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4.2 SWIFT BYPASS REACH INSTREAM FLOW STUDY (AQU 2)

4.2.1 Study Objectives

One issue being evaluated as part of the Lewis River relicensing process is the flow regime downstream of Swift Reservoir. At present, there is no minimum flow requirement in the Lewis River between Swift and Yale reservoirs. This report addresses the flow issue in this reach, and the potential benefits of increased flows.

The objective of this study is to provide information to evaluate incremental changes in aquatic habitat as a function of increased flows.

4.2.2 Study Area

The study area for AQU 2 is the Lewis River from the Swift No. 1 powerhouse to the upstream end of Yale Lake (Figure 4.2-1). This 2.7-mile (4.3 km) reach is commonly referred to as the Swift bypass reach (SBR). The elevation drops from about 570 feet at the upper end of the SBR to 490 feet at Yale Lake, for an average gradient of just less than 0.6 percent.

Harza mapped habitat conditions in the SBR in 1999. The reach was divided into 59 different habitat units, termed natural sequence orders (NSOs). The most common habitat types are riffles and glides, which together make up 78 percent of the length of the reach. The channel is divided for about 2,500 feet (762 m) between NSO 50 and 59. A 3,000 foot (914 m) side channel also exists in the vicinity of NSO 18.

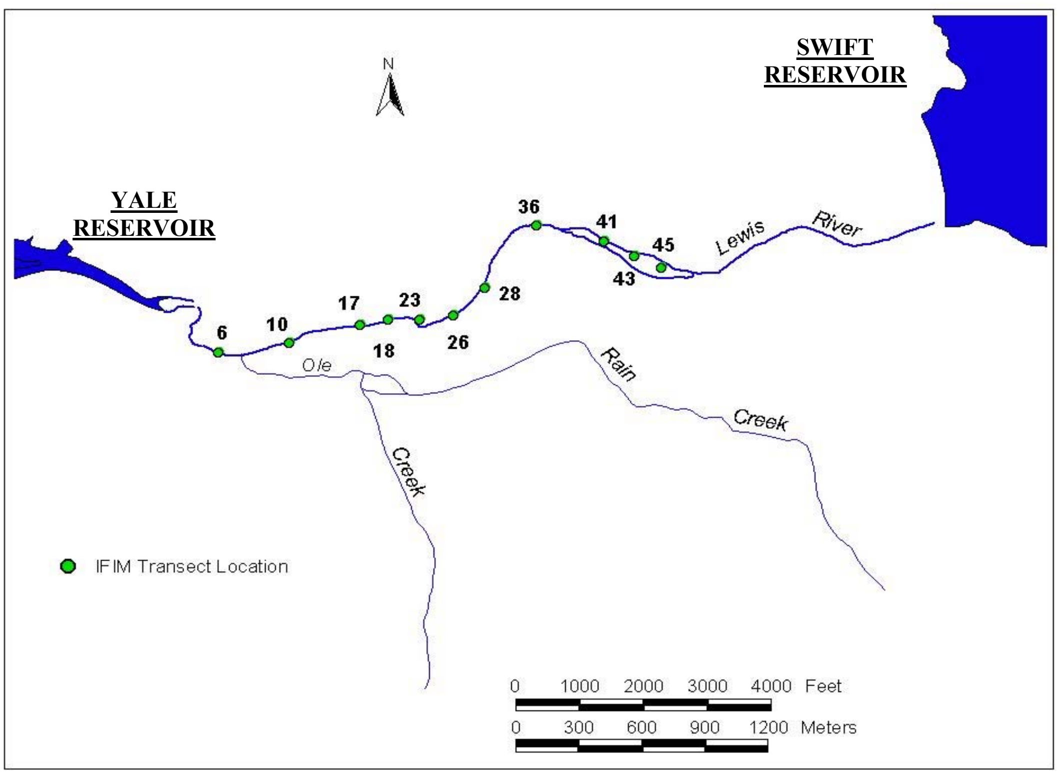

Figure 4.2-1. Map of the Swift bypass reach of the Lewis River.

Hydrology in the Study Area

Since 1958, all flow from the Lewis River leaving Swift Reservoir has been diverted into the Swift canal; that is, no flows are released into the SBR except under spill conditions. Groundwater or seepage from the Swift No. 2 canal contribute about 10 cfs into the middle to upper end of the reach. Ole Creek adds significantly to the flow in the lower part of the SBR (below NSO 9) during winter and spring, but is dry in summer and early fall. Table 4.2-1 lists historic flows in the SBR; Table 4.2-2 gives estimated median flows in Ole Creek.

Table 4.2-1. Historic mean monthly flows in the Lewis River at Cougar for years 1924-1957.

Month	Flow (cfs)	Month	Flow (cfs)
October	1,492	April	4,010
November	3,187	May	4,456
December	4,196	June	3,337
January	3,591	July	1,704
February	3,560	August	988
March	3,325	September	866

Table 4.2-2. Estimated median monthly flows in Ole Creek, based on correlation analysis with Speelyai Creek.

Month	Flow (cfs)	Month	Flow (cfs)
October	5	April	50
November	65	May	30
December	75	June	10
January	70	July	2
February	75	August	0
March	60	September	0

4.2.3 Methods

4.2.3.1 Modeling Approach

The primary tool used in this study was the Physical Habitat Simulation (PHABSIM) model, developed by the USFWS (Bovee 1982). PHABSIM is part of the Instream Flow Incremental Methodology, or IFIM (Stalnaker et al. 1994). PHABSIM is a microhabitat model that relates habitat quality and quantity to depth, velocity, substrate, and cover as a function of discharge. IFIM generally includes PHABSIM but also takes into account macrohabitat conditions such as temperature, water quality, and sediment movement.

The basic premises of PHABSIM are that numbers of fish are positively correlated with the amount of physical habitat; that physical habitat is related to discharge; and that physical habitat can be quantified in terms of depth, velocity, substrate, and cover.

The 4 principal components of PHABSIM are field measurements, a hydraulic model, habitat suitability criteria, and a habitat model. Field measurements are used to quantify the matrix of depth, velocity, substrate, and cover combinations that occurs along representative transects at a particular flow. A hydraulic model is then used to simulate this matrix over a range of flows. Habitat suitability criteria (HSC) describe the value to a species of any combination of physical variables. A habitat model combines HSC with output from the hydraulic model to generate an index of habitat value, termed Weighted Usable Area (WUA), as a function of flow.

The PHABSIM study of the SBR followed procedures outlined by the Instream Flow Group (Bovee 1982). It also complied with guidelines established by the Washington Department of Fisheries and Wildlife (WDFW) (Beecher 2000). The PHABSIM study consisted of the following steps.

- Mapping and transect selection
- Model selection
- Field data collection
- Computer simulation of hydraulics
- Development of habitat suitability curves (HSC)
- Determination of weighted usable area (WUA) as a function of flow
- Interpretation of WUA results, and recommended flows

4.2.3.2 Mapping and Transect Selection

The 2.7-mile (4.3 km) bypass reach was divided into 59 habitat units (NSOs) by Harza (1999). Based on this information, Hardin-Davis used a stratified-random process to select 9 habitat units to represent a variety of habitat types. Agency representatives attended a field review of these units on March 17, 2000. During this meeting, the final locations of the transects were agreed upon (Table 4.2-3) and documented in the meeting notes. These are depicted on Figure 4.2-1.

Table 4.2-3. Transects selected in the Swift bypass reach.

NSO[1] Number	No. of Transects	Habitat Type
6	1	Spawning
10	2	Riffle
17	2	Glide
23	1	Split channel
26	2	Riffle
28	2	Pool
36	2	Glide
41	2	Divided channel, riffle-glide on right, and pool-glide on left
43	2	Divided channel, riffle-glide on right, and pool-glide on left
45	2	Divided channel, riffle-glide on right, and pool-glide on left

[1]NSO: Habitat unit number.

4.2.3.3 Selection of the Hydraulic Model

Hydraulic modeling is an important part of the foundation for PHABSIM. Accurate simulation of depths and velocities is essential for calculation of habitat values at a range of flows.

Two different forms of the IFG-4 model (Milhous et al. 1981) have commonly been used in PHABSIM studies. To simulate velocities across the channel, one model uses regression on 3 measured velocities; the other uses Manning's equation on one measured velocity. The one-velocity model has been preferred by the majority of practitioners for the last 10 years. The U.S. Fish and Wildlife Service (USFWS) Instream Flow Group developed the one-velocity IFG-4 model in the mid-1980s. Their newest software does not include the 3-velocity regression model as an option.

WDFW and the Washington Department of Ecology (WDOE) prefer the 3-velocity model. Their rationale is that the 3-velocity model can be more precise for individual cells, and that sometimes individual cells of an important habitat type can have disproportionate influences on flow recommendations.

The Aquatic Resource Group (ARG) met to discuss the methods in 2000. It was agreed that the analyses would use the one-velocity model for transects describing rearing habitat, and the 3-velocity model for the spawning transect. Suitability criteria are shown in AQU 2 Appendix 1.

The goal of this study was to generate reliable hydraulic data for a range of flows from about 50 to 500 cfs. Therefore, the flow releases from Swift Dam were designed to cover this range with a reasonable amount of extrapolation. The flow releases were targeted at 60, 140, and 300 cfs.

4.2.3.4 Field Data Collection

Field data were collected in the spring of 2000. A complete description of the field methods used for this study is presented on pages AQU 2-3 through 2-6 of the Study Plan Document (PacifiCorp and Cowlitz PUD 1999, as amended). The ARG agreed upon these methods in February 2000.

<u>Surveying</u>

Headpins were installed at all the PHABSIM transects in April 2000. At that time, the relative elevations of the pins and the cross-sectional profile at each transect were surveyed. The relative elevations were later tied into true elevations with a benchmark survey covering the entire reach.

<u>Water Surface and Velocity Measurements</u>

During the week of May 15, 2000, water surface and velocity measurements were taken. Water surface elevations were surveyed at all transects and photographs taken during releases of 68, 134, and 290 cfs from Swift Dam (these are the best estimates of actual releases; target flows were 60, 140, and 300 cfs). Substrate and cover measurements were recorded at all transects at low flow. Velocities were measured at every transect at the 290 cfs release. Velocities were also measured at several transects, including the spawning transect, during releases of 68 and 134 cfs.

4.2.3.5 Computer Simulation of Hydraulics

Immediately after the field measurements, data were entered into the IFG-4 format. Various error-checks were done with programs in the PHABSIM and RHABSIM (Riverine Habitat Simulation) models. Discharge was calculated for each set of measured velocities, and compared to the known discharge for the field date. Stage-discharge relationships at each transect were examined for abnormalities. Simulated and measured velocities were compared at the observed discharges; simulated velocities were also examined at the upper and lower bounds of extrapolation to make sure the predicted values were reasonable. Once the error checking was complete, the IFG-4 program was used to generate hydraulic data for the flow range 50 to 500 cfs. The 2 transects at NSO 41 were dropped due to problems with the velocity calibrations.

WDFW (Beecher 2000) maintains a list of required data for instream flow studies. This includes information on water surface elevations at all measured flows, accuracy of velocity prediction, and other information listed below. These and other relevant data were supplied to agencies according to WDFW protocol. In addition, at the request of WDFW, IFG-4 files were compiled for all transects with no data modifications. The following information was supplied to WDFW and WDOE on November 28, 2000:

- Input file including bed elevations, water surface elevations, velocities, substrate/ cover, and calibration discharges for IFG-4;
- Table for each transect of "calibration details" with simulated velocities paired with corresponding measured velocities for each calibration flow;
- Table of velocity adjustment factors (VAF) for each transect and each simulated flow over the proposed range of the model;
- Table of "computational details" for each simulated flow, including calibration flows;
- List of options used in hydraulic model;
- Map of site showing placement of numbered transects in relation to pools, riffles, chutes, large boulders, large woody debris, and other channel features; and
- Table of stage differences between flows and between transects.

Calibrated IFG-4 files were supplied to agencies. The IFG-4 model is calibrated by making small adjustments to the input; these adjustments yield the most realistic results possible at simulated flows. The calibrated IFG-4 files were sent to WDFW and WDOE on January 2, 2001.

4.2.3.6 Development of Habitat Suitability Curves (HSC)

The HSC are used to translate hydraulic properties (depth, velocity) into an index of fish habitat value. Hardin-Davis developed HSC from literature sources and circulated them to agency representatives in December 2000. These curves were discussed in meetings on December 15, 2000 and January 5, 2001. The complete list of species and life stages to be evaluated was developed (Table 4.2-4), although no decision was made during these meetings regarding the weighting that any particular species or life stage might have in the flow recommendations. Final curves were agreed upon for all species; the depth and velocity coordinates for all these curves are listed in AQU 2 Appendix 1, along with the list of participants at the meetings.

Table 4.2-4. Species and life stages analyzed with PHABSIM in the Swift bypass reach.

Resident Species	Life Stage
Bull Trout	Rearing (juvenile and adult combined) Spawning
Rainbow trout	Juvenile Adult Spawning
Cutthroat trout	Rearing (juvenile and adult combined)
Mountain whitefish	Juvenile Adult
Anadromous Species	**Life Stage**
Chinook salmon	Juvenile Spawning
Coho salmon	Juvenile Spawning
Steelhead trout	Juvenile Spawning

4.2.3.7 Generation of WUA

The hydraulic data produced by IFG-4 were used in the HABTAT program. For the spawning life stages, results were based on a single transect at NSO 6. For the rearing life stages, the results from all the transects except NSO 6 were used. The results for individual transects were weighted based on the habitat mapping.

4.2.4 Key Questions

No key watershed questions were identified in the study plan.

4.2.5 Results

4.2.5.1 Hydraulic Simulation

Based on WDFW's review of input data, the hydraulic data were judged to be suitable for modeling a range of flows from 50 to 500 cfs. Details of the simulations are given in AQU 2 Appendix 2. This appendix includes:

- Cross-sectional profiles of each transect, with water surface elevation (WSEL) superimposed
- Cross-sections with measured and simulated velocities superimposed
- IFG-4 input files for all transects
- Velocity Adjustment Factors (VAF) for each transect

4.2.5.2 Weighted Usable Area

WUA vs. discharge is plotted for all resident rearing and spawning life stages (Figures 4.2-2 through 4.2-4). Bull trout rearing habitat peaks at 225 cfs. The peaks for other resident rearing species occur at flows of 200 to 500 cfs. Bull trout and rainbow trout spawning WUA peak at 250 and 375 cfs, respectively.

Plots for rearing anadromous species (Figure 4.2-5) indicate WUA peaks for juvenile coho salmon, Chinook salmon, and steelhead at 60, 150, and 275 cfs, respectively. For anadromous spawning, the peaks for these same species occur at 275, 425, and 425 cfs (Figure 4.2-6). Plots for anadromous species are presented in AQU 2 Appendix 3.

4.2.6 Discussion

4.2.6.1 Key Species and Flow Recommendations

Interpretation of PHABSIM results generally depends on the selection of key species and life stages, since it is difficult to optimize flows for a large number of species and life stages simultaneously (Bovee 1982). It has been generally agreed that some or all of the resident salmonids (bull trout, cutthroat trout, rainbow trout, and mountain whitefish) will be included as key species. Large-scale sucker, northern pikeminnow, threespine stickle-back, and sculpin are also native to the area (PacifiCorp and Cowlitz PUD 2001), but these species are not directly included in the instream flow study. However, flows that benefit the resident salmonid species would likely benefit other native species as well.

Reintroduction of anadromous species (coho and Chinook salmon and steelhead) is under consideration for the Lewis River projects. It is uncertain whether the Swift bypass reach will be considered for reintroduction of anadromy and, if it is, whether both spawning and rearing life stages will be included.

Of the resident species, bull trout is a primary species of interest in the SBR because:

- Bull trout are listed as a federally threatened species.
- The populations in the Lewis River basin are considered to be under “moderate” risk of extinction (WDFW 1998).
- Water temperature is a critical factor for bull trout survival. Flows from Swift Reservoir could provide suitable water temperatures for bull trout in the SBR.
- The population in Yale Lake relies entirely on approximately 1.5 miles (2.4 km) of Cougar Creek to meet all spawning and fry/juvenile rearing needs.

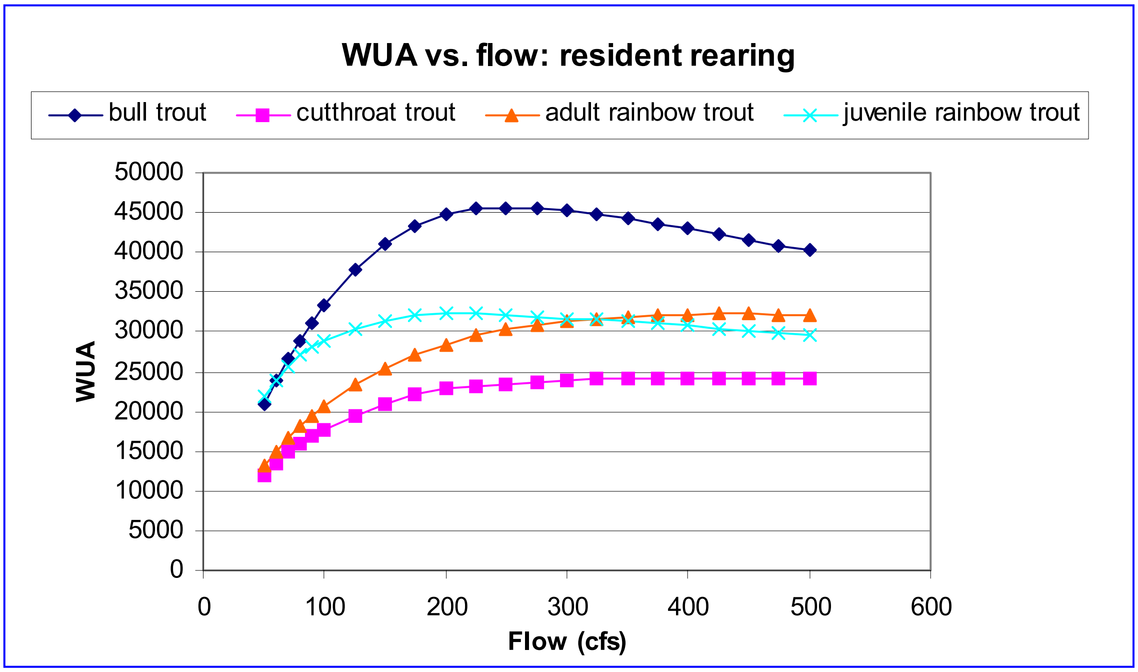

Figure 4.2-2. Weighted useable area vs. flow for rearing bull trout, rainbow trout, and cutthroat trout in the Swift bypass reach.

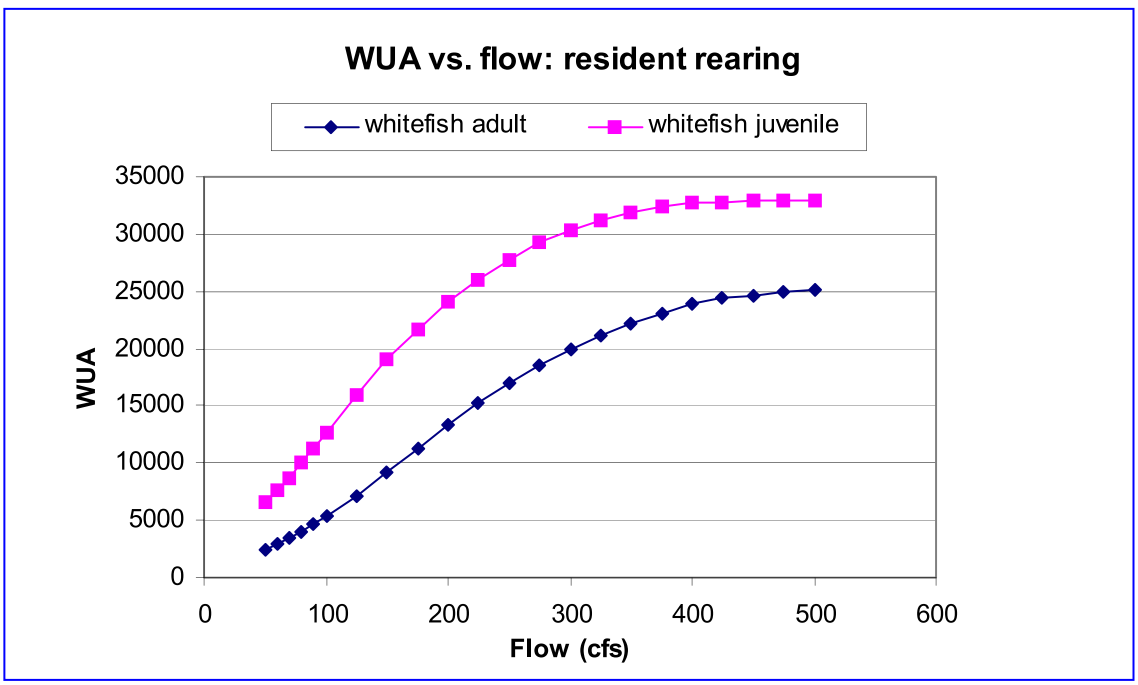

Figure 4.2-3. Weighted useable area vs. flow for rearing mountain whitefish in the Swift bypass reach.

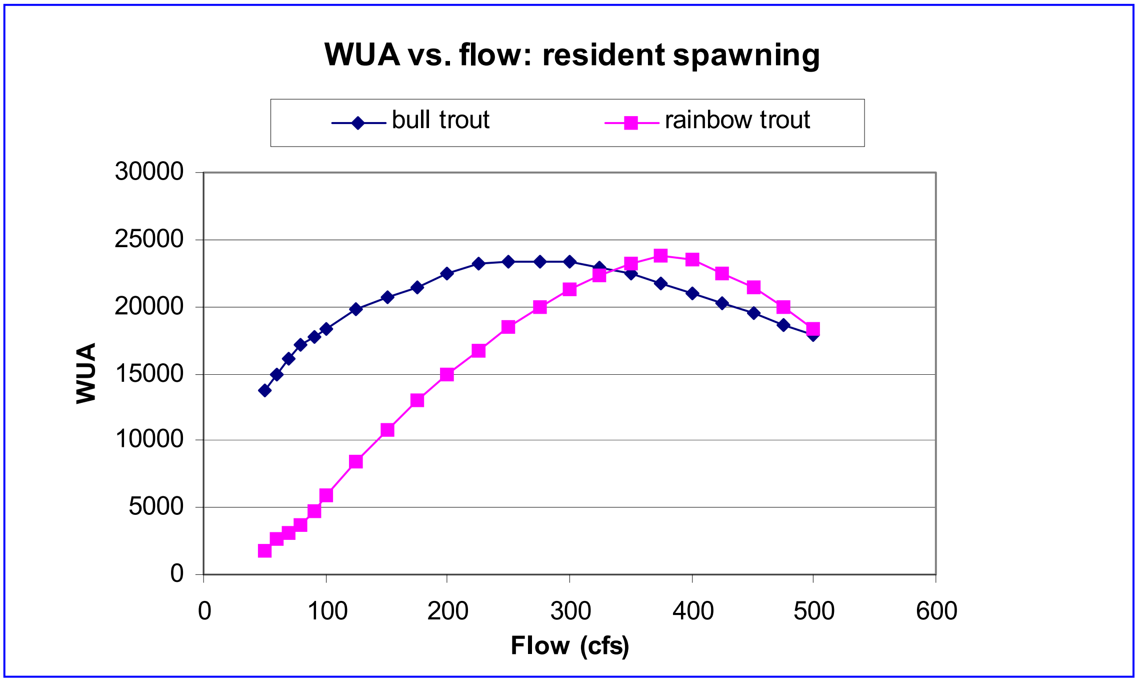

Figure 4.2-4. Weighted useable area vs. flow for spawning bull trout and rainbow trout in the Swift bypass reach.

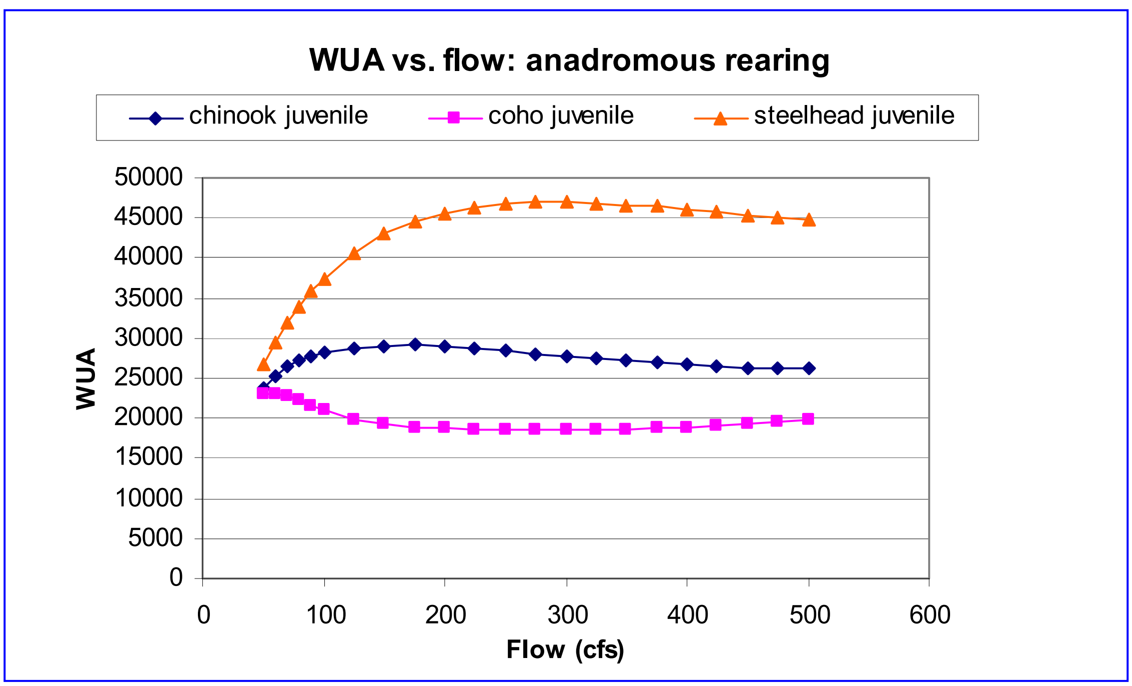

Figure 4.2-5. WUA vs. flow for rearing anadromous species in the Swift bypass reach.

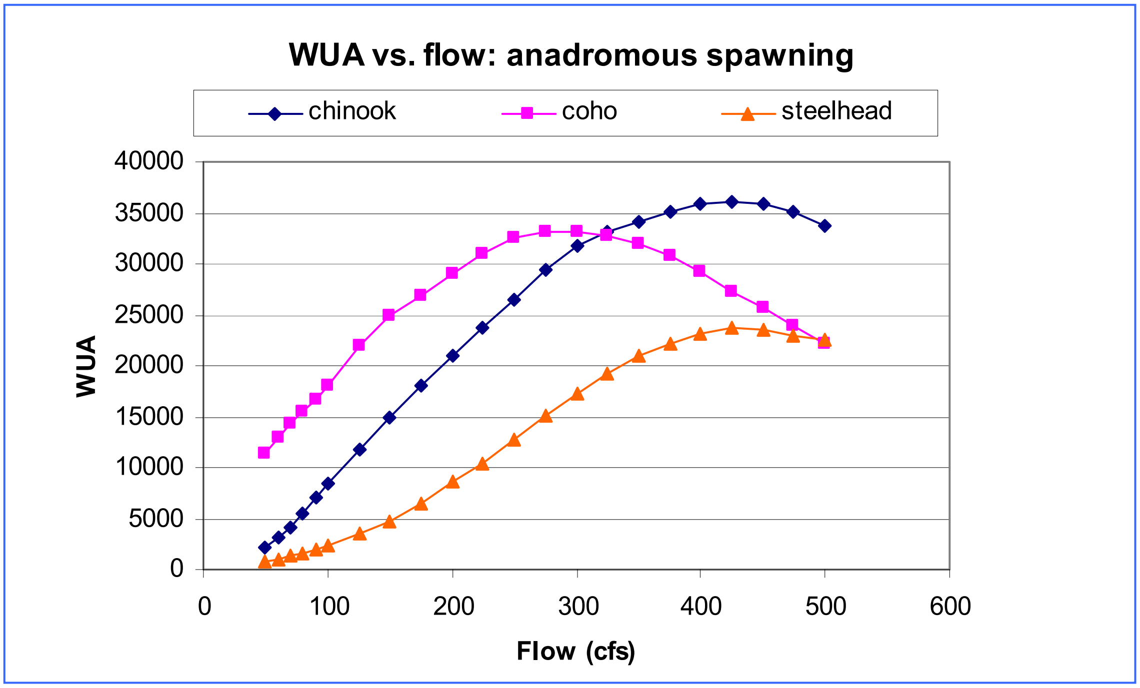

Figure 4.2-6. WUA vs. flow for spawning anadromous species in the Swift bypass reach.

Once final decisions are made on key species (including the anadromous reintroduction issue), the PHABSIM results can be used to guide the development of flow recommendations.

4.2.6.2 Other Flow Requirements

In addition to the issue of physical habitat for key fish species, studies on the SBR were intended to provide information for selecting a release that incorporates flows for riparian vegetation, sediment flushing, and other hydraulic purposes. Also, the issue of providing a variable flow, modeled after the Index of Hydraulic Alteration (IHA), has been discussed in several ARG meetings.

Riparian Flows

No flows have been proposed for riparian vegetation. With a flow release in the 100 to 200 cfs range, the current riparian vegetation boundary would shift, but the principal species would remain the same. Details of riparian vegetation modeling are found in Section 5.9 (TER 9).

Channel Maintenance Flows

No specific flows for sediment flushing or channel maintenance have been recommended. Swift Reservoir traps most of the sediment from upstream sources, and there are few sources of sediment upstream of Ole Creek. As a result, the channel upstream of Ole Creek has a very coarse substrate with no need for flushing flows. Periodic high flows (>25,000 cfs) have occurred in the SBR since 1958 as a result of spills from the Swift

Dam and the canal spillway. These high flows have transported sediment, removed encroaching riparian vegetation, and during some events, shifted the channel. The high flow events and their effects on the channel will continue under the new license. Therefore, no additional channel maintenance flows appear to be needed.

Variable Flows

Historically, flows in this reach were highly variable on a seasonal and daily basis. It has been suggested that a new flow regime be modeled after the historic variability. The problem with this approach is that the range of flows being modeled (50 to 500 cfs) represents less than 15 percent of the historic regime.

Attempts to mimic original ecosystem conditions are not usually undertaken unless about 70 percent or more of the natural flow volume is available (pers. comm., B. Richter, Nature Conservancy, October 2001). Even with 70 percent or more of the historic flow, it is difficult to reconstruct an ecosystem. In the present case, not only the annual flow volume, but the channel size, substrate, predominant species, and other components would differ markedly from historic conditions. Therefore, using the historic flow variability as a pattern for future releases does not appear to be a useful tool in designing a flow regime for the SBR.

Once an overall flow level is decided upon, it would still be possible to incorporate variation. For example, a specific flow volume could be selected as a fishery flow, but this number would represent an average release. At any given time, the actual release could be higher or lower as long as the average was maintained.

4.2.7 Schedule

This study is complete.

4.2.8 References

Beecher, H. 2000. Guidelines for instream flow studies. Washington Department of Fish and Wildlife, Olympia, Washington.

Bovee, K.D. 1982. A guide to stream habitat analysis using the instream flow incremental methodology. Instream Flow Information paper 12. U.S. Fish and Wildlife Service, FWS/OBS-82/26. 248 pp.

Harza. 1999. Habitat mapping in the Swift Bypass Reach. Study performed for PacifiCorp and Cowlitz PUD. Bellevue, Washington.

Milhous, R.T., D.L. Wegner, and T. Waddle. 1981. User's guide to the Physical Habitat Simulation System. Instream Flow Information Paper 11. U.S. Fish and Wildlife Service, FWS/OBS-81/43. Revised. 475 pp.

PacifiCorp and Cowlitz PUD. 1999, as amended. Study Plan Document for the Lewis River Hydroelectric Projects. Portland, OR and Longview, WA. October 29, 1999, as amended.

PacifiCorp and Cowlitz PUD. 2001. 2000 Technical Study Reports for the Lewis River Hydroelectric Projects: Report on Life History, Habitat Requirements, and Distribution of Aquatic Analysis Species (AQU 1). Portland, Oregon and Longview, Washington.

Stalnaker, C., B.L. Lamb, J. Henriksen, K. Bovee and J. Bartholow. 1994. The instream flow incremental methodology: a primer for IFIM. National Ecology Research Center, Internal Publication. National Biological Survey, Fort Collins, Colorado.

WDFW (Washington Department of Fish and Wildlife). 1998. Salmonid stock inventory appendix: bull trout and Dolly Varden. Washington Department of Fish and Wildlife Fish Program. July 1998.

4.2.9 Comments and Responses on Draft Report

This section presents stakeholder comments provided on the draft report, followed by the Licensees' responses. The final column presents any follow-up comment offered by the stakeholder and in some cases, in italics, a response from the Licensees.

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
TWHB	5	AQU 02	HSI curves	HSI model approach has not proven to be very useful. For example the USFWS SI curves for Chum should be viewed as "hypothetical models of the relation between levels of a particular environmental variable and its corresponding suitability as a habitat. Also, the development of HSI curves is normally done on the basis of available literature. AQU 2-6 indicates that Hardin-Davis developed HSC from literature sources and distributed them to agency reps. The final HSC were apparently done by consensus of those present at that meeting. Where those present on the day of the presentation considered "experts" on HSI models, or the species of interest. It is uncertain if this process would hold up to scientific standards and therefore should not be used. At a minimum the literature review by Hardin-Davis should be included in the appendix and a description of the relationship of those results and the meeting attendees presented. A better approach would be a through literature review. The temperature	HSI models, as incorporated into PHABSIM, are not perfect. Nevertheless, the methodology has been very successful in providing information that helps resolve instream flow issues. A key part of the methodology is having resource agencies and other interested parties provide input into the study plan. In this case, WDFW, WDOE, USFWS, USFS, and NGO representatives all contributed to the study plan (selection of flow models, transect placement, and range of flows to measure). In particular, standard procedures were followed on the HSI curves. Two HSI meetings were held in Lacey, Washington. Prior to the meetings, literature curves were sent to all interested parties. The meetings in Lacey were	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
				report Ann Richter and Steven Kolmes for the Willamette and Lower Columbia Rivers could serve as an example.	attended by Hal Beecher (WDFW), Brad Caldwell (WDOE), and Bob Tuck (YN)(in addition to Tim Hardin and Dave Leonhardt), all of whom have years of experience with HSI curves. At these meetings, the candidate curves were displayed with a projector. The group then adjusted the curves to best suit Lewis River conditions (for example, WDFW and WDOE have different sets of curves based on the size of a river). This is a standard process in a PHABSIM study where on-site curve development is not feasible. Supporting material is provided in Attachment A and includes: 1) summaries of the 2 meetings held in Lacey to reach consensus on the HSI curves; and 2) references for the literature curves that were considered.	
TWHB	1	AQU 02	Swift in stream reach study	This field part of this study will need to be redone since the channel breech caused considerable changes to the physical conditions in the Lewis River Channel. But, even without this	The licensees fully intend to repair the Swift No. 2 Project and until then, do not propose additional surveys. The current conditions in the	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
				event the report does not address desired future conditions. If a decision is reached to restore the areas ecological functions quite a bit of technical work remains. What flow, velocity, and elevation conditions will be required to support a healthy riparian environment to sustain salmonids needs to be determined.	bypass reach are temporary and do not reflect a future condition, so for the purposes of relicensing, the Utilities will not study the effects of the temporary flow regime. If the temporary high flows rearrange conditions such that specific habitat types are present but in different locations, and assuming the ratio of habitat types is the same, then the PHABSIM results should still be valid.	
USDA Forest Service: John Kinney	1	AQU 02	Limited scope in terms of modeled flows (agreed upon by ARG)	Modeled flows provide very little information relative to historical base flow conditions or the 1200 cfs flows currently passing through the channel. We suggest modeling flows that are similar to the historical flow regime (historical base flows through a range that captures potential spill events, as well as the 1200 cfs.) The analyzed flow may not account for all side channel aquatic habitat that would support reintroduced anadromous fish.	The PHABSIM study plan, developed in consultation with the resource agencies, specifically targeted flow releases of 50-300 cfs and simulation flows up to 400-500 cfs. There was never a study plan to measure or model flows beyond these levels. Current flow is temporary and does not pertain to the long-term plan for the Swift bypass reach.	We may need to revisit this study. The current flow situation as a result of the Swift canal breach released entrained Swift reservoir bull trout into Yale. Those fish are probably attempting to migrate upstream to their natal streams. In other words, those fish are more than likely located in the SBR (under current conditions). That means an ESA listed fish is occupying historical aquatic habitat that contains a portion of Federally managed public

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
						land.
WDFW – JIM BYRNE	1	AQU 02	Swift Bypass.	No real data. All output in form of WUA as directed. What is the value of the WUA as an assessment tool?	WUA is a standard assessment tool in instream flow studies. It is an estimate of the response of fish habitat to flow. Interpretation of WUA curves is generally done to provide recommended flow regimes.	
J. Sampson, Technical Advisor to the Conservation Groups	1	AQU 02-7 para 3	"… it is difficult to optimize flows for a large number of species and life stages simultaneously. "	This statement contradicts available scientific literature indicating that, within certain bounds, variation in river flows results in maximum biological diversity (Pollock et al. 1998; cites of Richter 1996, Richter et al. 1997). This information indicates that following natural patterns of variation in flows would be the best way to maximize benefits for a large number of species, including invertebrates, plants, and fish. This statement should be deleted, and a summary of the review of Pollock et al. (1998) and Pollock (1998) should be provided in this discussion.	WUA curves show the relationship between discharge and physical habitat for each life stage. The statement means that it is not possible to maximize more than one life stage, and that balancing, or optimizing, several life stages at once is difficult. Maximizing diversity of fish species can be done by considering all the WUA curves and picking flows that are compatible with the greatest number of them	
WDFW – KAREN KLOEMPKEN	1	AQU 02-10 – 11 para 1	Channel Maintenance Flows.	If anadromous reintroduction takes place, there will need to be more information on channel maintenance flows. Also if the SBR is used to enhance bull trout populations there will be a great need to change the way the	A discussion of high flows in the Swift bypass reach under current operations is included on page WTS 4-10 in the Swift Bypass Reach Synthesis report. High flows in the reach are dictated by flood control operations	

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
				current flow event affect the channel. There is still a need for channel maintenance flows, that need has not been met.	under the current license articles and are, in themselves, maintenance flows	
WDFW – KAREN KLOEMPKEN	1	AQU 02-11	Variable Flows.	The use of "average release" numbers for water flow is not the best way to monitor "fishery" flows. Fifteen-minute intervals provide better monitoring. With an average flow, there may be times when redds will be exposed or flows are too high for juveniles to maintain their position and not be swept out to the reservoir. There is still a need to quantify what range of flows are needed.	If variable flows are proposed, they should be tied to an average flow release and should not cause major adverse impacts, such as dewatering redds or flushing juveniles into the reservoir.	
USDA Forest Service: John Kinney	1	AQU 02-11 para 1	Channel Main. Flows	I could not find information (referenced or otherwise) that described the frequency and magnitude of spill events, and its effects on the SBR. I need to see a better discussion relative to the last sentence in paragraph 1.	The magnitude and frequency of spills in the Swift bypass reach are described on page WTS 4-10 and in Figure 2.4-6.	What about my second initial comment? **Licensees' Response**: *We apologize for overlooking this initial comment about the following sentence: "The problem with this approach is that the range of flows being modeled (50 to 500 cfs) represents less than 15% of the historic range." Based on discussions in ARG meetings in early 2000, it was agreed to collect PHABSIM data (depths and velocities at numerous cross-sections) at releases of about 50, 120, and 300 cfs. The*

Commenter	Volume	Page/ Paragraph	Statement	Comment	Response	Response to Responses
						actual releases during field measurements were 68, 134, and 290 cfs. With these measurements, flows were able to be modeled in the 50 to 500 cfs range.
J. Sampson, Technical Advisor to the Conservation Groups		AQU 02-11 para 4	"If a variable flow is adopted, it should be done in the context of managing the reach for important fish species. Proposed variation in flow should be based on quantifiable ecosystem benefits, and the results should be monitored."	This statement is not a direct conclusion of the data, and should therefore be deleted. This statement, which makes value judgments (adoptions of variable flows should be directed at single species management) but which does not reflect all the values of all of the participants, should not be included in the 2001 Technical Report. Moreover, all of the possible ecological values related to variable flows are not described. Therefore, this discussion of the mitigation options of variable flows and restoration of flows to the bypass is not complete, and for that reason it should not be presented at all. By stating what such mitigation options should do, while not fully exploring what they can do, the language attempts to discredit alternative views, and thereby pre-empt full discussion of alternative mitigation and enhancement measures.	This statement follows from the IFIM/PHABSIM study design. We set out to find the relationship between discharge and physical habitat for fish species. When variable flow came up in discussions within the ARG, we talked about setting some average flow level based on the WUA curves, and possibly designing variation around that average. The first sentence was meant to convey the idea that flow variation should not include highs or lows that would severely affect WUA. The second sentence means that a flow-variation proposal should have a stated ecosystem objective.	Verbal comments to Frank Shier (PacifiCorp) on 10/1/02 reiterated disagreement that this statement is appropriate. **Licensees' Response**: *The statement has been deleted from the report.*