Overview of the Instream Flow/Fish Habitat Element of the WRIA 1 Watershed Management Project

By

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January 31, 2006

Presentation Outline

- General Overview
  - Instream Flow and Fish Habitat (ISF/FH) Technical Teams
  - Goals of ISF/FH Element of Project
  - Why are we doing ISF/FH Element
  - How Work Was Conducted
- Details of Applied Methods and Work Products
  - Modeling Process and Results
  - Species and Life Stage Prioritization
  - Decision Support Information
  - Stratification/Extrapolation
- Schedule/Next Steps
- Summary

General Overview

ISF/FH Technical Teams

- ISF Tech. Team Lead: Jeremy Freimund (LIBC)
- Fish Habitat Technical Team Co-Leads:
  - Chris Fairbanks (PUD No. 1)
  - John Thompson (Whatcom County)
- Important other contributors/participants include:
  - Lummi Nation, Nooksack Tribe, WDFW, Ecology, Whatcom County, Utah State University, PUD No. 1, Bellingham, Diking and Drainage Caucus, Anvil Corporation

Goals of ISF/FH Element of Project

- Accurately estimate the relationship between stream flow and fish habitat quantity and quality for different fish species and life stages in WRIA 1.
- Integrate results with results from water quantity and water quality elements of project and support salmon recovery efforts.

Why are we doing ISF/FH Element

- To enable knowledge-based decision making based on the best available science
- Instream flow needs inextricably linked to water quantity and water quality
- To take action in response to ESA listing
- To address tribal water right claims
- To help determine the amount of water available for in- and out-of-stream uses

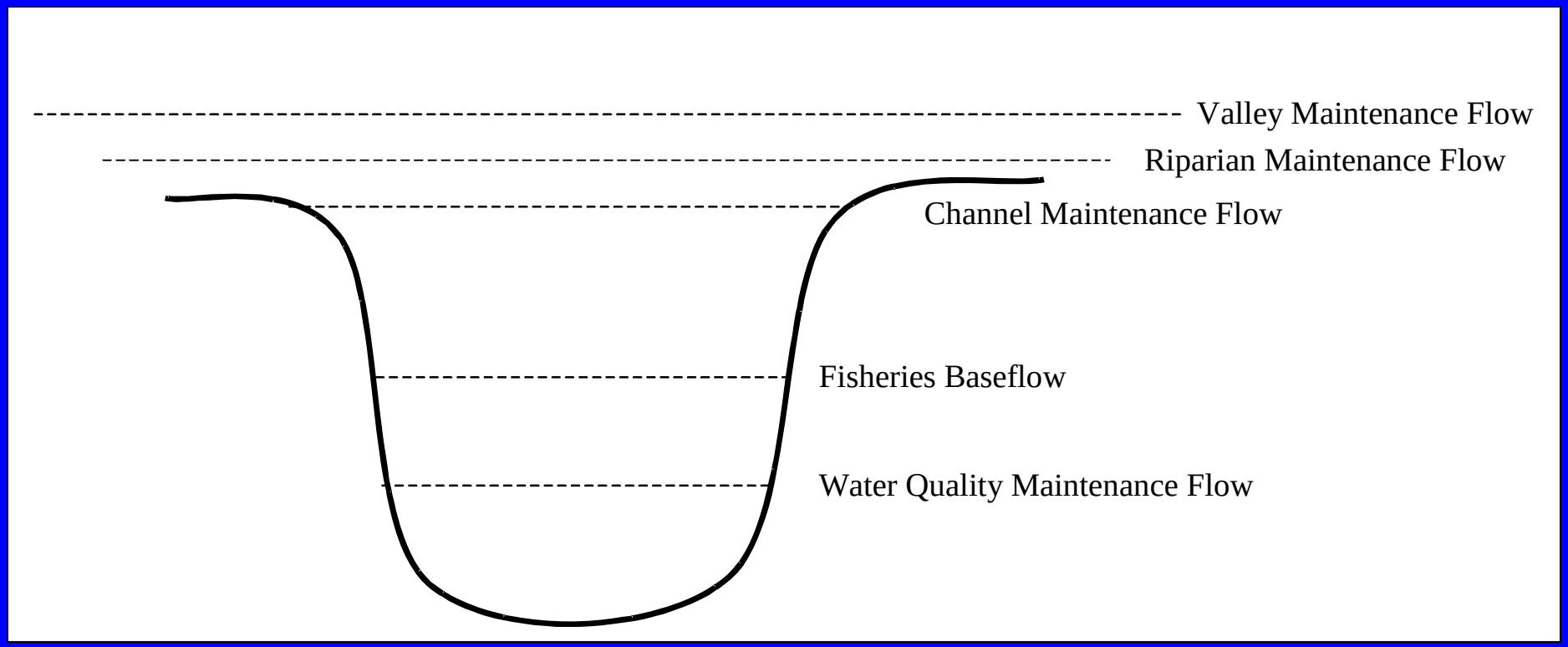
How Work Was Conducted

- Three Step Technical Process:
  1. Identification of the methods to be used (best available science) to estimate the relationship between stream flow and fish habitat quantity and quality
  2. Application of selected methods
  3. Recommend initial ecological flow regime
- Selection and Adoption Phase
  - Instream Flow Selection and Adoption Action Plan

Step 1. Identify Methods

- WRIA 1 Watershed Management Project Instream Flow Methods Conference September 15-17, 1999
- Local, Regional, National, and International experts participated in the conference
- Peer-reviewed report issued on conference results March 2000
- Concept of Ecological Flow Regime

Step 1. Ecological Flow Regime



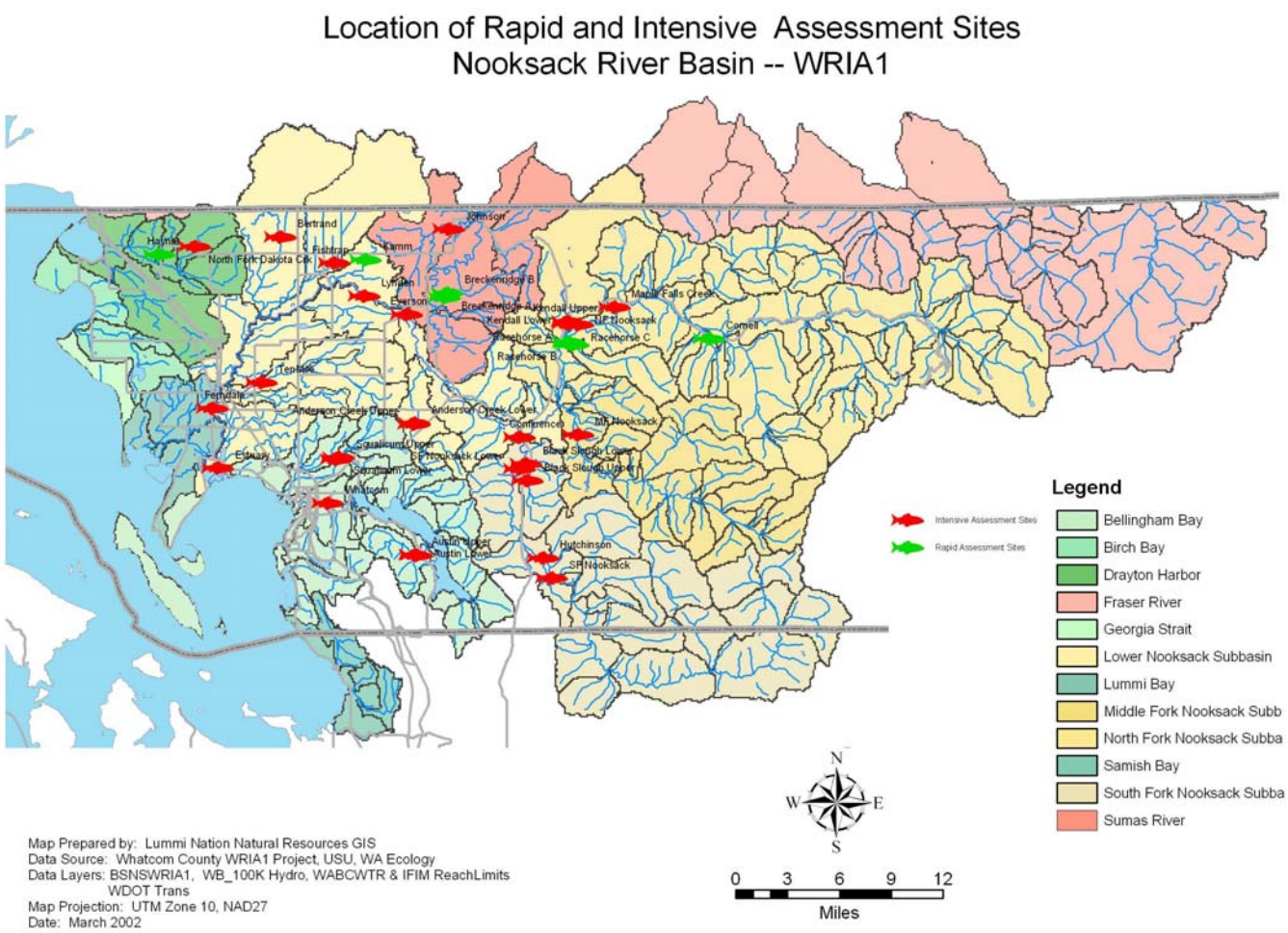
Step 2. Application of Selected Methods

- Utah State University (USU) selected to implement agreed to methods – (Thom Hardy and Craig Addley)
- Field data collected at 13 “intensive” study sites in 2000
- Field data collected at 9 “intensive” and 5 “rapid assessment” sites during 2001
- Field data initially collected at a total of 27 sites
- Habitat Suitability Criteria (HSC) Workshop held Oct. 10-12, 2000
- Modeling/analysis of field data initiated during summer of 2001

Step 2. Study Site Locations

- Study sites were identified by consensus of ISF/FH Technical Team members
- Sites selected based on factors including:
  - Representativeness of site
  - Availability of fish utilization data (e.g., spawner surveys, smolt traps)
  - Ecology “overlap” sites (n = 16)
  - Management issues overlay

Step 2. Study Site Locations



Step 2. Extrapolation

- Extrapolation workshop from April 2-3, 2002
  - Identify approach to extrapolate relationships between stream flow and fish habitat quantity and quality to downstream end of each drainage in WRIA 1.
  - Approach based on stratification of the 172 drainages in WRIA 1 into self-similar clusters.
  - Field data collected at 14 sites during 2003 and 2004 to validate extrapolation methods.
  - Field data collected at a total of 41 sites (27 initial sites and 14 validation sites)

Step 3. Instream Flow Selection

- Instream Flow Selection Methodology Symposium May 29-30, 2002 (technical, legal, policy experts)
- In July 2002, the Joint Board established an Inter-governmental Instream Flow Working Group to develop a draft Instream Flow Selection and Adoption Action Plan.
- June 2005, Instream Flow Selection and Adoption Action Plan adopted as part of the WRIA 1 Watershed Management Plan – Version 1.
- Selection and Adoption Action Plan has two "pilot" watersheds: Middle Fork Nooksack and Bertrand Creek

Details of Applied Methods and Work Products

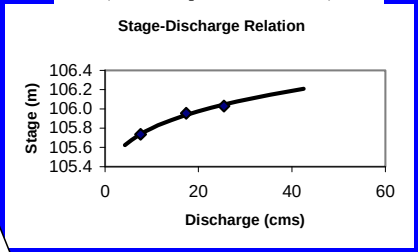
Overview of Instream Flow Technical Element

Data Collection

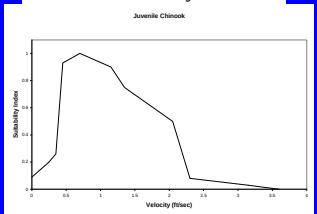
Method Selection
Site Selection
Field Data Collection
Literature Review

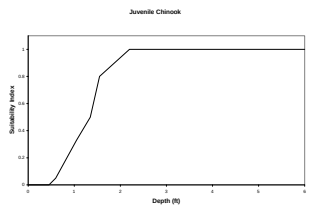
Data Analysis

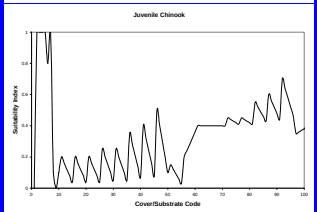
Hydraulic Data and
Channel Structure Representation
(i.e., Computational Mesh)



Habitat Suitability Criteria







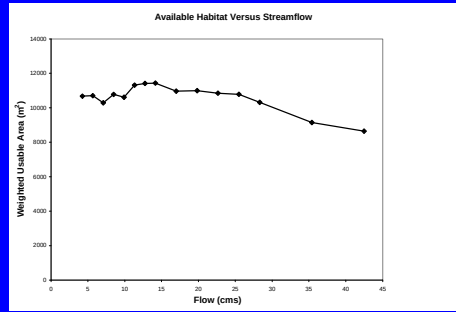
Computer Modeling

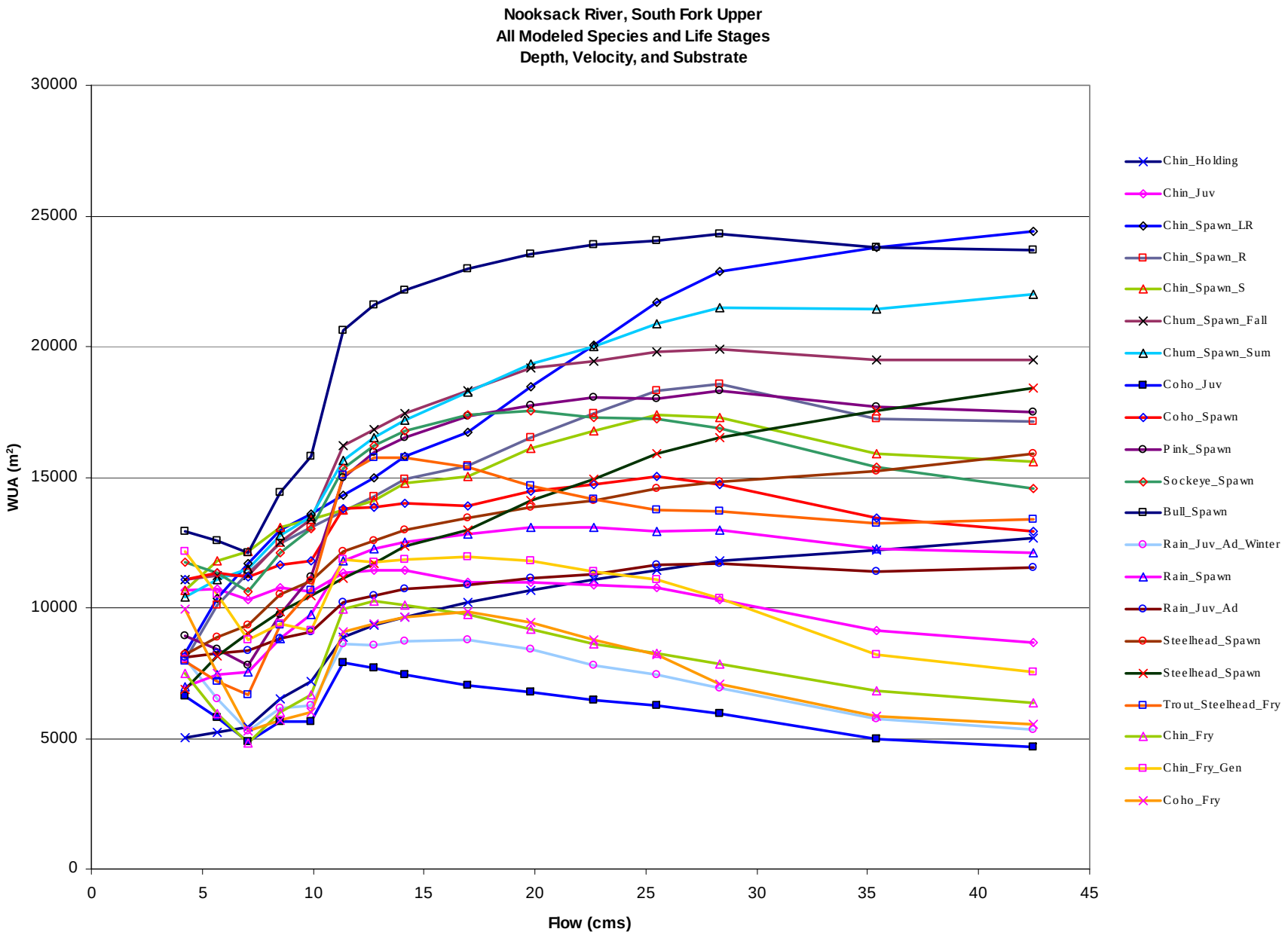
Model Calibration

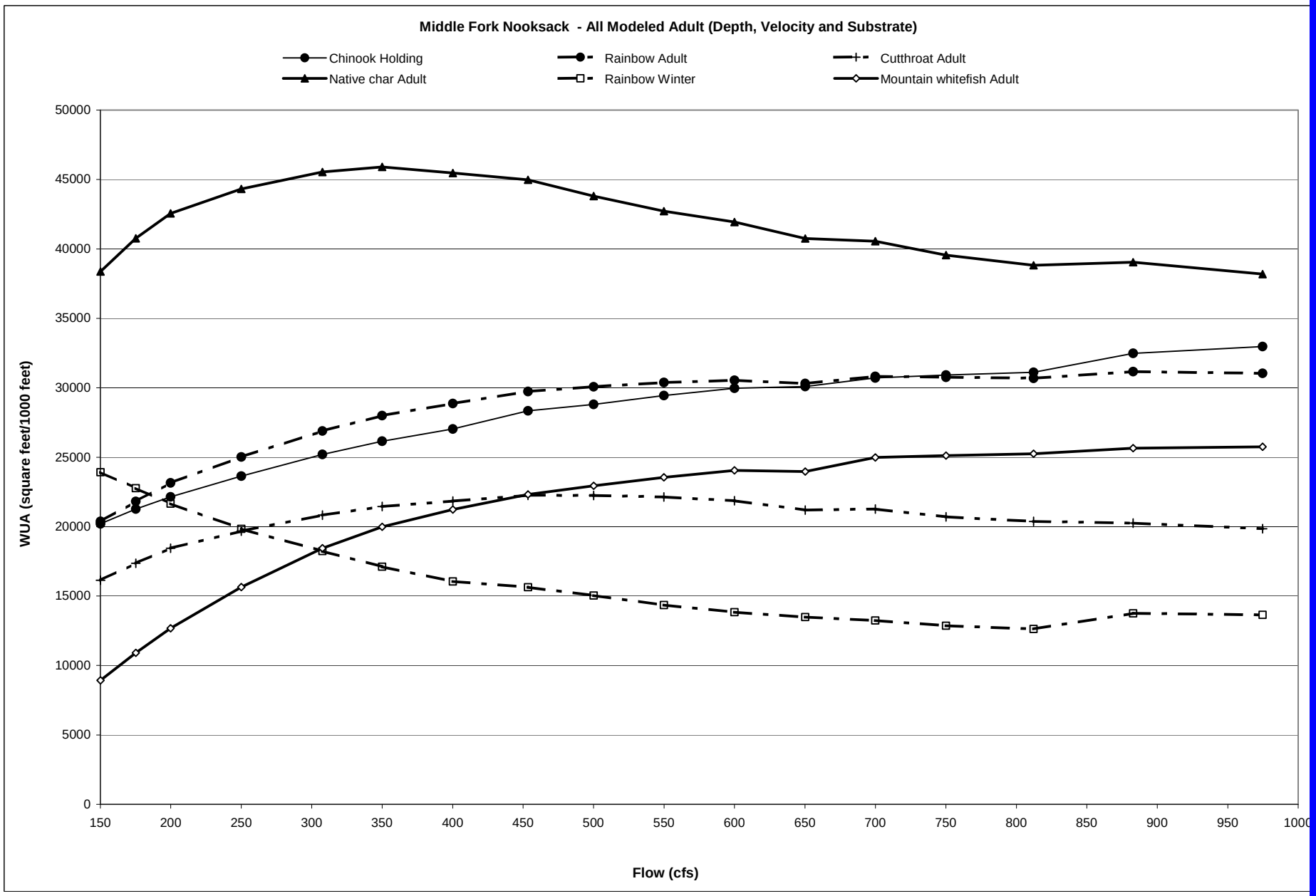
Utah State University Scientists

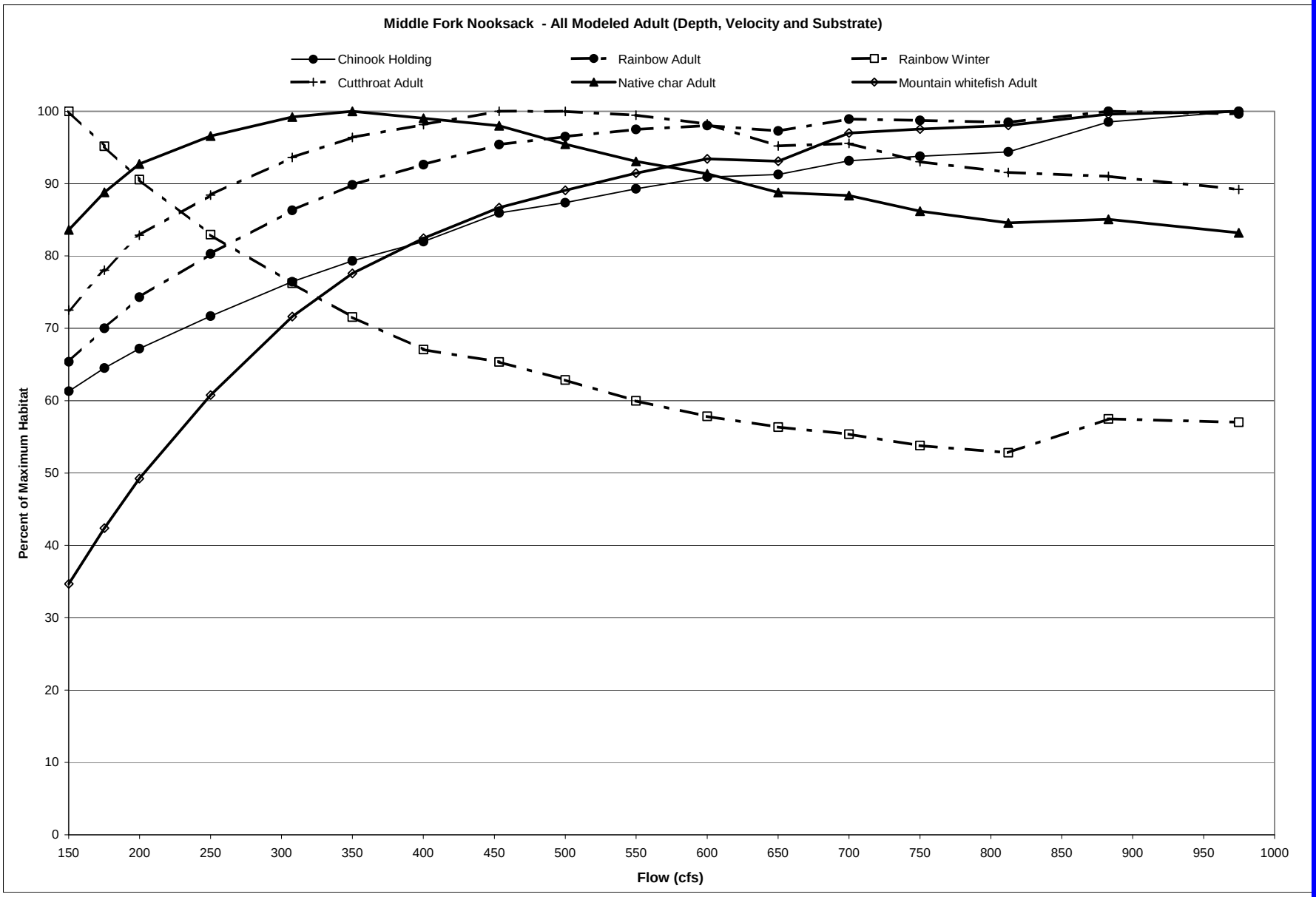
WRIA 1 Instream Flow and Fish Habitat Technical Teams

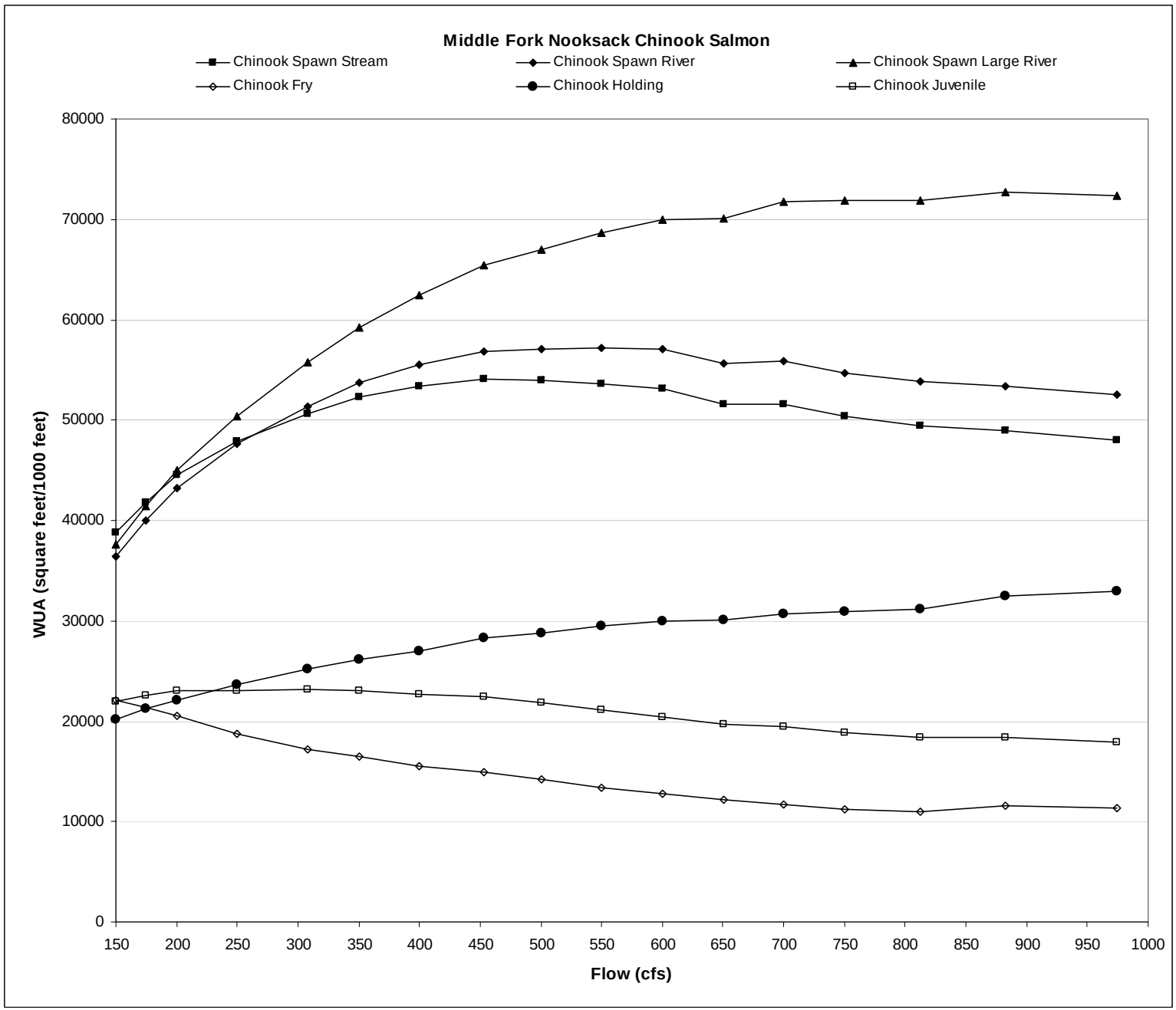
Decision Support Information




Nooksack River, South Fork Upper
All Modeled Species and Life Stages
Depth, Velocity, and Substrate
WUA (m²)
Flow (cms)
30000
25000
20000
15000
10000
5000
0
0
5
10
15
20
25
30
35
40
45
Chin_Holding
Chin_Juv
Chin_Spawn_LR
Chin_Spawn_R
Chin_Spawn_S
Chum_Spawn_Fall
Chum_Spawn_Sum
Coho_Juv
Coho_Spawn
Pink_Spawn
Sockeye_Spawn
Bull_Spawn
Rain_Juv_Ad_Winter
Rain_Spawn
Rain_Juv_Ad
Steelhead_Spawn
Steelhead_Spawn
Trout_Steelhead_Fry
Chin_Fry
Chin_Fry_Gen
Coho_Fry


Middle Fork Nooksack - All Modeled Adult (Depth, Velocity and Substrate)
Chinook Holding
Rainbow Adult
Cutthroat Adult
Native char Adult
Rainbow Winter
Mountain whitefish Adult
WUA (square feet/1000 feet)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
Flow (cfs)


Middle Fork Nooksack - All Modeled Adult (Depth, Velocity and Substrate)
Chinook Holding
Rainbow Adult
Rainbow Winter
Cutthroat Adult
Native char Adult
Mountain whitefish Adult
Percent of Maximum Habitat
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000


Middle Fork Nooksack Chinook Salmon
Chinook Spawn Stream
Chinook Spawn River
Chinook Spawn Large River
Chinook Fry
Chinook Holding
Chinook Juvenile
WUA (square feet/1000 feet)
80000
70000
60000
50000
40000
30000
20000
10000
0
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
1000
Flow (cfs)

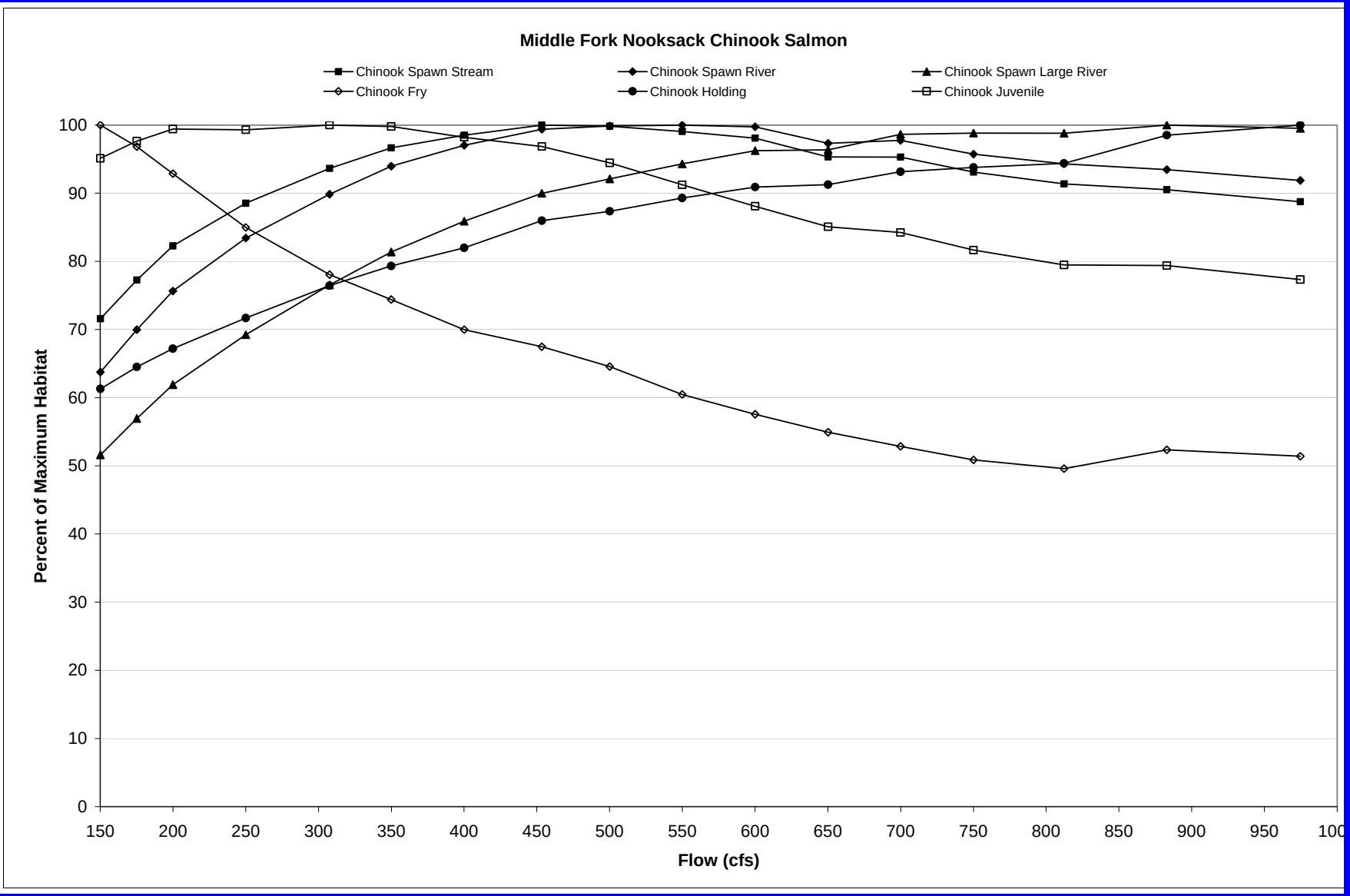
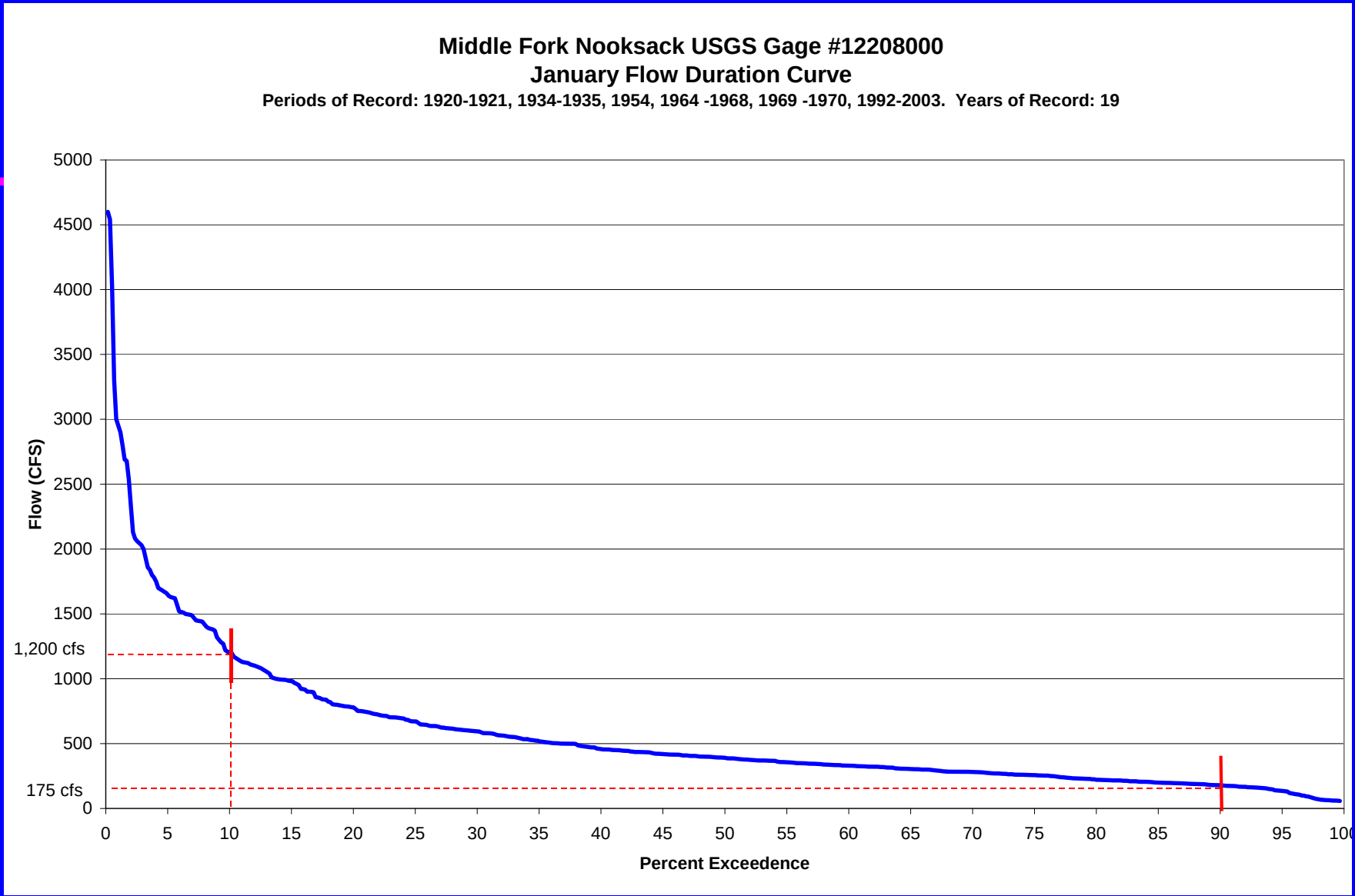
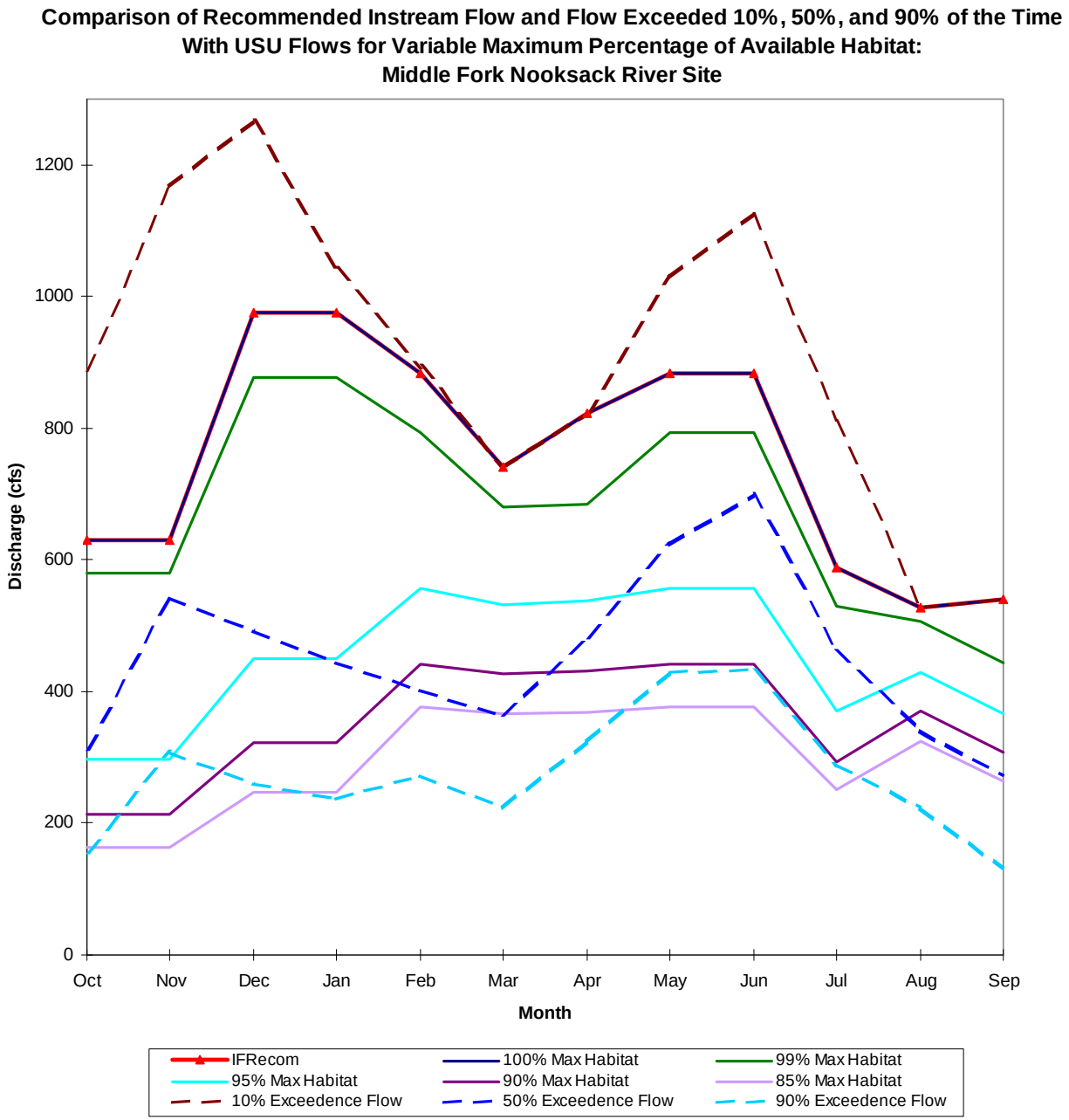

Middle Fork Nooksack Chinook Salmon
Chinook Spawn Stream
Chinook Spawn River
Chinook Spawn Large River
Chinook Fry
Chinook Holding
Chinook Juvenile
Percent of Maximum Habitat
Flow (cfs)
0
10
20
30
40
50
60
70
80
90
100
150
200
250
300
350
400
450
500
550
600
650
700
750
800
850
900
950
100

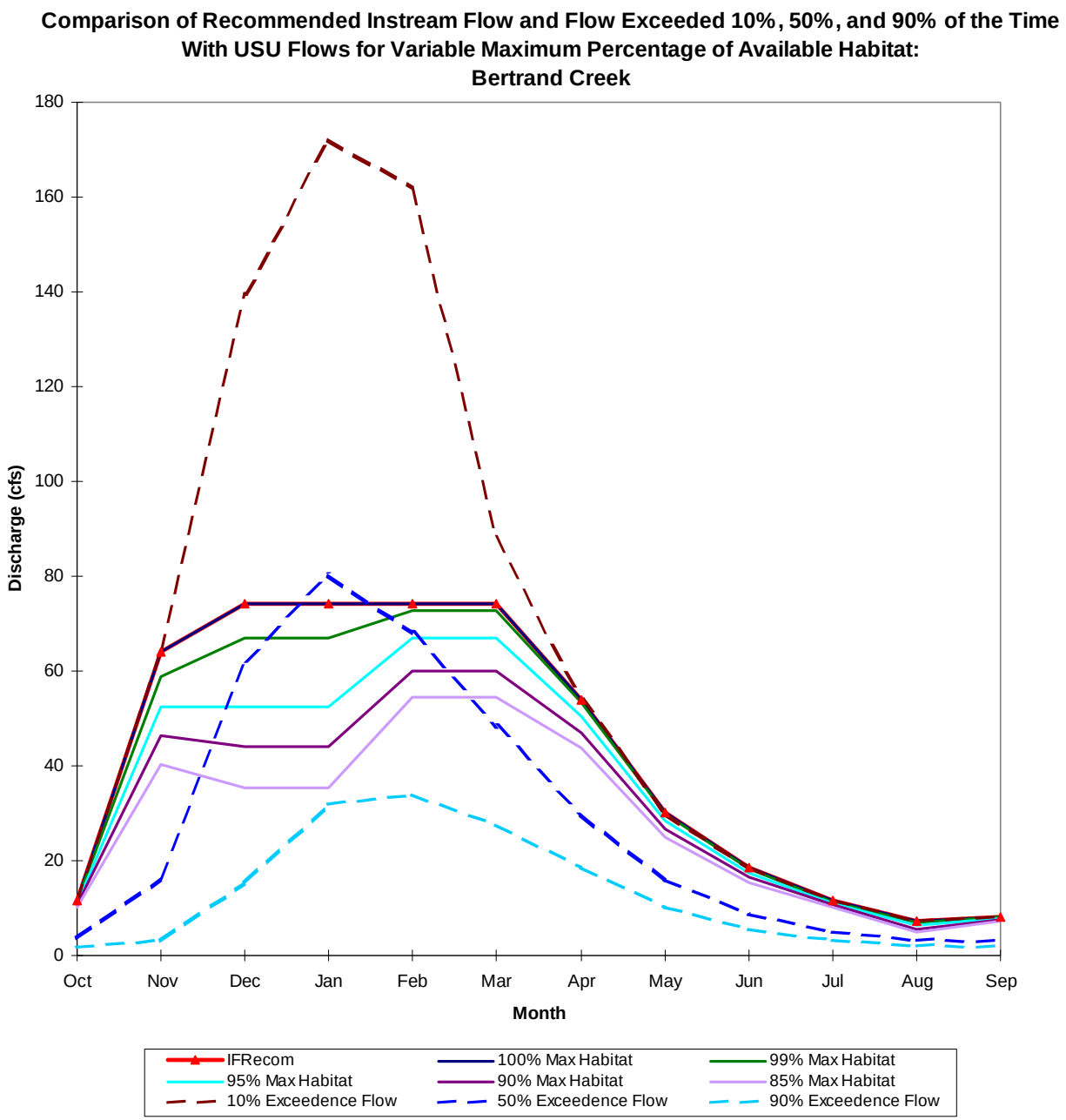
Table 1. Recommended rules for determination of priority species/lifestages in the lower and upper watersheds.

Geographic Subarea	Species Present	Priority Species/Lifestages	Months
Lower Watersheds (downstream of the confluence of the North and South forks of the Nooksack River near Deming, coastal streams including Whatcom Creek, and Sumas River drainage)	If chinook, chum, coho, steelhead present, then:	Chinook spawning	September – November
		Fall Chum spawning in current known distribution, otherwise coho spawning	December – January
		Steelhead spawning	February – July
		Steelhead incubation (2/3 of spawning flow) (consider also steelhead juvenile rearing)	August
	If chinook, coho, steelhead present (no chum), then:	Chinook spawning	September – November
		Coho spawning	December – January
		Steelhead spawning	February – July
		Steelhead incubation (2/3 of spawning flow) (consider also steelhead juvenile rearing)	August
	If coho, chum, steelhead present (no chinook), then:	Steelhead incubation (2/3 of spawning flow) (consider also steelhead juvenile rearing)	August
		Steelhead juvenile rearing	September
		Fall chum spawning in current known distribution, otherwise coho spawning	October – January
		Steelhead spawning	February – July

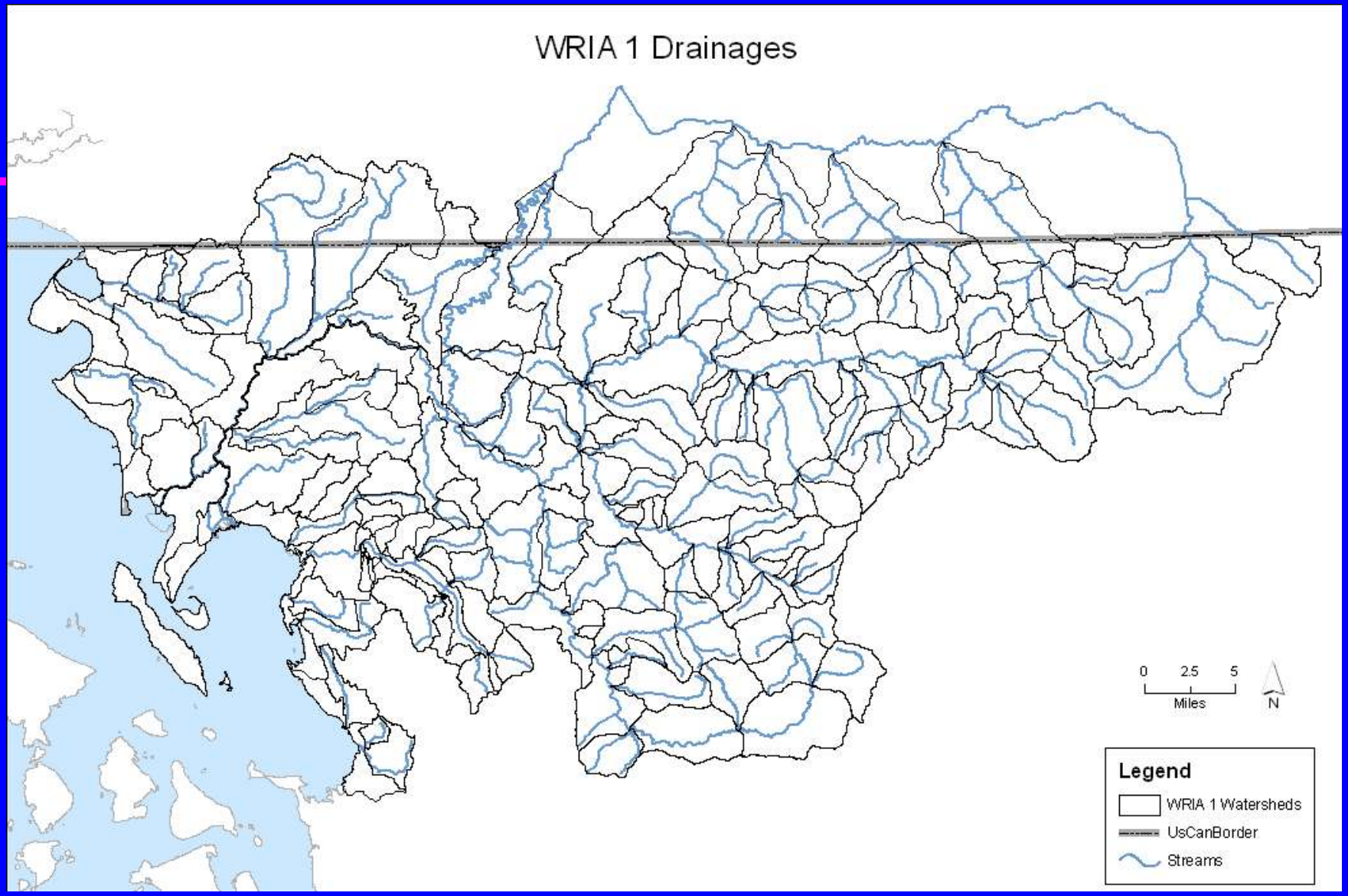

Middle Fork Nooksack USGS Gage #12208000
January Flow Duration Curve
Periods of Record: 1920-1921, 1934-1935, 1954, 1964 -1968, 1969 -1970, 1992-2003. Years of Record: 19
Flow (CFS)
5000
4500
4000
3500
3000
2500
2000
1500
1,200 cfs
1000
500
175 cfs
0
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Percent Exceedence

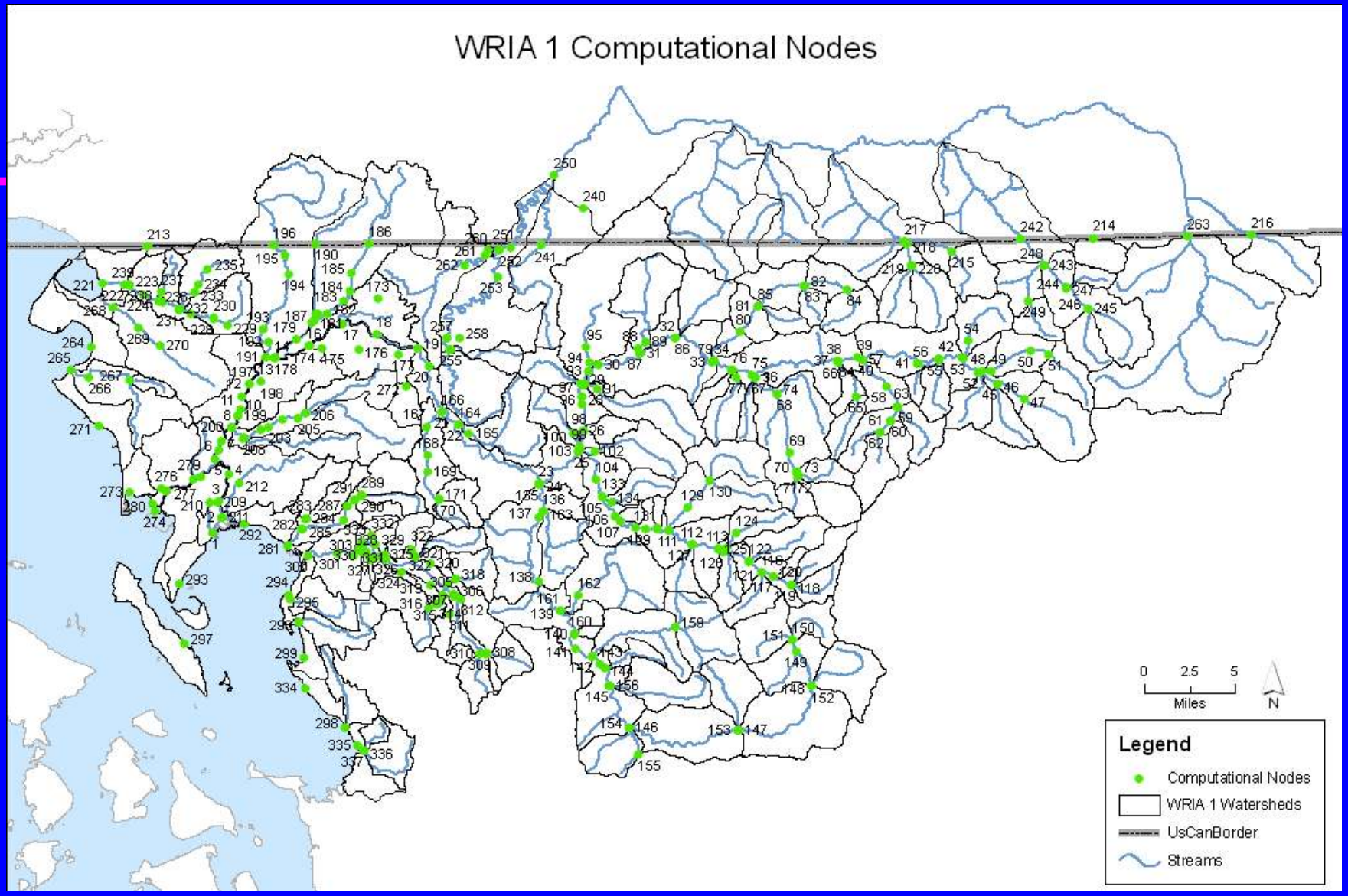
Decision Support Information

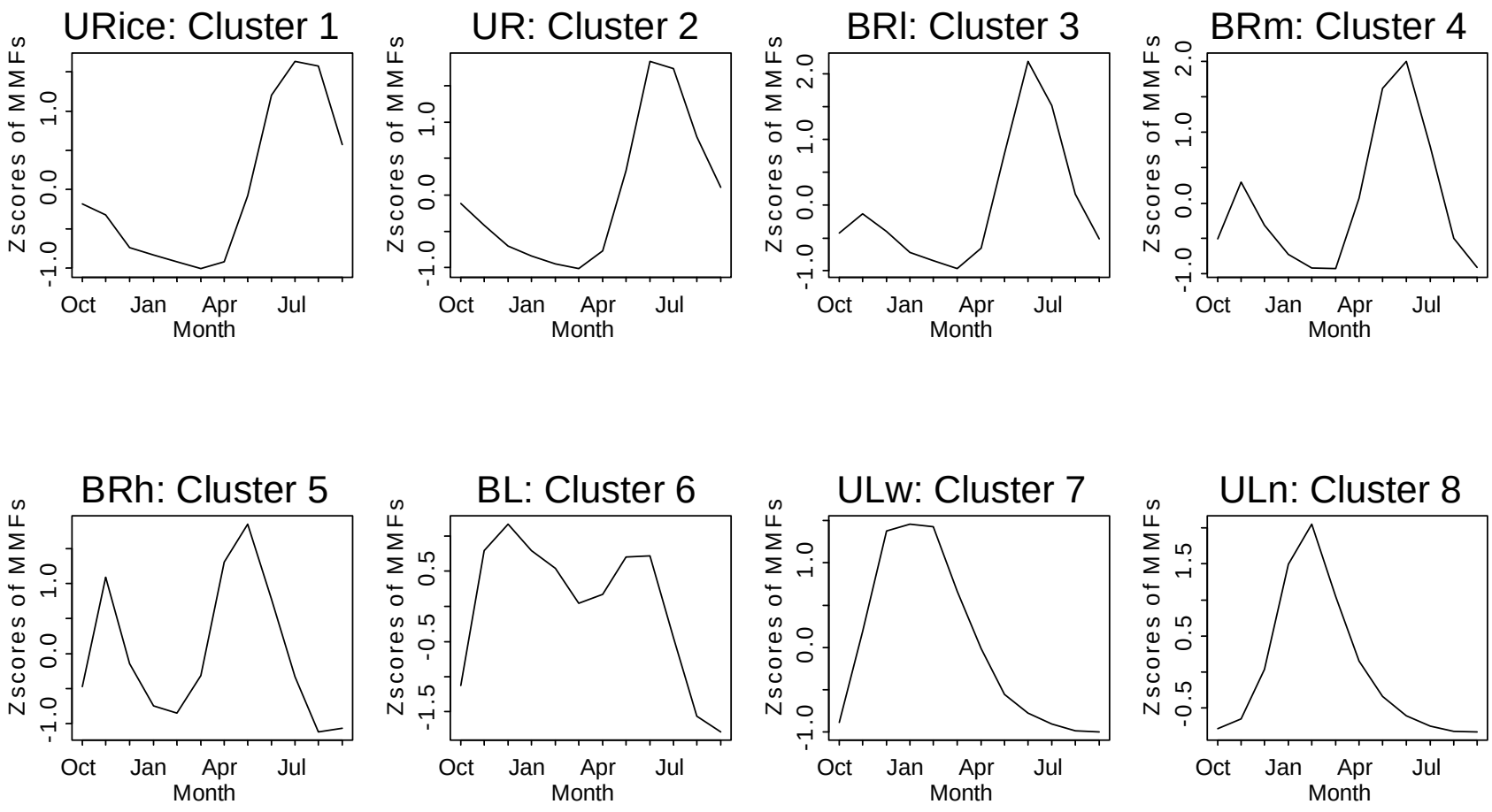

Comparison of Recommended Instream Flow and Flow Exceeded 10%, 50%, and 90% of the Time
With USU Flows for Variable Maximum Percentage of Available Habitat:
Middle Fork Nooksack River Site
Discharge (cfs)
0
200
400
600
800
1000
1200
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
IFRecom
100% Max Habitat
99% Max Habitat
95% Max Habitat
90% Max Habitat
85% Max Habitat
10% Exceedence Flow
50% Exceedence Flow
90% Exceedence Flow

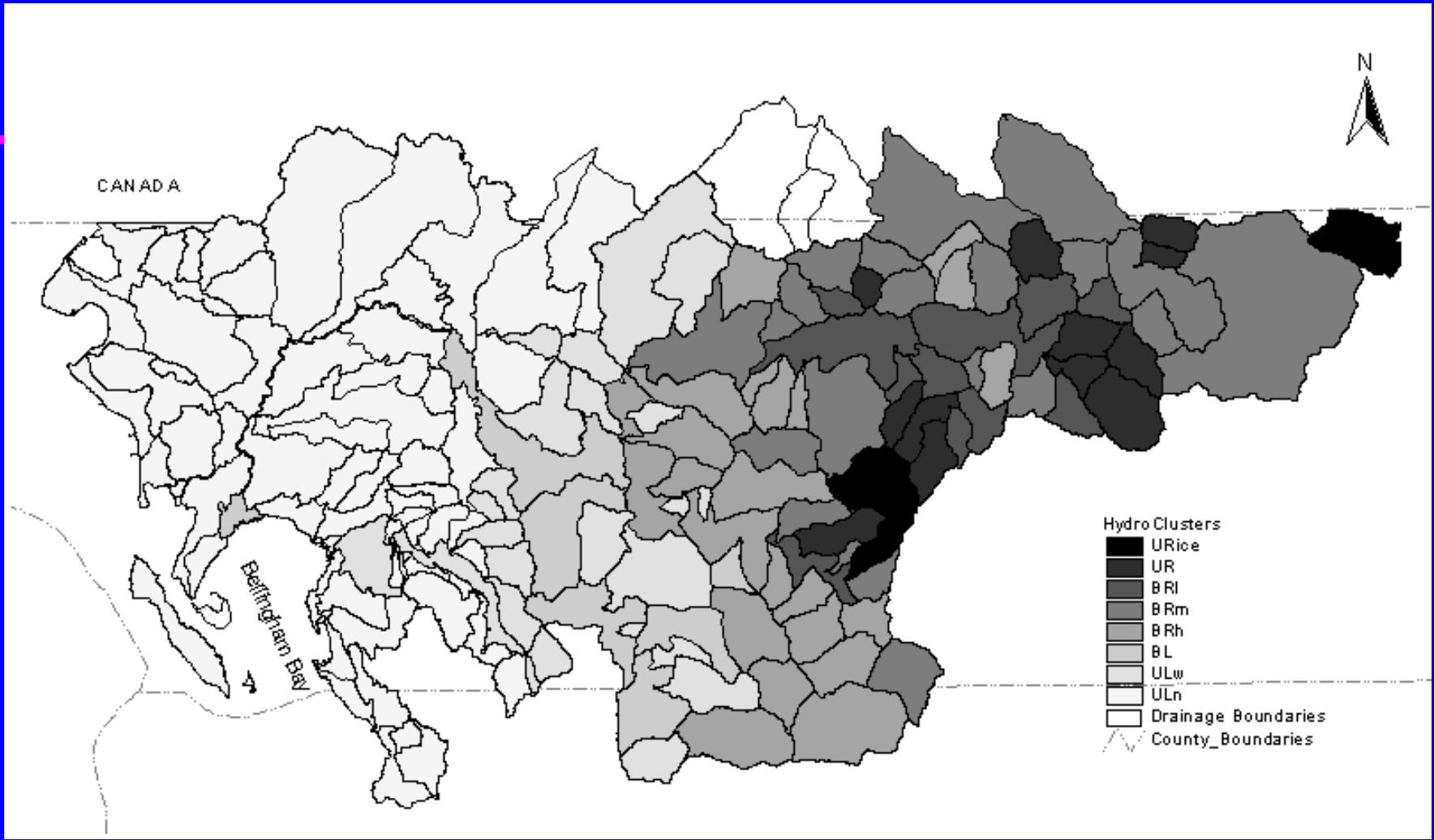

Comparison of Recommended Instream Flow and Flow Exceeded 10%, 50%, and 90% of the Time
With USU Flows for Variable Maximum Percentage of Available Habitat:
Bertrand Creek
Discharge (cfs)
180
160
140
120
100
80
60
40
20
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Month
IFRecom
100% Max Habitat
99% Max Habitat
95% Max Habitat
90% Max Habitat
85% Max Habitat
10% Exceedence Flow
50% Exceedence Flow
90% Exceedence Flow

Stratification/Extrapolation


WRIA 1 Drainages
0 2.5 5
Miles
N
Legend
WRIA 1 Watersheds
UsCanBorder
Streams


WRIA 1 Computational Nodes
0 2.5 5
Miles
N
Legend
Computational Nodes
WRIA 1 Watersheds
UsCanBorder
Streams


URice: Cluster 1
UR: Cluster 2
BRl: Cluster 3
BRm: Cluster 4
BRh: Cluster 5
BL: Cluster 6
ULw: Cluster 7
ULn: Cluster 8
Zscores of MMFs
Month
Oct
Jan
Apr
Jul


N
CANADA
Bellingham Bay
Hydro Clusters
URice
UR
BRl
BRm
BRh
BL
ULw
ULn
Drainage Boundaries
County_Boundaries

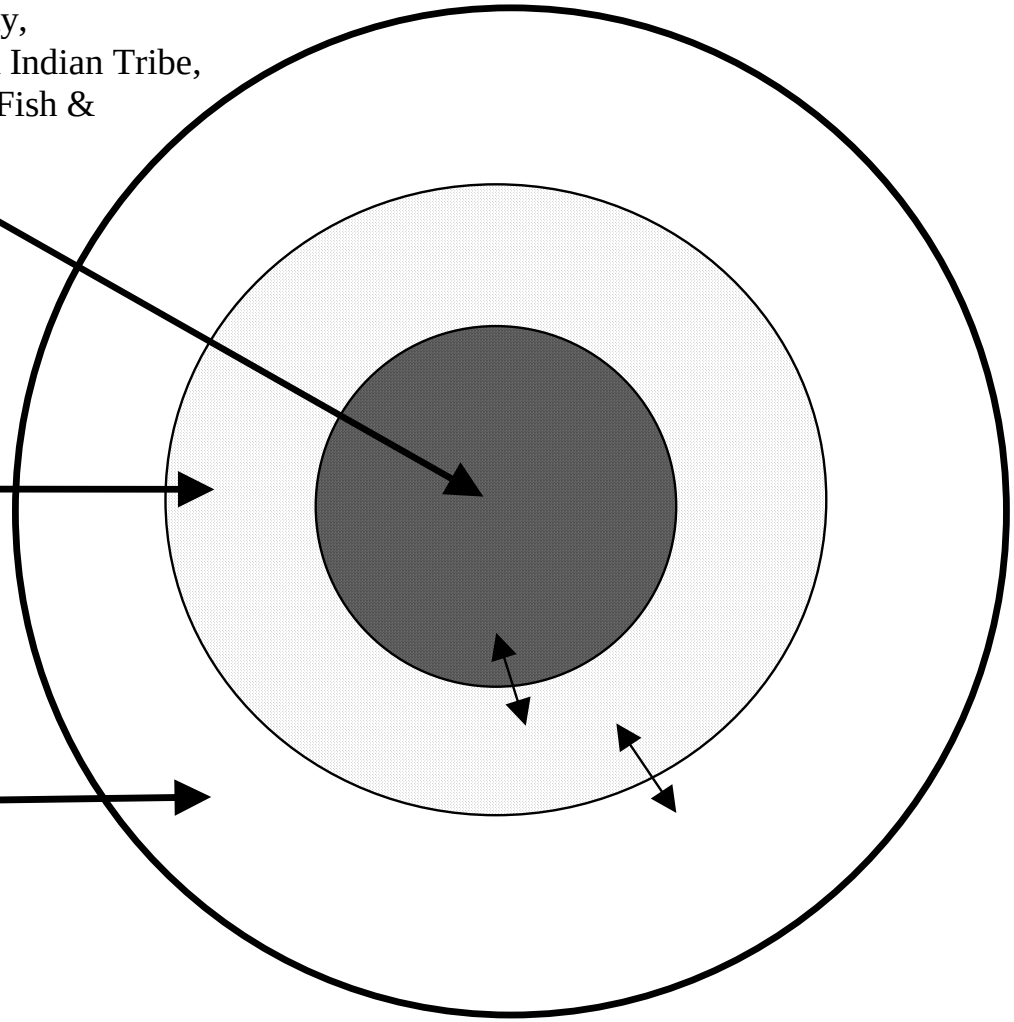
Selection and Adoption Action Plan

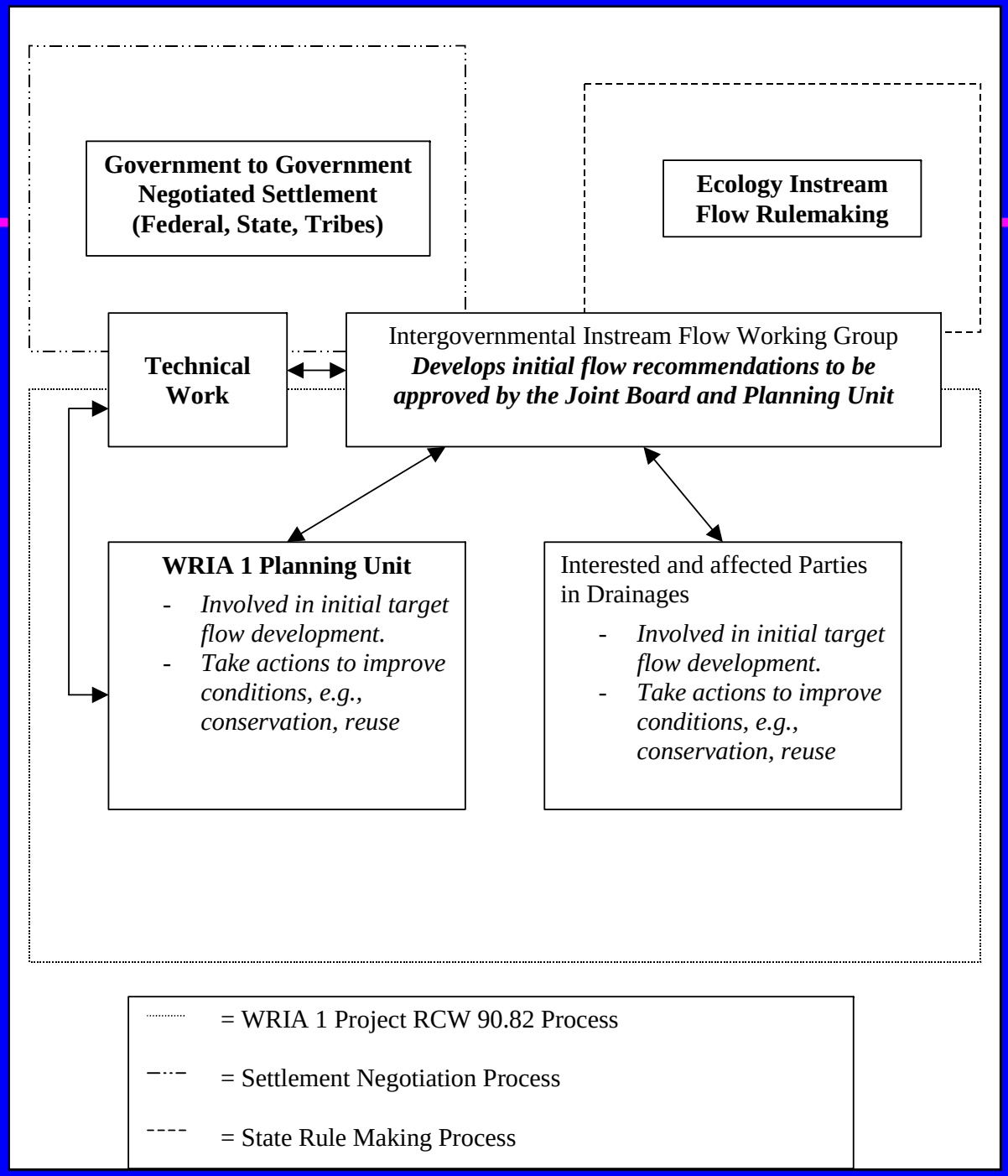
Concentric Circle Model of Consensus Decision-Making

Intergovernmental Working Group
(City of Bellingham, Whatcom County,
PUD No.1, Lummi Nation, Nooksack Indian Tribe,
Ecology, Washington Department of Fish &
Wildlife, NOAA , USFS, and EPA)

Planning Unit
(Governmental and
water interest caucus
representatives)

WRIA–wide Affected Parties




Government to Government Negotiated Settlement (Federal, State, Tribes)
Ecology Instream Flow Rulemaking
Technical Work
Intergovernmental Instream Flow Working Group
Develops initial flow recommendations to be approved by the Joint Board and Planning Unit
WRIA 1 Planning Unit
- Involved in initial target flow development.
- Take actions to improve conditions, e.g., conservation, reuse
Interested and affected Parties in Drainages
- Involved in initial target flow development.
- Take actions to improve conditions, e.g., conservation, reuse
= WRIA 1 Project RCW 90.82 Process
= Settlement Negotiation Process
= State Rule Making Process

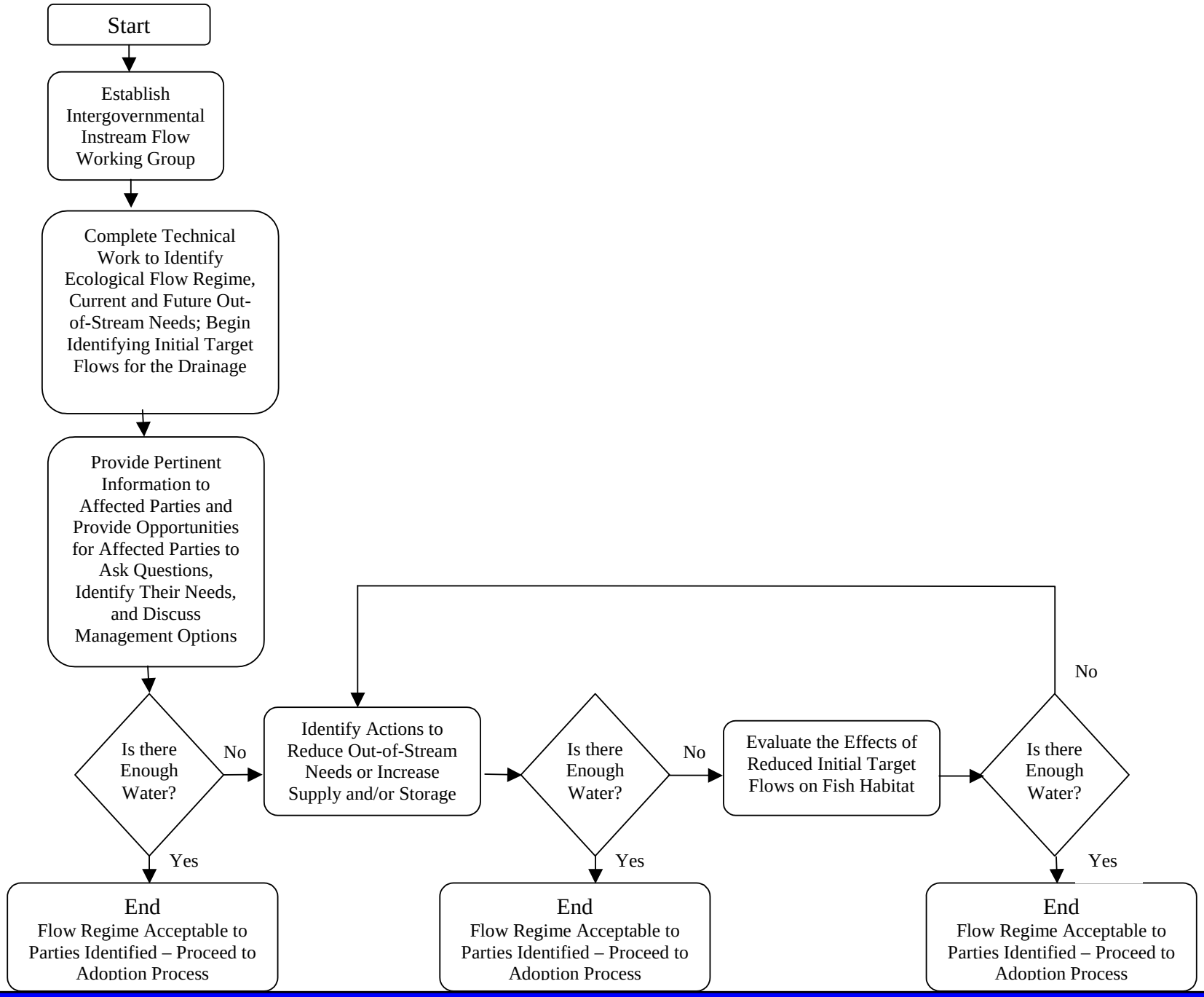
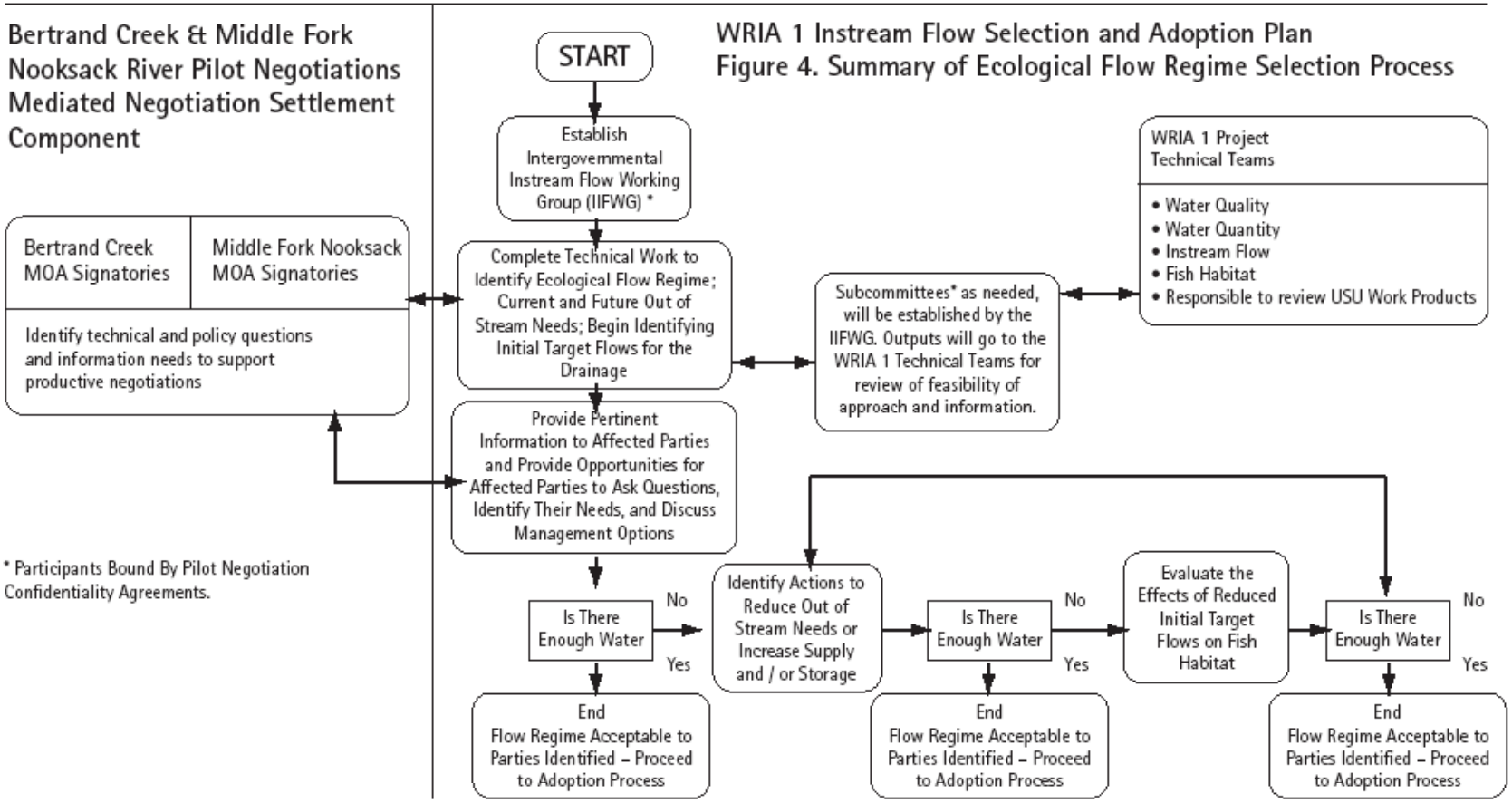

Start
Establish Intergovernmental Instream Flow Working Group
Complete Technical Work to Identify Ecological Flow Regime, Current and Future Out-of-Stream Needs; Begin Identifying Initial Target Flows for the Drainage
Provide Pertinent Information to Affected Parties and Provide Opportunities for Affected Parties to Ask Questions, Identify Their Needs, and Discuss Management Options
Is there Enough Water?
No
Yes
End
Flow Regime Acceptable to Parties Identified – Proceed to Adoption Process
Identify Actions to Reduce Out-of-Stream Needs or Increase Supply and/or Storage
Is there Enough Water?
No
Yes
End
Flow Regime Acceptable to Parties Identified – Proceed to Adoption Process
Evaluate the Effects of Reduced Initial Target Flows on Fish Habitat
Is there Enough Water?
No
Yes
End
Flow Regime Acceptable to Parties Identified – Proceed to Adoption Process

DIAGRAM 1: Bertrand Creek and Middle Fork Nooksack Pilot Negotiations Technical Work Development



Schedule/Next Steps

- Extrapolation Methods Reports due in February 2006
- All preliminary draft reports from USU due on March 17, 2006; comments on preliminary draft reports due on April 21, 2006
- All draft reports from USU due on June 9, 2006; comments on draft reports due July 14, 2006.
- All Final Draft 1 reports submitted to Independent Peer Review panel on August 25, 2006; Peer Review panel comments due by November 3, 2006.
- All Final Draft 2 reports from USU due on January 5, 2007; Final Approval February 9, 2007

Schedule/Next Steps

- Pilot Flow Negotiations for Middle Fork Nooksack and Bertrand Creek continue during 2006
- February 9, 2006, City of Bellingham to identify out-of-stream needs.
- Out-of-stream needs to be identified for Bertrand Creek during Spring 2006; start "pump and dump" test Spring 2006.

Summary

- The overall goal of the WRIA 1 Watershed Management Project is to have water of sufficient quantity and quality to meet the needs of current and future human generations.
- This goal includes the restoration of salmon, steelhead, and trout populations to healthy and harvestable levels, and the improvement of the habitats upon which fish rely.
- An essential step in achieving this goal is to develop the technical information necessary to evaluate instream and out-of-stream needs.

Summary

- This technical information must be evaluated in light of legal and policy considerations to determine how to meet the overall goal of the WRIA 1 Watershed Management Project.
- The goal of the instream flow analysis element of the WRIA 1 Watershed Management Project is to accurately estimate the relationship between stream flow and fish habitat quantity and quality for different fish species and life stages, and the maintenance of ecological health at selected locations throughout WRIA 1.