and riparian characteristics.
- Established photo points for long-term monitoring of stream channel changes.
- Used scantron for data documentation.

1989-1990 **Hydrologic Technician** • U.S.F.S. Mount Baker Ranger District • Sedro Woolley, WA.

- Assisted in layout and preparation of watershed/fisheries habitat improvement projects; monitored completed projects by recording graphics and establishing photo points.
- Created a stream file monitoring guide.
- Assisted in spotted owl surveys.

1984-1989 **Forestry Technician** • U.S.F.S. Fernan Ranger District • Coeur d'Alene, Idaho.

- Project supervisor - Fish habitat improvement structure installations; watershed inventories; coring and embeddedness surveys.
- Inventoried system and non-system roads; updated drainage map with culvert and road erosion site locations; documented problems and prescribed solutions.
- Arranged and assembled district watershed atlas for 62 stream drainages.
- Collected water samples and stream flow measurements; electrofished and snorkeled.
- Created a Future Fish Habitat Improvement Guide.
- Conducted field studies and documented data for fish habitat, elk browse, piliated woodpecker range management and watershed inventories.
- Assembled historical information for G.I.S. input.
- Served on initial attack crew for wild fire suppression.

Skills:

- **Computer**: Microsoft Word, WordPerfect, Excel, Quattro Pro and Quicken.
- **Habitat Assessments**: All modules of TFW methodology, or Hankin & Reeves. TFW quality assurance qualified.
- **Stream typing**: DNR certified.
- **Surveying**: Stream profiles (longitudinal or cross section), culvert assessments, or road abandonment.
- **Aerial Photo Interpretation.**
- **Equipment**: Compass, clinometer, planimeter, McNeil sampler, electroshocker, increment borer, flow meter.

Training:

- Timber Fish Wildlife Ambient Monitoring Workshops 1994-97
- Stream Typing Emergency Ruling workshop, DNR 1997
- 319 Grant Request Workshop, 1997
- Culvert College, Washington Trout, 1995
- CPR, 1993, 1994
- Effective management, U.S.F.S. 1988
- Defensive Driving - U.S.F.S. 1984-89
- Baci to Basics - Compass & First Aid Training, 1989
- Fire Suppression & Saw Training, 1984, 1985.

Awards:

- Recognized for significant contribution to the success of the Mt. Baker Ranger District Fisheries & Watershed Program during the 1989 field season.
- Awarded Certificate of Merit and Cash Award for extra effort and positive attitude in data base input and maintenance of fisheries, habitat database on Fernan District and for outstanding effort and high quality road condition inventories and work on the watershed road inventory database.

Education:

June 1994 — **Bachelor of Science**
Western Washington Univeristy, Bellingham, WA
Major: Watershed Studies; Minor: Biology.

May 1979 — **Associate of Arts**
Lincoln Land Community College, Springfield, IL.

Relevant courses:
Water resources, soils, stream ecology, hydrology, water quality, fluvial geomorphology, ichthyology, watershed management, limnology, entomology, botany, biometrics and biology.

References:

Kurt Beardslee, Executive Director
Washington Trout, Duvall, WA (425) 788-1167

Steve Conroy, Ph.D. Science/Research Director
Washington Trout, Duvall, WA (425) 78-1167

Karen F. Welch, M.S., or Peter Willing, Ph.D., Hydrologist
Water Resource Consultants
1903 Broadway, Bellingham, WA (360) 734-1445

Robin Sanders, Hydrologist
Olympic National Forest, 1835 Black Lake Blvd. SW, Olympia, WA (360) 956-2433

Ed Lider, Fisheries Biologist
Fernan Ranger District, Coeur d'Alene, Idaho (208) 752-1221, 664-2318

Caroline Hidy, Fisheries Biologist
2695 Highway 200, Box 212
Trout Creek, MT 59874, (406) 599-2714.

David Crabb
17425 Turtle Lane
Bow, WA 98232
phone: (360) 724-4902

Education:	Master of Science in Geography with Planning Western Washington University, Bellingham, Washington 1985.
	Secondary Teacher Certification (Social Studies) Western Washington University, 1982
	Fifth Year History, San Diego State University, San Diego CA, 1973
	Bachelor of Arts in History, Grove City College, Grove City PA, 1971
Teaching Experience	Graduate Teaching Assistant in Physical and Human Geography, Western Washington University, Bellingham, WA 1984-1985
	Substitute Teacher grades 7-12 in Sedro-Wooley, Burlington-Edison, Mt. Vernon and Arlington school districts 1982-83
Work History	1994-present: Washington Trout, Cuvall, WA. Watershed analysis water typing, fish habitat restoration, riparian protection and revegetation.
	1976-present: Forest Contractor, providing tree planting and inventory survey skills for reforestation, forest management plans.
	1977-1978: Scott Paper Company, Hamilton, WA . Reforestation, pre-commercial thinning.
	1974: Whatcom Falls Park Fish Hatchery, Bellingham, WA. Hatchery maintenance, landscaping and rockeries.
Skills	All aspects of reforestation, crew leadeership and training, culvert analysis, stream typing, rockeries.

Training	Culvert assessment, water typing methodology, electrofishing, habitat surveying, spawning surveys, riparian revegetation, salmonid identification.
Personal Data	Born 1949, married, two children, health excellent, take pleasure in all family-oriented activities, especially backpacking and camping, gardening and basketball. Interested in reading and stewardship of the environment.

Bill McMillan

Perhaps best known as an author and master of fishing for steelhead trout using dry lines, Bill McMillan has devoted the greater part of a lifetime to fishing Northwestern rivers and sharing the enchantment of the experience through the written word and public speaking.

McMillan has authored numerous articles in *Salmon Trout Steelheader* magazine, *Wild Steelhead and Atlantic Salmon* magazine, and many others. His book *Dry Line Steelhead* has been described as "a graduate course in steelhead fly fishing." Most recently, McMillan spent two seasons on Russia's Kamchatka Peninsula as resident camp director for the joint Russian/American scientific expedition coordinated by the Wild Salmon Foundation.

For 40 years, McMillan's attention has been focused on the plight of wild salmonids, particularly regarding competition with hatchery-raised fish and the decline of their habitat's quality and availability. Concerns he raised decades ago regarding threats to wild salmonids have all been substantiated and vindicated. His extensive and precise field journals have filled a gap in statistics that the Washington State Department of Fish & Wildlife never kept, and he is widely quoted in academic fisheries papers.

An internationally esteemed author on conservation, fish, flyfishing and nature topics, he served on the Gifford Pinchot Forest's Spotted Owl Citizen's Advisory Board from 1989-1990 and on the Washington Department of Wildlife's Fishery Policy Task Force from 1990-1993.

McMillan, a founding board member and past President who has served on Washington Trout's board for all but two years, studied fisheries, English and philosophy at Clark College, University of Washington, Portland State and Central Washington. He co-founded the Clark-Skamania Flyfishers in 1975 and initiated spawning surveys in 1979 and snorkel surveys in 1983 on several rivers in Southwest Washington. An early and ardent conservationist, he has spent a lifetime advocating for the wild fish.

Frank Staller
16 Malone Hill Branch Road
Elma, Washington 98541
(360) 482-2960

Education & Training

St. Benedict's High School, Chicago, Illinois, 1974 diploma.

DeVry Institute of Technology, Chicago, Illinois, Electronics Technician degree, 1976.

Grays Harbor College, Aberdeen, Washington, Environmental Services Contracting Certificate 1996.

Northwest Indian Fisheries Commission, TFW Monitoring Training Workshop, 1997.

Department of Natural Resources & Quinault Nation: DNR Stream Typing Updated Rulings & Electroshocking Workshop, 1997.

Specialized Training

Power Squadron boating course; U.S. Forest Service forest fire training; defensive driving certificate; First Aid and CPR; Hazmat Awareness Level; Swiftwater First Responder; Swiftwater Boat Rescue; Wilderness Survival; Wilderness First Aid; Helicopter I evacuation, safety and man-tracking, and culvert analysis.

Streamtyping Experience

Washington Trout, P.O. Box 402, Duvall, WA 98019
Scientific Field Technician: Three years of stream surveying, using maps and compass to report on condition of streams related to fish presence, barriers and condition for re-typing classification. I submitted reports and upgraded maps after streamtyping. I also did culvert analysis on Type 3 waters. I worked on road closure and culvert replacement projects, operated pumps, assisted in surveying and stream monitoring.

Washington Department of Fish & Wildlife, Montesano:
Stream surveyor using maps and compass to collect information on streams related to fish presence and barriers for stream type verification.

Self-employed timber salvage contractor: Eight years subcontracting cedar salvage through Weyerhaeuser and other private landowners to salvage down and dead cedar logs for roofing material. I ran chainsaw, graded blocks and partook in helicopter logging operations. We cut down dead fir logs into cants with portable chainsaw mill and flew them out with helicopter assistance.

Timber Faller: For six months I felled and bucked timber for private landowners for partial and clear-cut operations.

Forestry technician for USDA Forest Service, Quinault, WA for four nine-month seasons: set up logging areas by traversing boundaries, surveyed for new roads, prepared profile surveys, assisted in cruise plots and marked trees, plus assisted in transient

survey of national forest boundaries, placing section corner markers and marking bearing trees.

Other work has included two seasons as a fire crewman, three years in horticulture/landscaping, experience planting and thinning trees, building and maintaining the Quinault trail system plus two years as electronic technician.

Volunteer Activities

Grays Harbor Search & Rescue, Chehalis Valley Restoration wood Duck Project, Washington Department of Fish & Wildlife elk relocation project plus oak habitat mapping.

Gregory Ericksen
2832 Pacific
Hoquiam, Washington 98550
360-533-2058

General Summary

20 years' experience in positions requiring coordinated mental and physical skills to ensure productivity and safety.

Work equally well in a teaming environment or with minimal supervision. My varied work experiences indicate willingness and ability to learn.

Streamtyping Experience

Washington Trout, Duvall, WA.: I have taught stream typing to crews and TFW partners and participated in restoration projects including road closures, culvert surveys and replacement, and collected scientific data for Washington Trout and for Thomas Travis Young, Olympia (consultant).

I have performed streamtyping for the Washington Department of Natural Resources, Olympic Peninsula Office, Aberdeen, WA, the Department of Fish & Wildlife at Montesano, WA and stream typing plus tree planting for Weyerhaeuser. I have more than three years' experience in streamtyping.

Other Experience

Heavy equipment operator
Rigging operator
Mechanic
Carpenter
Landscaping
Supervisory
Watershed Restoration

Education

Washington State University survey class, Adopt-A-Stream, Everett WA.

Grays Harbor College, Aberdeen, Washington: Watershed analysis/data collection.

Department of Natural Resources wetland verification class, Forks, WA.

Hoquiam High School, Hoquiam, Washington.

References

Available upon request.

ITT Rayonier Pulp Mill 1977-1982
Yard Crew Run Equipment Fork lifts all sizes, Front End-loader, Back Hoe, Bob Cats, Riggin Slinger for lifting + Replacing Equipment Motor's, Pumps, Steam lines ect. Basically Anything in mill. Leadman for Crews + Work Alone. Take care of all safety equipment in the entire mill + Order + Replace.

2 Earley tire Co. 1983-1988
Auto Mech. Certified in Diagnostic Scope, Brake's, Air Cond. Tune-ups + Brakeman + Service A/C systems was work Done Schooling to Be Certified for all Area's.

3 Weyco. 1989-90 Plant trees for them + contract Work for them in tree planting Area of Work and Some Cedar Block cutting for them contract cutting

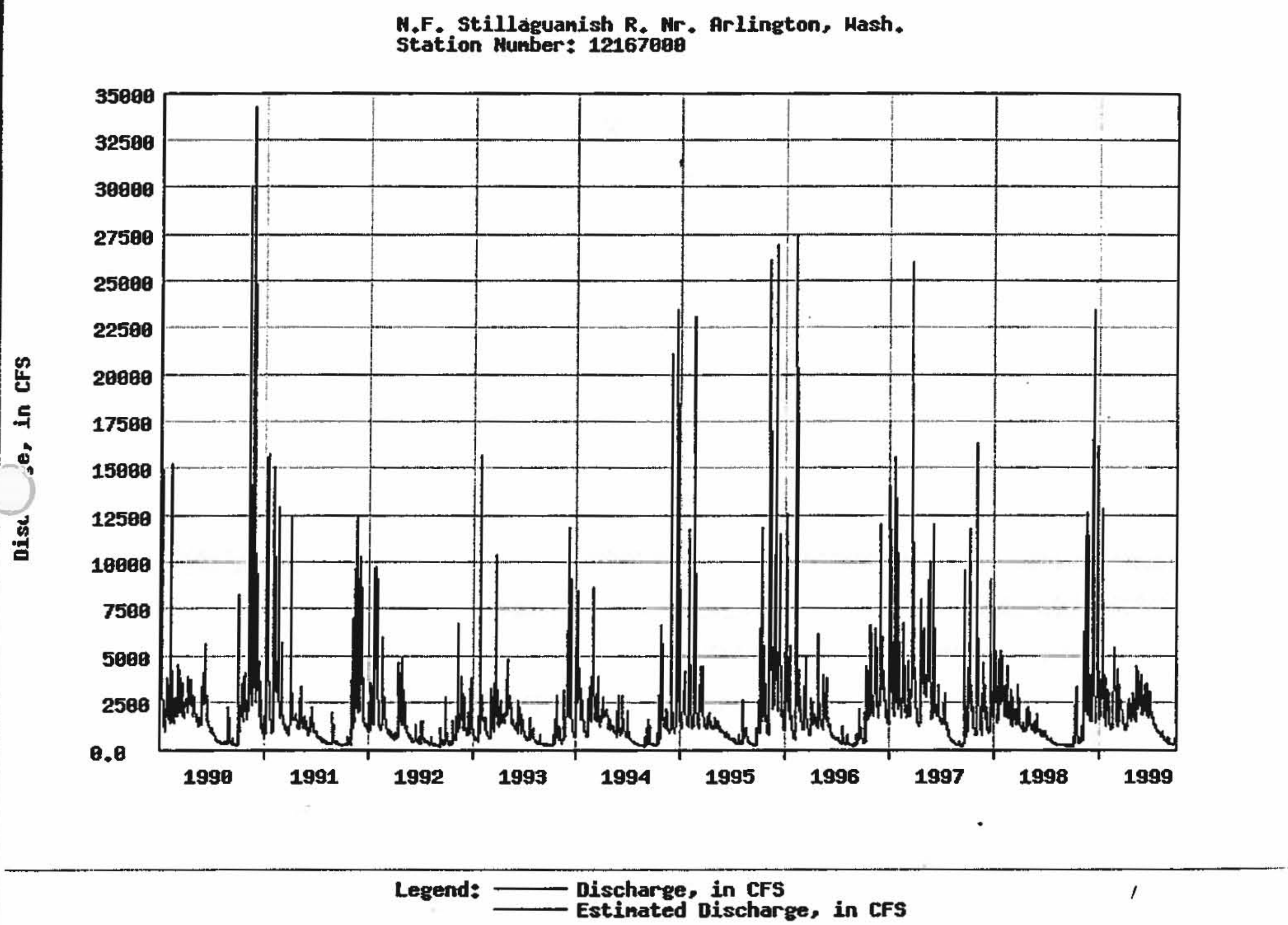
4 Work for Quality Homes const. Clark + Son + Locke Const. Building houses from ground up + foundation's also with Clark + Son was all commercial Building's
From 89-1994

5 Washington dept. fish + Wildlife 1995
Stream Retyping + Mapping of Streams + Restoration Work

Greg Ericksen

USGS
science for a changing world

Historical Streamflow Daily Values Graph for N.F. Stillaguamish R. Nr. Arlington, Wash. (12167000)

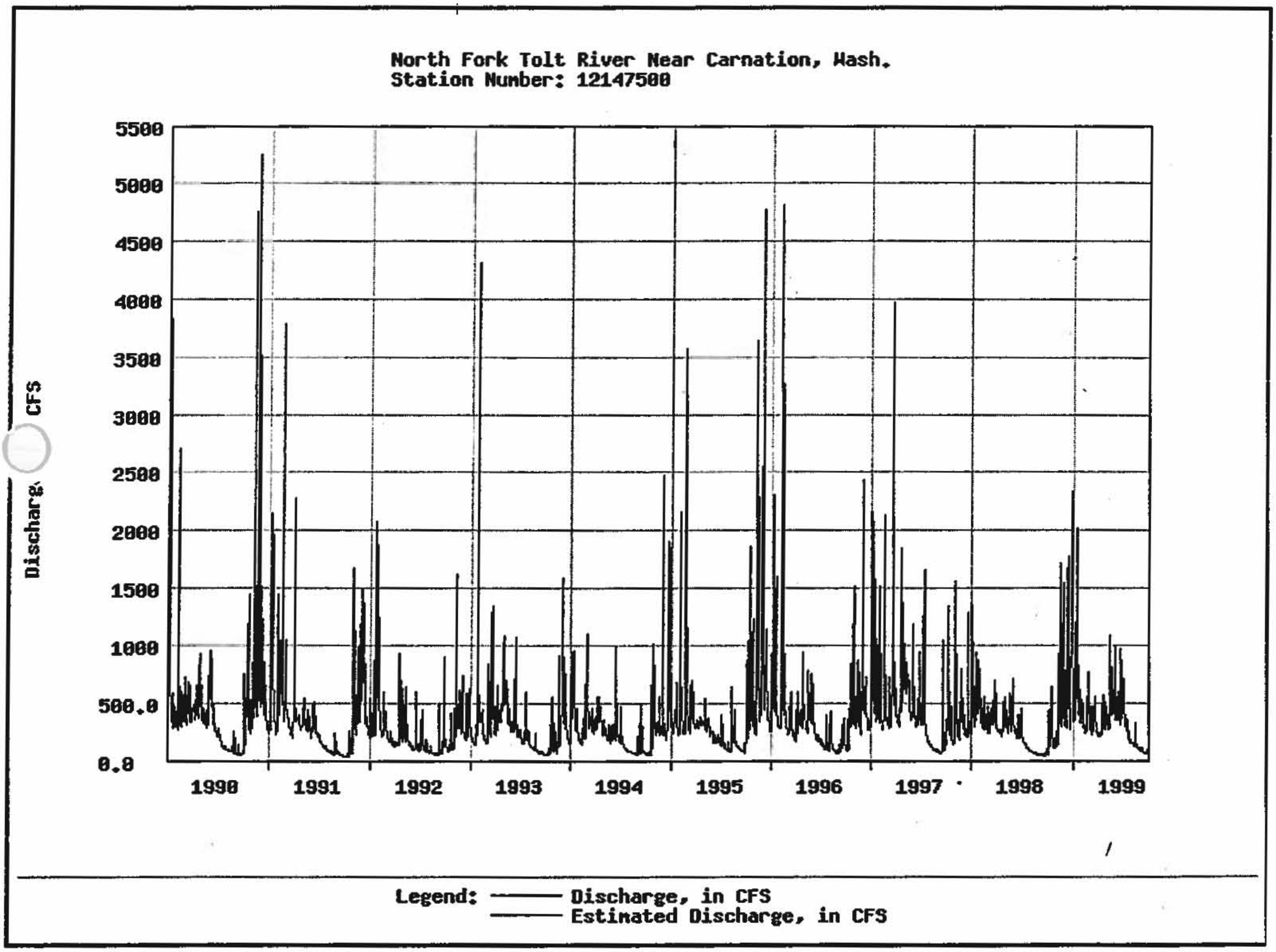


Some stations have red data points. These represent days for which data were estimated, rather than recorded.

Force this graph to be redrawn Why you might press this button

USGS science for a changing world

Historical Streamflow Daily Values Graph for North Fork Tolt River Near Carnation, Wash. (12147500)



Some stations have red data points. These represent days for which data were estimated, rather than recorded.

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Stillaguamish (Deer Creek / WRIA 050201)

Basin Discription – Washington trout crews surveyed all of the upper Deer Creek Watershed owned by the United States Forest Service and a large portion of the middle watershed owned primarily by Hancock Insurance company with intermittent parcels owned by Washington Department of Natural Resources. The lower portion of the Deer Cr. watershed owned by Washington department of Natural Resources, MRGC and private landowners was water typed by Washington Trout Crews and Tulalip Tribes. The water typing consolidation data submitted by Washington Trout does not include the water typing data collected by the Tulalip Tribes. A very small portion of the watershed < 5%, owned by Port Blakley was not water typed to my knowledge.

Deer Creek is a major salmonid spawning tributary of the NF Stillaguamish located north of Hwy 530, near the town of Oso, Wa. The mainstem is approximately 24 miles long with over 20 individual tributaries entering it. The middle and upper portions of the watershed, composed primarily of the Higgins and Little Deer drainages are undeveloped and could be considered unspoiled if not for the logging roads and clear-cuts evident throughout the Little Deer drainage, which has been heavily logged, contributing to the significant silt loading and flooding tendancies in the mainstem.

A collaborative watershed restoration effort has been ongoing in the North Fork since 1985 in response to a massive land slide in the Little Deer Watershed. This effort includes state, federal, and local agencies, Indian tribes, conservation groups, educational institutions, small and large private landowners and interested citizens.

A very narrow valley floor constricted by a canyon encompasses much of the lower five miles of the watershed; the remaining 21 miles of mainstem valley bottom are narrow with intermittent broad sections. In general, tributary gradients are steep, in the lower reaches due to the ravine or canyon, and in the upper reaches due to mountain terrain. The riparian areas, with the exception of the uppermost headwaters and areas influenced by logging, are dominated by moderate to heavy forest cover composed of Douglas-fir, western hemlock, silver fir, western red cedar and intermittent stands of old growth spruce.

Salmonid Utilization – Although the Washington Department of Fish and Wildlife was unaware of a cutthroat population in the Deer Creek Tributaries. Washington Trout crews identified cutthroat (Oncorhynchus clarki), along with rainbow (Oncorhynchus mykiss), coho (Oncorhynchus kisutch), and native char (Salvelinus malma, during their surveys of the Deer Creek tributaries.

DEER CREEK DRAINAGE

This stream section covers the entire Deer Creek drainage from its mountainous headwaters north of the Stillaguamish Valley downstream to its confluence with the North Fork Stillaguamish River at the town of Oso. It includes approximately 24 miles of mainstem stream plus 23 individual tributaries adding a total of nearly 56 additional stream miles.

Stream Description

From its headwaters Deer Creek courses generally west about 16 miles, then south 8 miles to its confluence with the North Fork. Its major tributaries are Higgins Creek and Little Deer Creek. These, along with the majority of smaller tributaries, exhibit steep gradient characteristics common to mountain streams.

Throughout the drainage the valley floor is quite narrow, with only a few intermittent broad sections. Adjacent hillsides rise quickly away from the streambed and, except where logging has occurred, are densely forested. Very narrow, ravine and sometimes canyon-like conditions predominate in the lower 5 miles. The upper watershed is almost entirely undeveloped. The major portion of all tributaries entering above mile 13, plus the remainder of upper Deer Creek drainage above mile 17, are located within Mt. Baker National Forest. Clear-cut logging is evident throughout much of the upper drainage, and is especially heavy in the Little Deer Creek watershed. Logging roads provide the principal access throughout most of the area. There are a few rural residences in the lower reaches, with Oso the only community development. The watershed receives relatively heavy recreation use, especially in the summer and early fall months.

Stream gradient is moderately steep throughout most of the drainage, with some very steep sections in the canyon between mile 1.5 and 5.0. A number of channel sections exhibit flood plain characteristics, particularly where a somewhat broader valley floor exists. In such areas, channel splitting and extensive broad gravel riffles and gently sloped gravel beaches predominate. For most of the stream length, however, bottom composition is mainly boulder-strewn, interspersed with rubble, and only a few riffle and patch gravel sections. In spite of apparent flooding effects, the major portion of the channel appears quite stable. Stream widths throughout most of the upper drainage range from 5 to 12 yards. In the lower 1.5 miles, below the ravine and canyon-like area, widths range from 12-20 yards. Natural, stable stream banks prevail throughout the drainage, most of them relatively low earth cuts or boulder-strewn beaches. Steep slopes with some vertical walls exist in the lower canyon section. Except where logging has approached the immediate stream bank, cover is moderate to dense, composed mainly of conifers and mixed deciduous trees and underbrush.

Salmon Utilization

Deer Creek is accessible to anadromous fish runs nearly to its headwaters. It serves spawning and rearing fall chinook, spring chinook, and coho with some pink and an occasional chum observed. Most tributaries provide relatively short access; however, a number received heavy spawning concentrations of coho. Since most of the tributaries are quite small and provide limited rearing area, most salmon juveniles spend the major portion of their fresh-water life in Deer Creek proper.

Limiting Factors

One of the principal factors limiting salmon production in the Deer Creek drainage is its flash flooding tendency, with consequential heavy silt loading of the stream. This condition is aggravated by extensive clear-cut logging practices in the upper watershed. Steep gradient conditions in the lower canyon, particularly between miles 1.5 and 3, may present at least a partial barrier to salmon migration, probably blocking most pink and chum salmon. The heavy silt deposition existing over riffle areas in the lower 2 miles would affect pink and chum the most. In the upper watershed, stream sections exhibiting considerable channel splitting have a definite lack of adequate shade and cover. Also, during low summer flow periods, water in these stretches tends to spread out, often forming potholes, trapping juvenile fish. Increasing stream gradient above R.M. 17 may present obstacles to migration. Also, considerable logging debris along the stream course could intermittently create barriers at some locations.

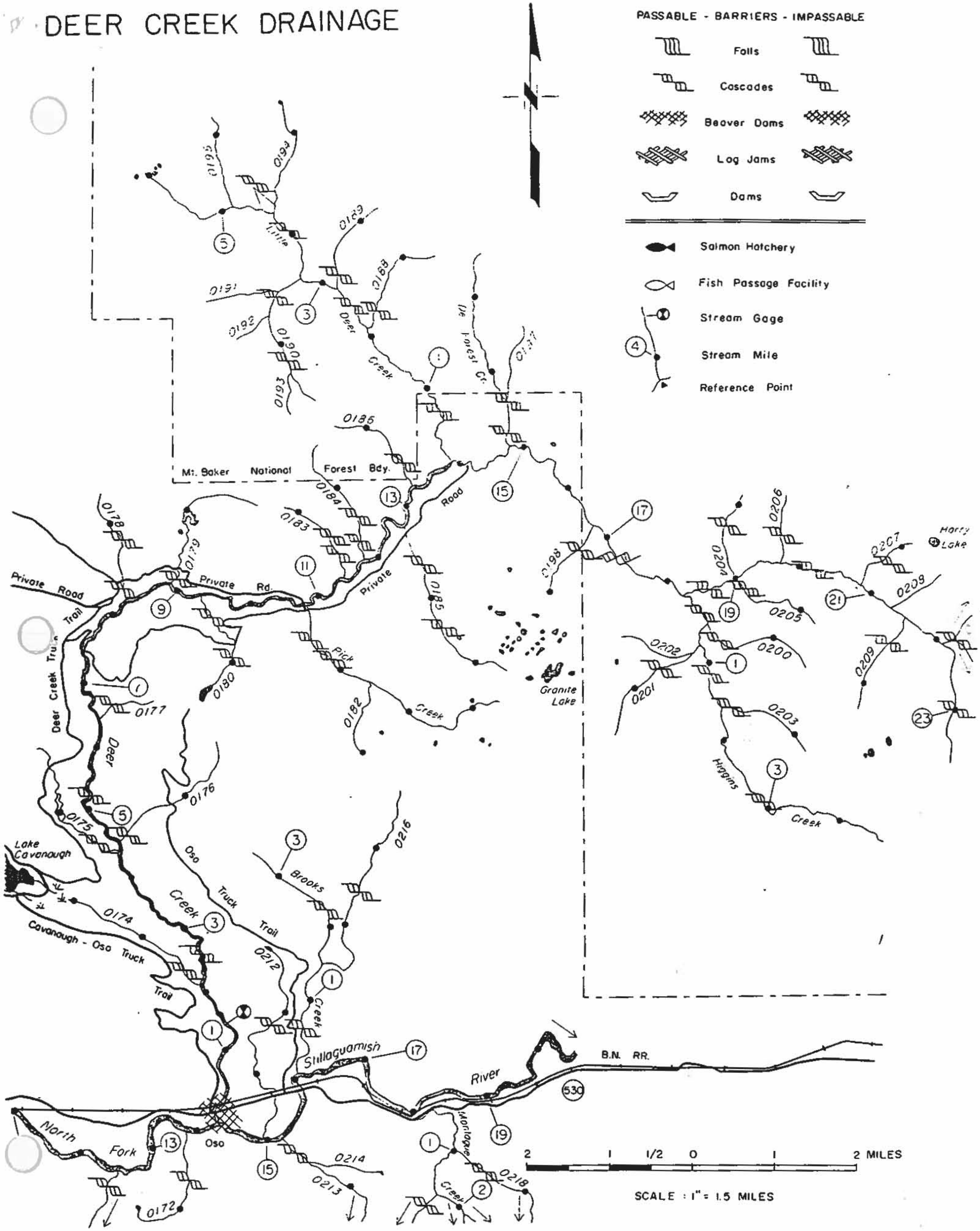
Beneficial Developments

No facilities or programs have been undertaken in this drainage area to specifically benefit salmon production.

Habitat Needs

A major requirement to maintain fish production in this section is to insure that forest logging activities are performed in accordance with the Forest Practices Act protecting the natural stream habitat. In addition, cleaning of streambed gravel over the lower 2 miles would be of considerable benefit.

DEER CREEK DRAINAGE



DEER CREEK DRAINAGE
Stillaguamish River Basin — WRIA 05

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0001	Stillaguamish River				
0135	N. F. Stillaguamish R.				Chin., Coho, Pink, Chum
0173	Deer Creek	RB-14.3	23.7	—	Chin., Pink, Coho
0174	Unnamed	RB-2.1	2.6	—	Unknown
0175	Unnamed	RB-4.3	1.8	—	Unknown
0176	Unnamed	LB-4.4	1.9	—	Coho
0178	Unnamed	RB-8.2	1.4	—	Unknown
0179	Unnamed	RB-8.8	1.9	—	Unknown
	Unnamed Pond	Outlet-0.8	—	—	
0180	Unnamed	LB-9.3	1.3	—	Coho
	Unnamed Lake	Outlet-1.3	—	—	
0181	Rick Creek	LB-10.7	3.3	—	Coho
0182	Unnamed	LB-1.4	1.0	—	None
0183	Unnamed	RB-11.4	1.1	—	Unknown
0184	Unnamed	RB-11.8	1.7	—	Unknown
0185	Unnamed	LB-12.8	2.4	—	Coho
0186	Unnamed	RB-13.3	1.3	—	Unknown
0187	Little Deer Cr.	RB-13.9	6.0	—	Coho
0188	Unnamed	LB-2.1	1.4	—	None
0189	Unnamed	LB-2.8	1.2	—	None
0190	Unnamed	RB-3.3	1.9	—	None
0194	Unnamed	LB-4.4	1.5	—	None
0195	Unnamed	LB-4.9	1.2	—	None
0196	DeForest Creek	RB-14.9	2.6	—	Unknown
0198	Unnamed	LB-16.8	1.0	—	Unknown
0199	Higgins Creek	LB-18.4	4.6	—	Coho
0200	Unnamed	RB-0.5	1.5	—	Unknown
0201	Unnamed	LB-0.8	1.6	—	Unknown
0203	Unnamed	RB-1.6	1.2	—	None
0204	Unnamed	RB-19.0	1.1	—	Coho
0205	Unnamed	LB-19.05	1.2	—	Unknown
0207	Unnamed	RB-20.9	1.2	—	Unknown
0209	Unnamed	LB-21.55	1.3	—	Unknown
0210	Unnamed	RB-22.1	1.4	—	Unknown
	Segelsen Lake	Outlet-1.4	—	—	

SNOQUALMIE RIVER
Lower Mainstem

This drainage section includes the lower 12 miles of Snoqualmie River from a few miles above Duvall downstream to the confluence with the Skykomish River (R.M. 20.5). Eleven tributaries enter in this section, adding more than 83 total stream miles. Principal access in this northwest King-southwest Snohomish counties section is provided by State Highway 203 running south from Monroe.

Stream Description

From stream mile 12.0 the Snoqualmie River meanders northeast approximately five miles to Cherry Creek, then northwest to the confluence with the kykomish River. Principal tributaries include Tuck, Cherry, and Peoples creeks.

The flat valley floor is two miles wide and is cleared with only occasional strips or small thickets of deciduous trees and underbrush. The low, rolling hills bordering the valley are moderately steep-sloped with deciduous and some mixed conifer cover. Land use is almost exclusively agricultural pasture land. Recreation use is heavy, consisting of both fishing and hunting. The only community development is Duvall; however, there are a few widely scattered rural residences within this section. Some logging occurs in the upper Cherry Creek watershed.

Through this section, the Snoqualmie River is contained within a broad channel ranging from 30 to 45 yards during fall months. The gradient is gentle with a few nearly flat stretches. The channel meanders back and forth across the valley, forming oxbows. Stream flow is sluggish in many stretches, with numerous long, deep pools and slow-moving glides predominating. Stream bottom is primarily sand and silt, with only a few short, scattered gravel-riffle sections, generally heavily silted. Most banks are moderately high, sharply sloped earth cuts, with a few gently sloped sand-gravel beaches. Some bank protection work has taken place at certain locations within this stretch of river in the form of artificial contour and rock riprap, cabled logs, and discarded car bodies or other large debris to divert flow from easily eroded banks.

Bank cover is sparse to moderately dense, consisting almost entirely of intermittent strips or small thickets of deciduous trees and underbrush. In many areas this growth actually overhangs the banks, and with numerous logs and accumulated debris extending out from the shore, provides favorable protective cover for fish life.

Tributaries in this section exhibit gentle to moderate gradients over their lower reaches as they course across the valley floor. Their upper slopes, however, are quite steep and generally offer limited access to salmon. Through their accessible reaches, most of these streams contain good pool-riffle conditions within relatively narrow stream channels. Stream bottoms are predominantly gravel and sand over the lower reaches, with gravel and some rubble materials above. Tributary cover is usually moderate to dense growth of mainly deciduous trees and underbrush.

Salmon Utilization

This lower Snoqualmie River section provides transportation for all salmon utilizing the upper drainage. Chinook, coho, pink, and chum salmon inhabit these waters. Only limited spawning habitat is available in the Snoqualmie; however, tributaries, including Cherry, Peoples, and Tuck creeks, support good to excellent spawning populations. These tributaries as well as this section of mainstem river provide important rearing habitat for juvenile salmon.

Limiting Factors

One factor limiting salmon production is low summer stream flow in some of the smaller tributaries. This restricts rearing potential and, when continuing into the fall months, can inhibit adult salmon access. One activity which could potentially limit production is clear-cut logging over some reaches of upper tributary drainages. Such logging can influence the productive capacity of streams emerging from such areas, as well as affect production in their drainagesbelow. Another potential limiting condition involves water quality throughout the lower mainstem Snoqualmie. The slow-moving water lacks cover and is more easily warmed, and offers the potential for concentrating pollutants that could severely affect the natural production capabilities. Occasionally, heavy poaching activity occurs on adult salmon in some of the smaller tributaries.

Beneficial Developments

No facilities or programs have been undertaken in this drainage section to specifically benefit salmon production. Occasionally, stream maintenance activities involving removal of minor jams are undertaken on small streams.

Habitat Needs

The major requirement to maintain salmon production potential in this section is to protect the natural conditions that presently exist, i.e. natural stream cover, pool-riffle character, quantity and quality of stream gravel, good water quality, etc. Restoration of natural stream cover where it has already been eliminated is highly desirable, particularly on the tributary drainages.

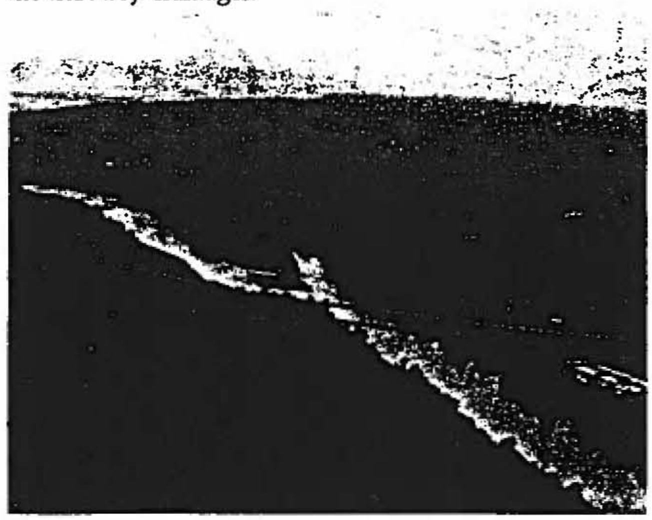
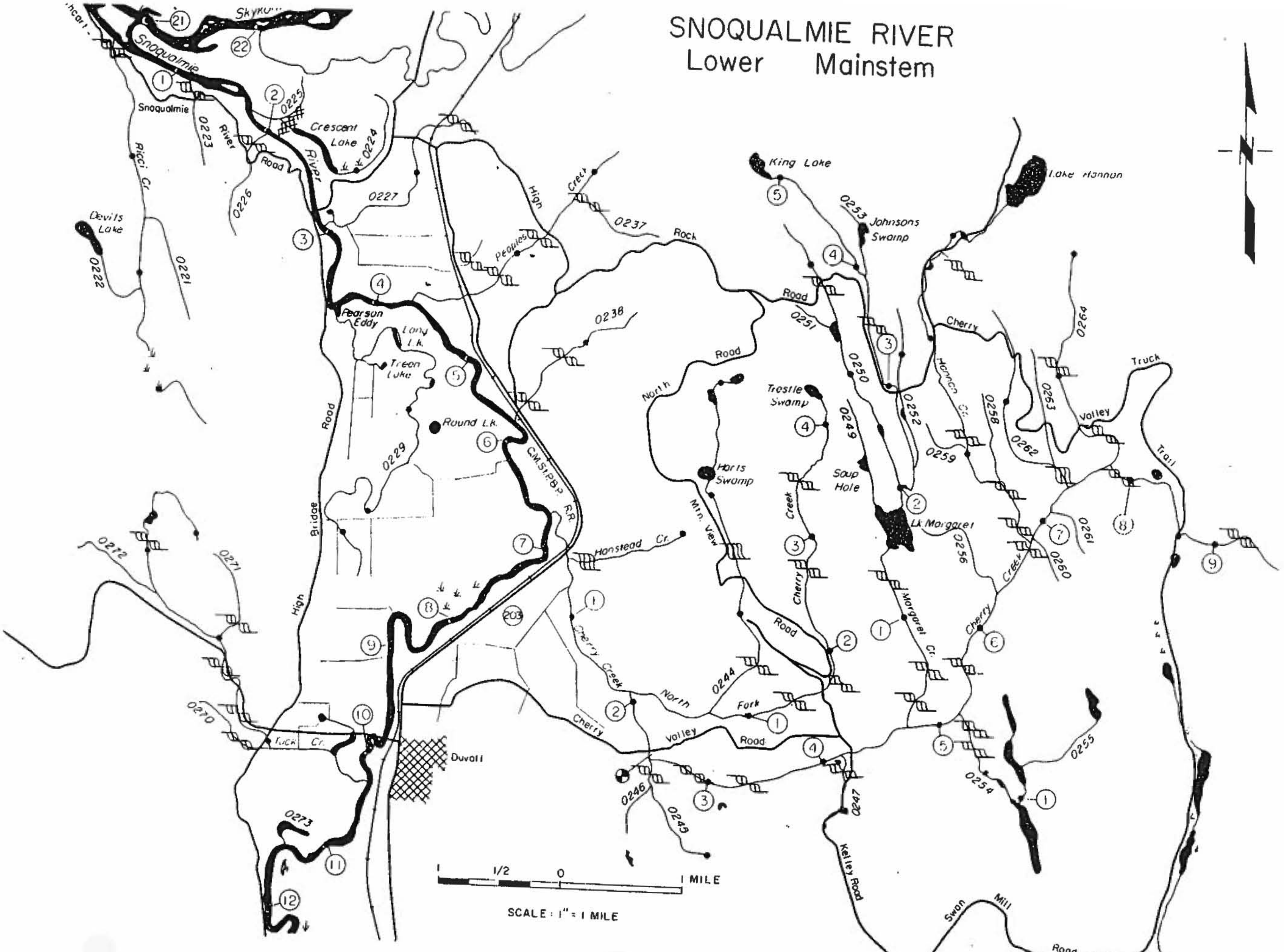


PHOTO 07-19. Confluence of the Skykomish and Snoqualmie Rivers.

SNOQUALMIE RIVER
Lower Mainstem

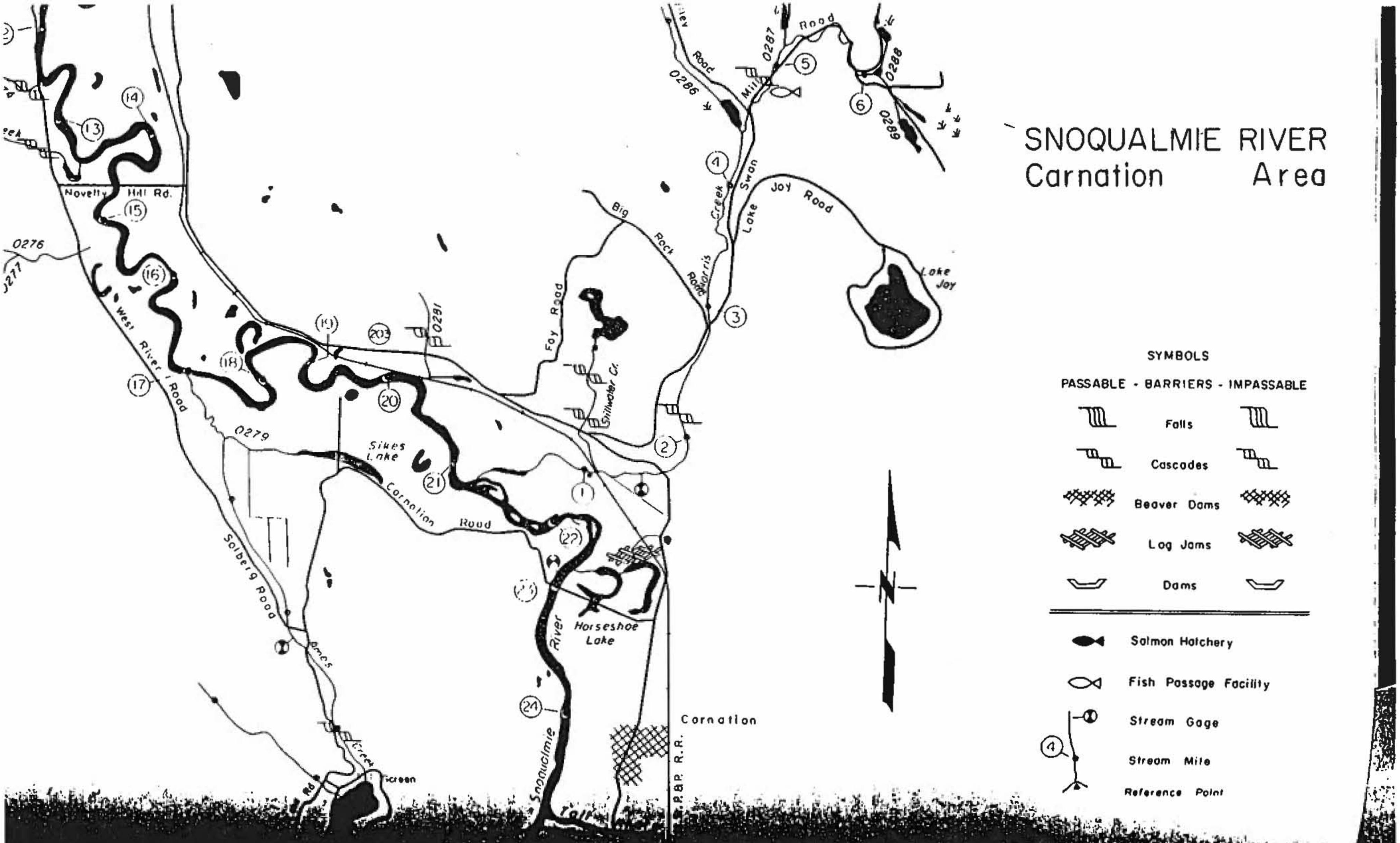


SNOQUALMIE RIVER — LOWER MAINSTEM
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho Pink, Chum
0219	Snoqualmie River	LB-20.5	84.55	693.0	Chin., Coho, Pink, Chum
0220	Ricci Creek	LB-0.4	3.5	—	(Coho)
0224	Unnamed	RB-1.7	1.7	—	Unknown
	Crescent Lake	Outlet-0.35	—	—	
0227	Unnamed	RB-2.9	1.9	—	(Coho)
	Drainage Ditch	LB-0.2	~ 2.1	—	Unknown
0229	Pearson Eddy Creek	LB-3.6	4.35	—	Unknown
	Long Lake	Outlet-1.0	—	—	
0233	Drainage Ditch	RB-3.85	~ 1.3	—	Unknown
0236	Peoples Creek	RB-4.3	2.3	—	Coho
0238	Unnamed (Duvall Cr)	RB-5.7	1.5	—	(Coho)
0240	Cherry Creek	RB-6.7	9.9	—	Chin., Coho, Pink, (Chum)
0241	Hanstead Creek	RB-0.5	1.0	—	Unknown
0242	Drainage Ditch	LB-0.75	~ 3.5	—	Unknown
0243	N. Fk. Cherry Cr.	RB-1.9	4.2	—	Coho, (Pink), (Chum)
0244	Unnamed	RB-0.7	3.1	—	(Coho)
	Harts Swamp	Outlet-2.15	—	—	
	Unnamed Lk.	Outlet-2.8	—	—	
	Unnamed Lk.	Outlet-3.1	—	—	
	Trestle Swamp	Outlet-4.2		—	
0245	Unnamed	LB-2.5	1.0	—	Unknown
0248	Margaret Creek	RB-4.7	5.1	—	(Coho)
	Margaret Lk.	Outlet-1.55	—	—	
0250	Unnamed	RB-2.0	2.4	—	None
	Roth's Sw.	Outlet-0.45	—	—	
	Unnamed Lk.	Outlet-1.35	—	—	
0252	Unnamed	LB-2.2	1.3	—	
	King Lake	Outlet-5.1	—	—	
0254	Unnamed	LB-5.2	1.6	—	Unknown
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-0.85	—	—	
	Unnamed Lk.	Outlet-1.15	—	—	
	Unnamed Lk.	Outlet-1.6	—	—	
0257	Hannan Cr.	RB-6.8	3.55	—	(Coho)

SNOQUALMIE RIVER — LOWER MAINSTEM
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
	Unnamed Lk.	Outlet-2.65	—	—	
	Lake Hannan	Outlet-3.55	—	—	
0262	Unnamed	RB-7.4	1.9	—	None
0264	Unnamed	RB-7.8	2.0	—	(Coho)
	Cherry Lake	Outlet-9.9	—	—	
0267	Tuck Creek	LB-10.3	4.05	—	Coho, (Chum)
0268	Drainage Ditch	LB-0.4	~ 1.1	—	Unknown
	Unnamed Lake	Outlet-3.25	—	—	
	(Cont. Snohomish 703)				



SNOQUALMIE RIVER
Carnation Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSABLE
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
Novelty Hill Rd.
West River Road
Solberg Road
Carnation Road
Foy Road
Big Rock Road
Lake Joy Road
Swan Lake Creek
Morris
Mill Road
Sikes Lake
Horseshoe Lake
Lake Joy
Stillwater Cr.
Snoqualmie River
Carnation
P.&P. R.R.
0276
0279
0281
0286
0287
0288
6820

SNOQUALMIE RIVER — CARNATION AREA
Snohomish River Basin — WRIA 07

Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
...omish River				Chin., Coho, Pink, Chum
...oqualmie River				Chin., Coho, Pink, Chum
Adair Creek	LB-13.35	1.65	—	Unknown
Unnamed	LB-15.1	1.05	—	Unknown
Ames Creek	LB-17.0	5.2	—	Coho, (Chum)
Unnamed	RB-0.55	0.7	—	Unknown
Drain. Ditch	LB-0.25	~ 1.6	—	Unknown
Sikes Lake	Outlet-0.7			
Ames Lake	Outlet-3.5	—	—	
Harris Creek	RB-21.3	6.45	—	Coho, (Chum)
Unnamed Lake	Outlet-0.2	—	—	
Stillwater Cr.	RB-1.11	1.1	—	Coho
Unnamed	RB-4.45	1.1	—	Coho
Unnamed Lake	Outlet-6.1	—	—	
Unnamed Lake	Outlet-6.45	—	—	
Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)

(See Snohomish 803)
... Snohomish 1003)

This section includes the lower 9.0 miles of Tolt River with nine tributaries, excluding the South Fork, providing an additional 13.2 stream miles. The Tolt River originates in the range of mountains including Mt. Index, Red Mountain, and Mt. Phelps east of the Snoqualmie River, then flows southwest to its confluence with the Snoqualmie (R.M. 24.9) near the town of Carnation. The entire watershed lies within King County and road access to the lower river is provided by the Tolt River Road along the north bank, upstream from about six miles, and by the Bunker Road on the south bank from the mouth to river mile 1.8. Stossel Creek is the principal tributary and is accessible from the Tolt Truck Trail. The upper watershed will be discussed with Map 901.

Stream Description

The lower Tolt River includes the 9.0 miles below the confluence of the North and South forks. Flows are controlled by the spillway releases from the Seattle Water Supply Reservoir on the South Fork. The peaks of the upper watershed mountain range extend to 5,000-foot elevation and drop rapidly from steep canyon boulder zones to the 450-foot elevation near the forks. The Tolt River Valley broadens below this point and becomes predominantly of floodway character. Stream width varies from 45 to 75 feet above river mile 5.0 and extends to 90 feet in the lower river. Channel splitting and overflow side channels occur below river mile 4.0. Above river mile 5.0 the streambed is comprised mostly of rubble and boulders with few patch gravel areas. Flows are mostly of fast riffle character with a few rapids. Below river mile 5.0 the bottom composition changes, with the streambed exhibiting rubble and gravel with a few boulder-strewn sections. Proceeding downstream from R.M. 5.0 there are increasing sections of gravel riffles and generally good pool-riffle balance.

Land use is confined to a few permanent small rural farms in the lower 2 miles, with heavy recreational use up to river mile 6.0 at the end of the Tolt River Road. Some logging occurs in the upper section near the forks. Stossel Creek is the principal tributary providing 4.45 miles of accessible stream. This tributary contains several reaches of beaver ponds. There are 8 short tributaries that also provide considerable drainage runoff to this system. These contain good shade cover and some sections suitable for salmon production.

Salmon Utilization

Chinook, coho, chum and pink inhabit the lower Tolt River with chinook and coho ascending this entire section and chum and pink utilizing the lower 4.0 miles, particularly the channel splits and overflow channels. Coho ascend all of the accessible portions of the tributaries, particularly Stossel Creek and Langlois Creek.

Limiting Factors

Steep gradients, cascades and falls restrict some fish use in the smaller unnamed tributaries. Gravel removal, particularly in the lower river, has altered the streambed conditions. Riprapping and other flood control measures below river mile 4.0 has tended to eliminate natural overflow channels and construct the main channel in some cases. Cleared logged-off slopes in the upper watershed contribute to the flash flooding and silting in the basin. Large boulders in the streambed limit the spawning areas. The Seattle-Tolt Water Reservoir controls the flows from the South Fork, reducing summer rearing capacity.

Beneficial Developments

A U.S.G.S. gaging station, located about 0.5 mile downstream of the confluence of the South Fork, has continuously recorded stream flow measurements from the Seattle Water Reservoir since 1952. Another U.S.G.S. gaging station, with records dating back to 1928, is located near the mouth of Stossel Creek. Negotiations for minimum flow releases for fish use were initiated in 1957 but have never been consummated into a formal agreement. Based on average flows of 200 cfs from September 15 to June 1, and 125 cfs from June 1 to September 15, as measured below Stossel Creek, releases from the Seattle Storage Dam would amount to 38 cfs in the winter period and 24.5 cfs in the summer period. In critical water years, which occur one out of ten, the reduction of 30% in these quantities would be made in the monthly release schedule.

Habitat Needs

A firm minimum flow agreement should be negotiated through the Department of Ecology with Seattle Water Department for Tolt River Reservoir releases for fish use. Gravel removal operations in the lower Tolt River should be prohibited as recruitment of gravel is minimal in this river.

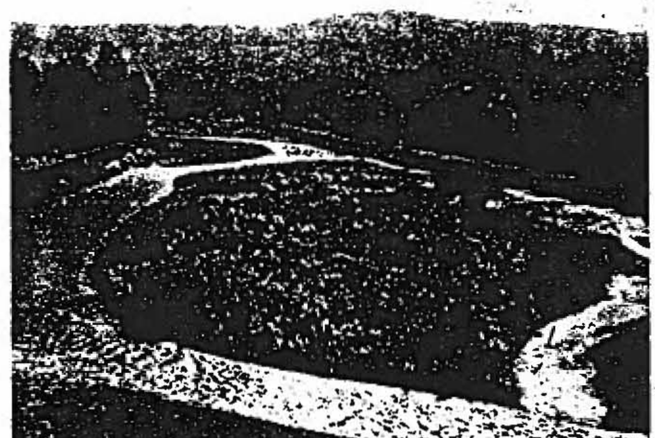
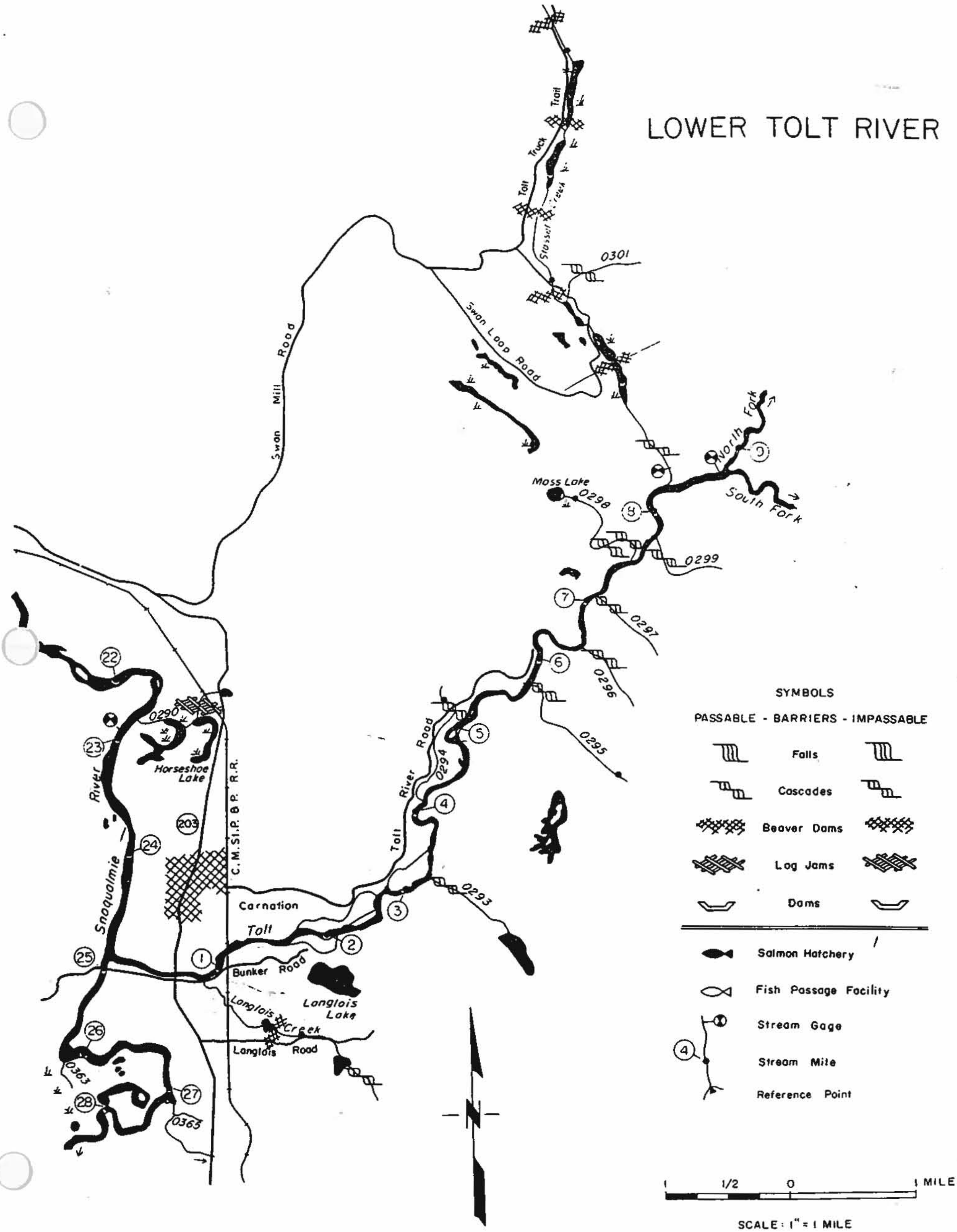


PHOTO 07-21. Set back levees on lower Tolt River allows the river to meander.

LOWER TOLT RIVER



LOWER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River	RB-24.9	26.2	—	Chin., Coho, Pink, (Chum)
0292	Langlois Creek	LB-0.85	1.85	—	Coho
	Unnamed Lk.	Outlet-0.7	—	—	
	Unnamed Lk.	Outlet-1.4	—	—	
0294	Unnamed	RB-4.1	1.1	—	(Chin), Coho
0295	Unnamed	LB-5.8	1.1	—	Unknown
0298	Unnamed	RB-7.5	1.15	—	(Coho)
0300	Stossel Cr.	RB-8.3	4.45	—	Coho
	Unnamed Lk.	Outlet-0.8	—	—	
	Unnamed Lk.	Outlet-1.2	—	—	
	Unnamed Lk.	Outlet-1.56	—	—	
	Unnamed Lk.	Outlet-2.9	—	—	
	Unnamed Lk.	Outlet-3.4	—	—	
	Unnamed Lk.	Outlet-4.45	—	—	
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
	(See Snohomish 903)				
	Tolt R. cont. as	@ mi. 8.81)	—	—	
	No. Fk. Tolt R.				
	(Cont. Snohomish 903)				

This section covers the upper Tolt River basin. Above the South Fork (R.M. 8.8) it continues as North Fork more than 17 miles. Some 22 tributaries and 50 stream miles. The South Fork is also about 17 miles long, with 15 tributaries adding 30 stream miles. The area is located six miles east of Carnation, in north-central King County. Access is via logging roads from the town of Snoqualmie. The North Fork and tributaries above R.M. 18 are within Snoqualmie National Forest. Also, much of the area is managed as watershed by the City of Seattle.

Stream Description

From the northwest slopes of Red Mountain the North Fork flows first northwest, then west about eight miles, then southwest nine miles to the South Fork confluence. The only large tributary other than the South Fork is North Fork Creek.

Over its upper 6-7 miles the North Fork cuts through a narrow, steep-sloped valley. The upper three or so miles hold dense conifer forest; the lower slopes mostly clear-cut. Downstream from Titicaca Creek (R.M. 20.6) the valley shallows and broadens for six miles, showing many clear-cuts and various stages of reforestation. The lower six miles cut through deep ravine-canyon terrain, where most side slopes are thickly forested. Similar mountain terrain exists over the South Fork; however, most slopes here hold dense forest cover. Little development has occurred in the upper drainage. Principal activity is logging, with some recreation.

The North Fork's upper six miles are mostly steep, the stream's narrow channel holding some falls, numerous cascades, a few short pool-riffle stretches. Widths range 2-6 yards, the bottom mainly boulder and rubble, little gravel.

The gradient over the next six miles is mostly moderate. Fall widths range 5-10 yards, with some channel splitting. There are a number of good pool-riffle stretches, with the bottom being mainly rubble and gravel, and a few boulder areas. Banks are mostly low earth or rock cuts, with a few gravel-rubble beaches. Cover consists of patches or strips of mainly deciduous growth and some mixed conifer.

Over the next 3-4 miles, the ravine-canyon area presents mostly steep gradient, with numerous falls, cascades, and rapids, and only a few deep pools and short riffles. One large falls, exceeding 25 feet, is located about R.M. 10.8. Stream widths above the falls range from 4 to 9 yards. The bottom is mostly large rock and boulders, with some bedrock and a few rubble-patch gravel stretches.

The lower two miles of the reach present moderately steep gradient. The channel remains confined, ranging 5-12 yards in width in the fall, exhibiting numerous cascades and rapids, and occasional pools and short riffles. The bottom is boulder and rubble, with some patch gravel. Banks are steep-sloped, maintaining moderate to dense deciduous/conifer cover where logging has not occurred.

The South Fork's upper three miles is steep gradient stream, with conditions much the same as in the upper North Fork. For the next three miles, the gradient is moderately steep, with the stream presenting mostly fast riffles, a few cascades, and some short pool-riffle stretches. Here, fall widths range 3-5 yards, with the bottom composed mostly of rubble and scattered boulders, and some patch gravel areas. Cover is mostly conifer timber, with some mixed deciduous growth. Seattle's South Fork Tolt Reservoir encompasses the next 3.5 miles (R.M. 8.5-12.0). A large falls is located just downstream from the dam. Over the remaining eight or so miles the South Fork presents moderately steep to steep gradient, with mostly fast riffles and some cascades, particularly in a short canyon (R.M. 2.5-3.5). Stream widths range from 5 to 14 yards. Some deep pools, with a few short riffles, exist along this lower stretch. The bottom is mainly rubble and boulders, with a few short gravel riffles and patch gravel strips. The South Fork banks are generally sharp earth or rock cuts holding dense cover, except for the lower river stretches where clear-cut logging has occurred.

Nearly all smaller tributaries exhibit steep mountain stream character, with numerous cascades and rapids, and mostly boulder and rubble bottoms.

Salmon Utilization

This section receives limited salmon use, some chinook and coho ascending the North Fork about a mile, the South Fork as far as eight miles. Chinook juveniles rear for a short time in these waters, coho having year-round habitation.

Limiting Factors

Natural salmon production limitations include the North Fork and South Fork falls, plus the steep gradient restricting spawning habitat within accessible stream reaches. Additional factors include low flows during critical dry seasons, and occasional heavy siltation from a South Fork slide.

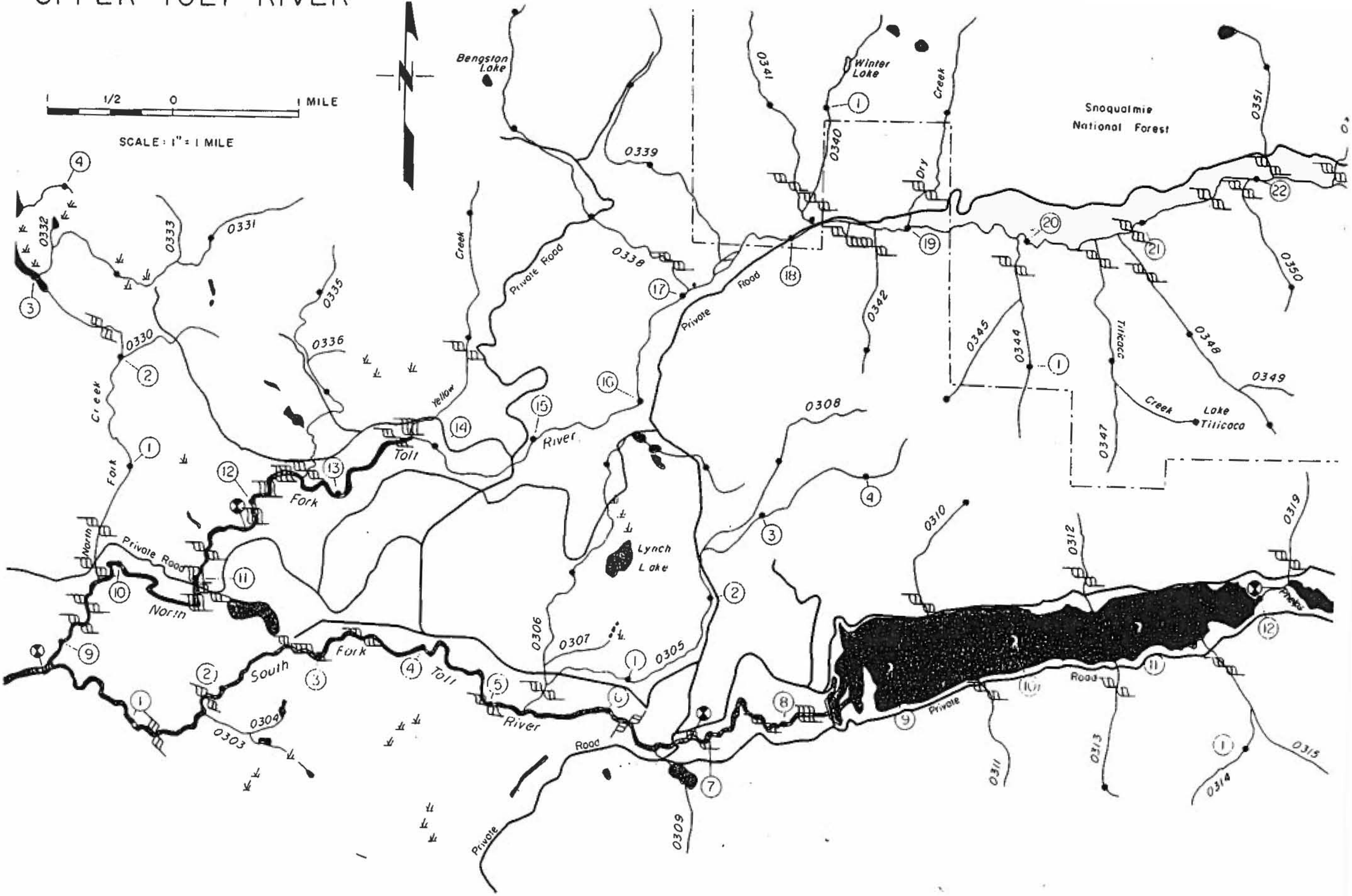
Beneficial Developments

The only programs to benefit salmon production is a minimum flow agreement with the City of Seattle to insure against severe flow reductions.

Habitat Needs

Requirements to maintain production habitat include preserving stream side cover, and maintaining stream conditions in a near natural state. Containment of the South Fork slide would benefit the more productive areas downstream.

UPPER TOLT RIVER



UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River				Chin., Coho, Pink, Chum
0219	Snoqualmie River				Chin., Coho, Pink, Chum
0291	Tolt River				Chin., Coho, Pink, (Chum)
0302	S. Fork Tolt R.	LB-8.8	16.8	—	Chin., Coho
0305	Unnamed	RB-5.3	4.5	—	Unknown
0306	Unnamed	RB-0.3	3.4	—	None
	Unnamed Lake	Outlet-2.3	—	—	
	Unnamed Lake	Outlet-2.5	—	—	
0308	Unnamed	RB-2.45	1.9	—	None
	Tolt-Seattle Water Sup. Res.	Outlet-8.4	—	—	
0310	Unnamed	RB-9.4	1.0	—	None
0313	Unnamed	LB-10.8	1.1	—	None
1314	Unnamed	LB-11.5	1.6	—	None
0315	Unnamed	RB-0.7	1.0	—	None
0316	Phelps Cr.	LB-12.3	2.2	—	None
0320	Unnamed	RB-12.9	1.0	—	None
0323	Unnamed	RB-14.5	1.0	—	None
	Tolt R. cont. as N. F. Tolt R.	@ mi. 8.81	—	49.3	
0329	N. Fork Creek	RB-9.7	4.1	7.53	Unknown
	Unnamed Lake	Outlet-2.85	—	—	
0331	Unnamed	LB-3.0	2.8	—	None
	Unnamed Lake	Outlet-3.55	—	—	
0335	Unnamed	RB-12.6	2.5	—	None
0337	Yellow Creek	RB-13.8	2.2	—	None
0338	Unnamed	RB-17.05	3.7	—	None
0339	Unnamed	RB-17.4	2.9	—	None
0340	Unnamed	RB-18.25	3.0	—	None
0341	Unnamed	RB-0.15	2.7	—	None
	Winter Lake	Outlet-1.35	—	—	
0342	Unnamed	LB-18.7	1.2	—	None
0343	Dry Creek	RB-19.0	2.4	—	None
0344	Unnamed	LB-19.9	1.6	—	None
0345	Unnamed	LB-0.5	1.0	—	None

UPPER TOLT RIVER
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0346	Titacaca Creek	LB-20.6	1.9	—	None
	Lk. Titicaca	Outlet-1.9	—	—	
0348	Unnamed	LB-20.8	2.1	—	None
0350	Unnamed	LB-21.9	1.2	—	None
0351	Unnamed	RB-22.1	1.4	—	None
0352	Unnamed	RB-22.6	1.1	—	None
0353	Unnamed	RB-23.1	1.2	—	None
0354	Unnamed	RB-23.39	1.4	—	None
0355	Titicaed Cr.	LB-23.4	1.65	—	None
	Titicaed Lk.	Outlet-1.65	—	—	
0358	Unnamed	RB-23.55	1.1	—	None

SNOQUALMIE RIVER
Tolt Area

Thirteen miles of main Snoqualmie River are covered in this section from Tolt River upstream to Tokul Creek, plus fourteen tributaries exclusive of the Raging River, providing an additional 51.0 stream miles. The principal town in this valley section is Fall City located near the confluence of the Raging River with the Snoqualmie River at mile 36.0. Access along this stretch of river is by the Fall City to Monroe State Highway 203 on the east valley, and by the west valley road which connects to the Redmond-Fall City State Highway 522 two miles northwest of Fall City. This portion of the Snoqualmie River lies within King County. The Raging River will be presented in Map 1101.

Stream Description

This section of the Snoqualmie River from river mile 25.0 at the mouth of the Tolt River upstream to river mile 39.3 near Tokul Creek, about a mile below Snoqualmie Falls, provides the floodway for the extensive mountainous headwaters of this watershed above the falls. The Snoqualmie River winds in shallow bends downstream to river mile 33.5, below which it forms extensive oxbows and zigzags across the valley floor in serpentine fashion downstream to the town of Carnation. The valley averages about 1.5 miles in width with hillsides rising to the 400-foot elevation, forming valley walls on either side. Many large side sloughs formed by overflow waters are located in this stretch, with the largest group located on the east valley side between river mile 36.0 and 33.0 below Fall City. The mainstem Snoqualmie varies in width from 150 to 400 feet, averaging about 250 feet over much of the distance. Gradient is extremely shallow, descending from 100-foot elevation to 55-foot elevation within this 13.8 mile distance, with only a five-foot drop in the lower 6 miles. Below river mile 33.0 the river becomes a slow, deep slough, confined within diked banks with heavy mud and silt bottoms. Few patch gravel shoreline bars are present even on inside curves. Long gravel riffles with goo gravel composition occur between river mile 34.0 and 35.0. Above this point, the river again becomes deep and slow moving. Good tree cover with brush-covered banks occurs throughout this section. Land use is essentially agricultural and pastural. Due to annual flooding in the valley, there are only scattered rural homes.

Griffin Creek is a major tributary providing some 13 stream miles of drainage. The creek ranges from 10 to 25 feet in width with fair gravel composition. The average flow from 20 years of record is 42.3 cfs. Many beaver dams and swamps occur above stream mile 5.0 and much of the upper watershed has been logged off. Many summer homes are located on the lower stream.

Patterson Creek is 9.25 miles in length with an additional 9.7 miles of tributaries. It is a typical lowland-type stream with fair to good gravel, good pool-riffle balance and excellent shade and cover. Average discharge for 19 years of record is 32.2 cfs.

Salmon Utilization

Chinook, coho, chum and pink salmon utilize the mainstem Snoqualmie within this section for transportation, spawning and rearing. Chinook spawning is intense between river mile 34.0 and 35.0 with some chum and pink utilizing this same area as well as the mouth of the Raging River. Below R.M. 33.5 there is minimal spawning area with only a few shoreline gravel sections. Coho utilize mainly the tributaries; especially Griffin Creek, Patterson Creek, Skunk Creek, and the lower accessible portions of the other small unnamed tributaries. In Griffin Creek the main coho spawning occurs between R.M. 3.0 and 5.1 at the outlet of the lower swamp lake.

Limiting Factors

Heavy snowmelts and runoffs from above Snoqualmie Falls create heavy flooding in the valley. The I-90 road construction on Snoqualmie Pass Highway causes heavy silt loads in the lower river. Heavy deposits of silt and mud are found throughout the deep, slow oxbows of the lower river. Logging in the headwaters of Griffin Creek creates heavy runoff and gravel bed shifting in this stream. Steep gradients and cascades of the small independent tributaries reduce the streams to minimum salmon usage.

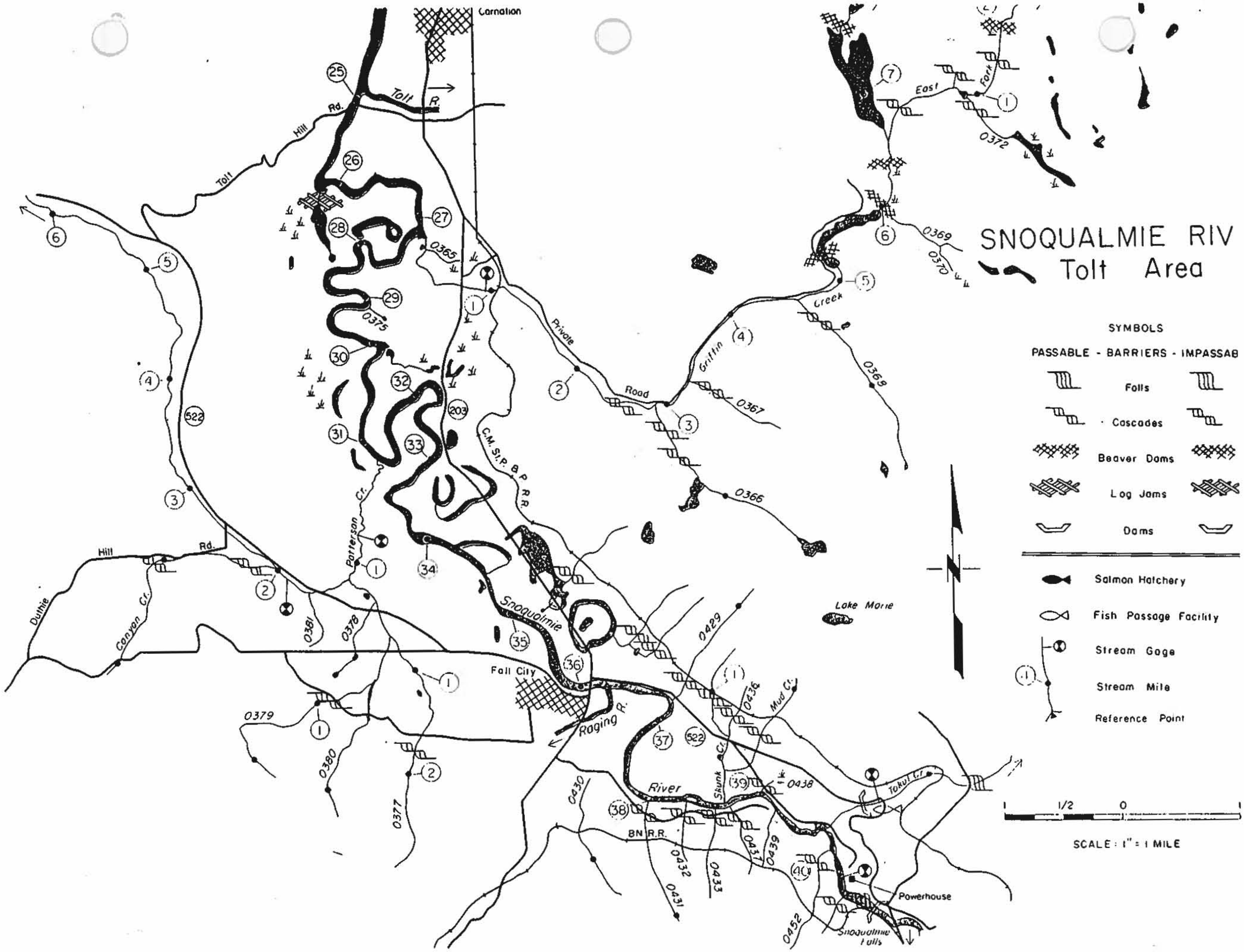
Beneficial Developments

No facilities or programs have been undertaken in this section to specifically benefit salmon production.

Habitat Needs

Major requirements for maintaining the fish production habitat in this section include: developing zoning laws preventing construction of permanent buildings within the flood plain; coordinating flood control activities with King County Flood Control; and the development of a good watershed management plan to preserve the environment.

PHOTO 07-22. Good chinook riffles on Snoqualmie River.



SNOQUALMIE RIV
Tolt Area
SYMBOLS
PASSABLE - BARRIERS - IMPASSAB
Falls
Cascades
Beaver Dams
Log Jams
Dams
Salmon Hatchery
Fish Passage Facility
Stream Gage
Stream Mile
Reference Point
SCALE: 1" = 1 MILE
Carnation
Tolt R.
Tolt Hill Rd.
Private Road
Griffin Creek
East Fork
C.M. St.P. & P. R.R.
Lake Marie
Snoqualmie River
Patterson Cr.
Fall City
Raging R.
Mud Cr.
Skunk Cr.
Tokul Cr.
Powerhouse
Snoqualmie Falls
BN R.R.
Hill Rd.
Duthie
Canyon Cr.
522
203

SNOQUALMIE RIVER — TOLT AREA
Snohomish River Basin — WRIA 07

Stream Number	Stream Name	Location Of Mouth	Length	Drainage Area	Salmon Use
0012	Snohomish River			—	Chin., Coho, Pink, Chum
0219	Snoqualmie River	LB-20.5		—	Chin., Coho, Pink, Chum
0364	Griffin Creek	RB-27.2	11.4	—	Chin., Coho, Pink, (Chum)
0366	Unnamed	LB-2.9	1.75	—	(Coho)
	Unnamed Lk.	Outlet-0.75	—	—	
	Unnamed Lk.	Outlet-1.75		—	—
0368	Unnamed	LB-4.6	1.7	—	(Coho)
	Unnamed Lk.	Outlet-5.1	—	—	
0371	East Fork	LB-6.6	3.3	—	Coho
	Unnamed Lk.	Outlet-0.9	—	—	
	Unnamed Lk.	Outlet-2.6	—	—	
	Hull Lake	Outlet-3.05	—	—	
	Unnamed Lk.	Outlet-3.3	—	—	
	Unnamed Lk.	Outlet-6.75	—	—	
	Unnamed Lk.	Outlet-7.8	—	—	
	Unnamed Lk.	Outlet-8.9	—	—	
	Unnamed Lk.	Outlet-11.0	—	—	
0376	Patterson Creek	LB-31.2	9.25	—	Coho
0377	Unnamed	RB-1.2	2.9	—	Coho
0379	Unnamed	LB-0.6	2.2	—	Unknown
0380	Unnamed	RB-0.55	1.2	—	Unknown
0382	Canyon Creek	RB-2.0	2.1	—	(Coho)
0383	Unnamed	RB-6.5	1.3	—	Unknown
	Unnamed Lake	Outlet-9.25	—	—	
0384	Raging River	LB-36.2	15.2	—	Chin., Coho, Pink, (Chum)
	(See Snohomish 1103)				
0429	Unnamed	RB-36.8	1.2	—	Unknown
0430	Unnamed	LB-37.65	1.4	—	Unknown
0431	Unnamed	LB-37.95	1.0	—	Unknown
0434	Skunk Creek	RB-38.64	1.4	—	Coho
0435	Mud Creek	LB-0.3	1.1	—	(Coho)
	(Cont. Snohomish 1303)				