
BAKER RIVER PROJECT RELICENSE

Aquatic Resources Group

January 10, 2006

9:00 a.m. – 2:00 p.m.

USFS Supervisor's Office

21905 64th Avenue W

Mountlake Terrace, WA

(425) 775-9702

Conference Call Procedures-Dial In Info :

1-866-297-7238 (toll free number)-Dial in at the designated date and time –

Conference ID: **278284**

Conference Password: **2685**

DRAFT AGENDA

1. Review Agenda, Notes, Actions	9:00 – 9:15
2. Fish Facilities Operations Topics <ul style="list-style-type: none">• Sockeye Spawning Beach & Artificial Incubation Operations• Fish Rearing Inventories & Releases• Adult Trap Protocol Update or Changes• Imprinting/Release Sites for Chinook study	9:15 – 10:30
<i>Break at 10:30</i>	
3. Update on Early Implementation Activities <ul style="list-style-type: none">• Fish Propagation Facilities• Fish Passage Technical WG Report	10:45 - 11:30
<i>Lunch (provided)</i>	
4. Relicense Studies Update <ul style="list-style-type: none">• A-38 Native Char Investigations (prelim. 2005 field results)• A-09 Instream Flow (draft report progress update)	12:00 - 1:30
5. BRICC/FERC DEIS Update	1:30 - 1:45
6. Confirm Date (March 14) & Agenda for Next Meeting, Evaluate the Meeting	1:45 - 2:00



Baker River Hydroelectric Project

(FERC No. 2150)

Washington

MIDDLE SKAGIT RIVER CHINOOK SPAWNING SURVEYS

2005 Study Results

Final Draft

Prepared by:

R2 Resource Consultants, Inc.

15250 NE 95th Street

Redmond, Washington 98052-2518

Prepared for:

Puget Sound Energy, Inc.

10885 NE 4th Street PSE-09

Bellevue, Washington 98004-9734



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MIDDLE SKAGIT RIVER CHINOOK SPAWNING SURVEYS 2005 STUDY RESULTS December 2005

INTRODUCTION

As part of Section 7(a)(2) consultations between the Federal Energy Regulatory Commission and the National Marine Fisheries Service (NOAA Fisheries), Puget Sound Energy (PSE) is voluntarily monitoring the timing and distribution of Chinook salmon spawning in the middle Skagit River, Washington. Operation of PSE's Baker River Hydroelectric Project affects flow in the middle Skagit River and monitoring efforts were conducted to assess the relationship between Skagit River flows and salmon spawning success.

The Baker River Project, FERC No. 2150 (the "Baker Project"), is owned and operated by Puget Sound Energy, Inc. ("PSE"). The Baker Project consists of two hydroelectric generating developments; both located on the Baker River, in Washington State. Construction of the Lower Baker Development, including the Lower Baker Dam at River Mile (RM) 1.1, was completed in 1925 prior to the enactment of the Federal Power Act. In 1927, the Federal Power Commission (now known as the Federal Energy Regulatory Commission or "FERC") issued a license to Puget Sound Power & Light Company (now known as PSE) to operate the Lower Baker Development. The Federal Power Commission subsequently issued a License in 1956 to construct the Upper Baker Development. The License combined the operations of both developments into a single federal license for the Baker River Project (Figure 1). Construction of the Upper Baker Development, including the Upper Baker Dam at River Mile (RM 9.2), was completed in 1959.

The existing Baker Project license expires in April 2006. Puget Sound Energy filed an application to relicense the Project in April 2004 and a Settlement Agreement was filed with the FERC on November 30, 2004. In advance of relicensing of the Project, PSE (as the prospective license applicant) initiated informal consultation as the non-federal designee under Section 7 of the Endangered Species Act (ESA). Under Section 7, "a federal agency shall consult with the Secretary [of Commerce or Interior, as appropriate] on any prospective agency action at the request of, and in cooperation with, the prospective permit or license applicant if the applicant has reason to believe that an endangered species or threatened species may be present in the area affected by his project and that implementation of such action will likely affect such species." 16 USC §1536(a)(3). The Puget Sound Evolutionarily Significant Unit of Chinook salmon and the Coastal-Puget Sound Distinct Population Segment of bull trout are the only salmonid species in the Skagit Basin currently protected under the Endangered Species Act.

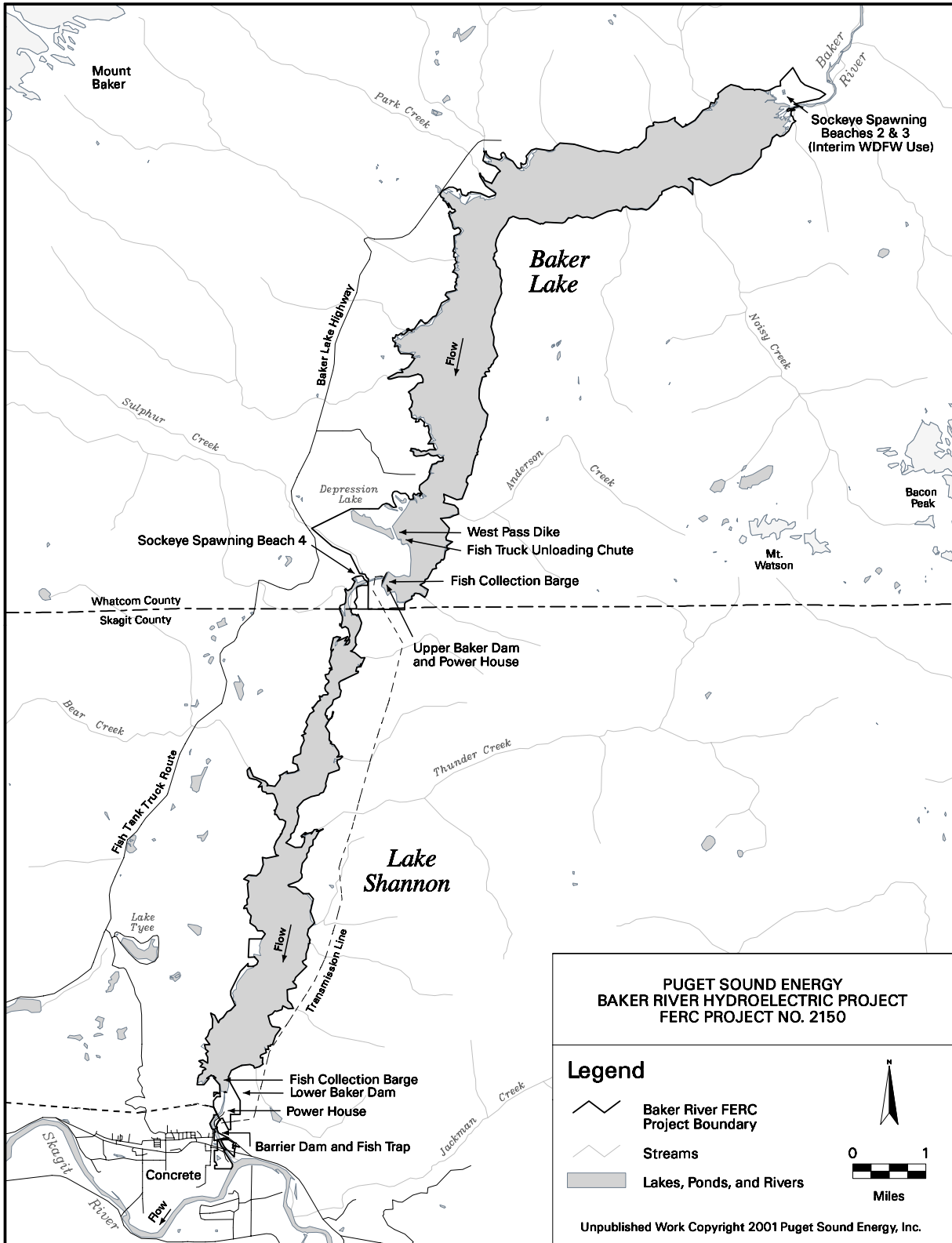


Figure 1. Baker River Hydroelectric Project, Concrete, Washington.

By letter dated March 5, 2001, the FERC authorized PSE to act as its non-federal designee in consultation with NOAA Fisheries and the U.S. Fish and Wildlife Service (USFWS), subject to limitations described in the FERC order. By letter dated June 13, 2002, Puget submitted an application to the Commission for Amendment of License to modify project operations during the interim period prior to license expiration in April 2006. In their application for License Amendment, PSE proposed modifications to current operations to be implemented during the interim period (prior to expiration of the license) and provided a draft biological assessment of the effects of Project operations on Chinook salmon.

Based on the analysis and conclusion of the biological assessment, the FERC concluded that the interim operation of the Baker Project and its proposed interim conservation measures were likely to adversely affect listed Puget Sound Chinook salmon in the Baker and Skagit rivers, and requested initiation of formal consultation under Section 7 of the ESA. On August 14, 2002, NOAA Fisheries received a copy of the biological assessment from the FERC addressing the effects of Baker Project operations on Puget Sound Chinook salmon and the proposed interim protection plan. The interim protection plan described operations and actions to be implemented prior to expiration of the current license in April 2006. After a series of letters, meetings and conference calls with NOAA Fisheries, USFWS, FERC and PSE representatives, PSE presented an analysis of modified start and end dates for the proposed interim protection plan and proposed adjusting the location for monitoring Skagit River flows that would trigger changes in Baker Project flow releases. NOAA Fisheries subsequently submitted a draft Biological Opinion on May 28, 2004 that included the proposed adjustments to the interim measures. The draft Biological Opinion also included eleven Terms and Conditions to be implemented in order to minimize take. One of the conditions stated that PSE must monitor salmon redds in the middle Skagit River:

“9.4 Terms and Conditions

In order to be exempt from the take prohibitions of Section 9 of the ESA and regulations issued pursuant to Section 4(d) of the ESA, FERC must include in the license amendment and PSE must implement the following terms and conditions, which implement the RPMs [reasonable and prudent measures] listed above. These terms and conditions are non-discretionary.”...

6. “PSE will conduct a monitoring program to document the number of redds exposed by project operations and submit an annual report of the results of this monitoring to NOAA Fisheries by January 1 of each year. NOAA Fisheries will review and approve the monitoring plan before implementation.”

In response to the draft Biological Opinion, PSE voluntarily began monitoring Chinook redds in the middle Skagit River consistent with Condition No. 6. These efforts were complementary to salmonid spawning surveys conducted by PSE as part of relicensing of the Baker River Project.

By letter dated October 25, 2004, NOAA Fisheries issued a final Biological Opinion for ESA Section 7 consultation addressing interim operations (prior to a new FERC license) of the Baker Project. In its Biological Opinion (Consultation No. 2002/01040), NOAA Fisheries identified reasonable and prudent measures, including a condition requiring PSE to monitor Chinook spawning in the middle Skagit River in response to a License Amendment. As of December 2005, the FERC has not issued an amendment to the existing Baker River Project License.

This report presents the results of Chinook spawning surveys conducted in the fall of 2005 and an analysis of the risk of dewatering of Chinook redds constructed during the fall 2005 spawning season. Operation of the Baker Project affects flows in the lower 1.1 miles of the Baker River, and affects flows in the mainstem Skagit River downstream of RM 56.5. The mainstem Skagit River is also affected by operation of Seattle City Light's Skagit River Hydroelectric Project (FERC No. 553), located approximately 40 miles upstream of the Baker River's confluence with the Skagit River. In addition to flow fluctuations associated with operation of the hydroelectric projects, the mainstem Skagit River is subject to natural flow fluctuations in response to rainfall, and diurnal flow fluctuations as a result of glacial and snowfield meltwater in the Sauk River. Due to the complexity of isolating the source of flow fluctuations, no attempt was made to isolate the effects of Baker River Project operations and Chinook spawning activity in the middle Skagit River.

BACKGROUND

Operation of the Baker Project affects flows in the lower 1.1 miles of the Baker River, and affects flows in the mainstem Skagit River downstream of RM 56.5. The mainstem Skagit River is also affected by operation of Seattle City Light's Skagit River Hydroelectric Project (FERC No. 553) (the "Skagit Project") located approximately 40 miles upstream of the Baker River's confluence with the Skagit River. Both the Baker Project and the Skagit Project are typically operated as load-following plants. Baker typically operates once or twice a day, usually during mornings (i.e., 0500 to 0900) and evenings (i.e., 1700 to 2300). These periods of operation vary daily, weekly and seasonally in response to power demands and power value. For instance, electrical demand is generally higher Monday through Friday and in response, the Project may not operate during the weekend. Daily peaking operations may cause flows in the Lower Baker River to fluctuate up to 4,200 cfs.

The Skagit River basin is the largest watershed in the Puget Sound and supports spawning populations of Chinook (*Oncorhynchus tshawytscha*), chum (*O. keta*), pink (*O. gorbuscha*), sockeye (*O. nerka*), and coho (*O. kisutch*) salmon, cutthroat (*O. clarki*) and steelhead (*O. mykiss*) trout and bull trout (*Salvelinus confluentus*) and Dolly Varden (*S. malma*). Many of the salmonid populations within the Skagit River system are considered healthy; however, Chinook salmon and bull trout are listed as threatened under the ESA. Characteristics of salmonid spawning in the Skagit River system can vary dramatically between species and location within the river system. Management efforts by tribes and Washington Department of Fish and

Wildlife provide information on salmonid timing and distribution in the Skagit River Basin. Information regarding salmonid spawn timing and distribution specific to the Upper Skagit River basin are available as a result of licensing activities of the Skagit River Project. Data specific to the middle Skagit River below the Baker River confluence were recently gathered as part of relicensing of the Baker River Hydroelectric Project.

Data on Pacific salmon species (Chinook, pink, chum and steelhead) spawning in the middle Skagit River between the Baker River confluence (RM 56.5) and the pipeline crossing above Sedro Woolley (RM 24.5) were presented in the Baker relicensing report A-09c [www.pse.com/hydro/baker/studies/aquaticreports/A09c] and in a Baker Relicensing Summary Instream Flow Report (*in progress*). In addition to summarizing available information on the timing and distribution of anadromous salmonid spawning in the middle Skagit River, data were presented that were gathered during spawning surveys of the middle Skagit River conducted annually during 2001 through 2004. These surveys provided information to evaluate assumptions regarding spawn timing and distribution and to identify redd depths and lateral locations within middle Skagit River habitats. Aerial and jet boat surveys were conducted approximately every two weeks beginning prior to the anticipated start of spawning and continuing through the observed end of spawning. Scheduling of specific survey dates was dependent upon middle Skagit River flow and visibility conditions. Flow in the study reach was monitored using the USGS gage on the Skagit River near Concrete (USGS No. 12194000), while visibility in the middle Skagit River was checked by Puget Sound Energy staff below the mixing plume of the confluence of the Baker and Skagit rivers. Decisions regarding the ability to effectively conduct surveys were based on these observations. The visibility requirement for surveys was defined as the ability to differentiate substrate types at a minimum water depth of 2.5 feet.

Biologists conducting annual Baker relicensing surveys during 2001 through 2004 observed Chinook, pink, chum, and steelhead spawning in the middle Skagit River. Fall Chinook migrate to the Skagit River from mid-July to early October and were observed spawning from early September to mid-November in the middle Skagit River (Table 1). Pink salmon spawning in the middle Skagit River started in early September and continued to late October, and chum salmon were observed spawning mid-October through late December. Coho salmon primarily use tributary streams and side channels for spawning and were not observed during PSE mainstem spawning surveys. The Baker River run of sockeye salmon is the only known sustaining population in the Skagit River Basin. Sockeye migrate up the mainstem Skagit River during June through August, with peak numbers collected at the Baker River trap in mid-July. All sockeye entering the Baker trap are transported and released upstream into artificial spawning beaches or released to spawn naturally in Baker Lake tributaries.

Table 1. Middle Skagit River Salmonid Periodicity.

Species / Lifestage	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul
Chinook spawning ^(a, 1)		10 25	31	15								
Chinook incubation ⁽²⁾												
Chinook peak alevin ^(a, 3)												
Chinook fry <50 mm ^(a, 2,4)												
Pink spawning ^(a, 1)		10 20	20									
Pink incubation ⁽²⁾												
Pink peak alevin ^(a, 3)												
Pink fry <50 mm ^(a, 2,4)												
Chum spawning ^(a, 1)			15	1	5	31						
Chum incubation ⁽²⁾												
Chum peak alevin ^(a, 3)												
Chum fry <50 mm ^(a, 2,4)												
Steelhead spawning ^(a, 1)								15	11	15	31	
Steelhead incubation ⁽²⁾												
Steelhead peak alevin ⁽³⁾												
Steelhead fry <50 mm ^(a, 2,4)												
Steelhead yearlings												
Middle Skagit monthly water temperature (°C) ^(b)	13.0	11.7	10.3	8.0	5.6	4.2	4.3	5.0	6.7	8.1	9.8	11.8

(a) **Off-peak** **Peak** (b) **<8°C** **≥8°C**

(1) Middle Skagit River Salmonid Spawning Surveys, Report to the Baker Relicensing Aquatic Resources Working Group, dated October 2003.

(2) Middle Skagit River Juvenile Salmonid Timing and Distribution, Report to the Baker Relicensing Aquatic Resources Working Group, dated February 2003.

(3) Assuming 30 days prior to peak abundance of newly emerged fry.

(4) Presence of fry less than 50 mm length may reflect downstream movement from spawning sites upstream of the Baker River confluence.

STUDY OBJECTIVES

Four primary study objectives were identified in response to Condition No. 6 of the NOAA Fisheries Biological Opinion:

1. Measure the distribution and depth of Chinook salmon redds in the middle Skagit River to evaluate the risk of dewatering associated with mainstem Skagit River flows.
2. Collect additional data on the annual variability in the start, peak and end of salmon spawning to confirm assumptions of periodicity used to support timing of instream flow measures.
3. Collect additional data to improve baseline database on salmon spawning in the middle Skagit River to identify changes in salmon behavior that might influence timing of instream flow measures.
4. Record observations of adult and sub-adult char in the middle Skagit River.

Understanding the start, peak and end of salmon redd construction in the middle Skagit River would help identify flows that occurred during salmon spawning periods. Identifying flows that occur during the spawning season would allow PSE to estimate the proportion of redds at risk of dewatering during low flow conditions and during the subsequent incubation season. Although Baker River Project operations affect flows in the middle Skagit River, flows in the middle Skagit River are also affected by flow management associated with Seattle City Light's Skagit River Project and natural flow fluctuations associated with Skagit River tributaries such as the Sauk River. Isolating the effects of the Baker River Project on the number of redds at risk of dewatering or scour was beyond the scope of this study. In addition, data collected from this study was not used to develop estimates of adult salmon escapement for the middle Skagit River.

FIELD METHODS

Field methods for conducting salmon spawning surveys in the middle Skagit River were similar to those employed during PSE surveys conducted during Baker relicensing studies. Aerial flights (fixed wing) were conducted in conjunction with jet boat surveys in order to locate, identify, and measure salmon redds throughout the spawning period. Survey flights were conducted over a broader reach of the Skagit River, between the Sauk River confluence (RM 67.2) and the pipeline crossing above Sedro Woolley (RM 24.5), than the boat surveys so that comparisons of spawn timing could be made between areas upstream and downstream of the Baker River confluence (RM 56.5). Aerial survey flights were used to determine spawn timing, obtain redd counts, and map redd distributions within the survey reach. Flights were scheduled approximately every two weeks from September through December (Table 2); however, flights were only conducted when water clarity in the mainstem Skagit River allowed substrate particle

sizes to be discerned at water depths of at least 2.5 feet. Redd counts and records of redd distributions obtained during aerial surveys were used to facilitate location and measurement of redds during subsequent jet boat surveys. Jet boat spawning surveys were conducted as soon as possible after an aerial survey flight.

Table 2. Proposed middle Skagit River salmon spawning survey timing, type of survey and survey area in response to NOAA Fisheries Condition No. 6. Timing and intensity of survey effort changed based on weather, turbidity and middle Skagit River flow conditions.

Survey Timing	Survey Type	Coverage Area
Late August/early September	Fixed Wing	Sauk River to pipeline
Mid to Late September	Fixed Wing / Jet Boat Combo	Baker River to pipeline
Early October	Fixed Wing / Jet Boat Combo	Baker River to pipeline
Mid October	Helicopter / Jet Boat Combo	Baker River to pipeline
Late October	Fixed Wing / Jet Boat Combo	Baker River to pipeline
Mid November	Fixed Wing / Jet Boat Combo	Baker River to pipeline
Late November	Fixed Wing / Jet Boat Combo	Baker River to pipeline
Mid December	Fixed Wing / Jet Boat Combo	Baker River to pipeline
Late December	Fixed Wing	Sauk River to pipeline

Individual redds were measured either directly from the deck of a jet boat or on foot. Redd measurements and observations were recorded for each of the salmon species observed spawning in the middle Skagit River. Redd data recorded during jet boat spawning surveys included redd location (longitudinal and lateral), depth of wetted redds, elevation of dewatered redds relative to mainstem river stage, and time of redd measurement. Additional microhabitat data, such as velocity, substrate and cover, that are typically used in support of instream flow studies were not collected since the results of the instream flow study conducted during relicensing of the Baker Project were already available.

The longitudinal location of each measured redd within the survey reach was recorded to the nearest 0.1 river mile and distance to the nearest Baker relicensing instream flow study transect was also recorded (Figure 2 and 3). The lateral position of each redd within the river channel was also measured as distances from the redd to the active bankfull river margins. Distances were measured with a laser rangefinder, which displayed measurements to the nearest even yard (e.g., 19.1 yards = 20 yards). Redd depths were recorded to the nearest 0.1 foot with a graduated rod. Elevation of dewatered redds were surveyed relative to the adjacent water surface elevation using an auto level, tripod and stadia rod, and recorded to the nearest 0.01 foot.

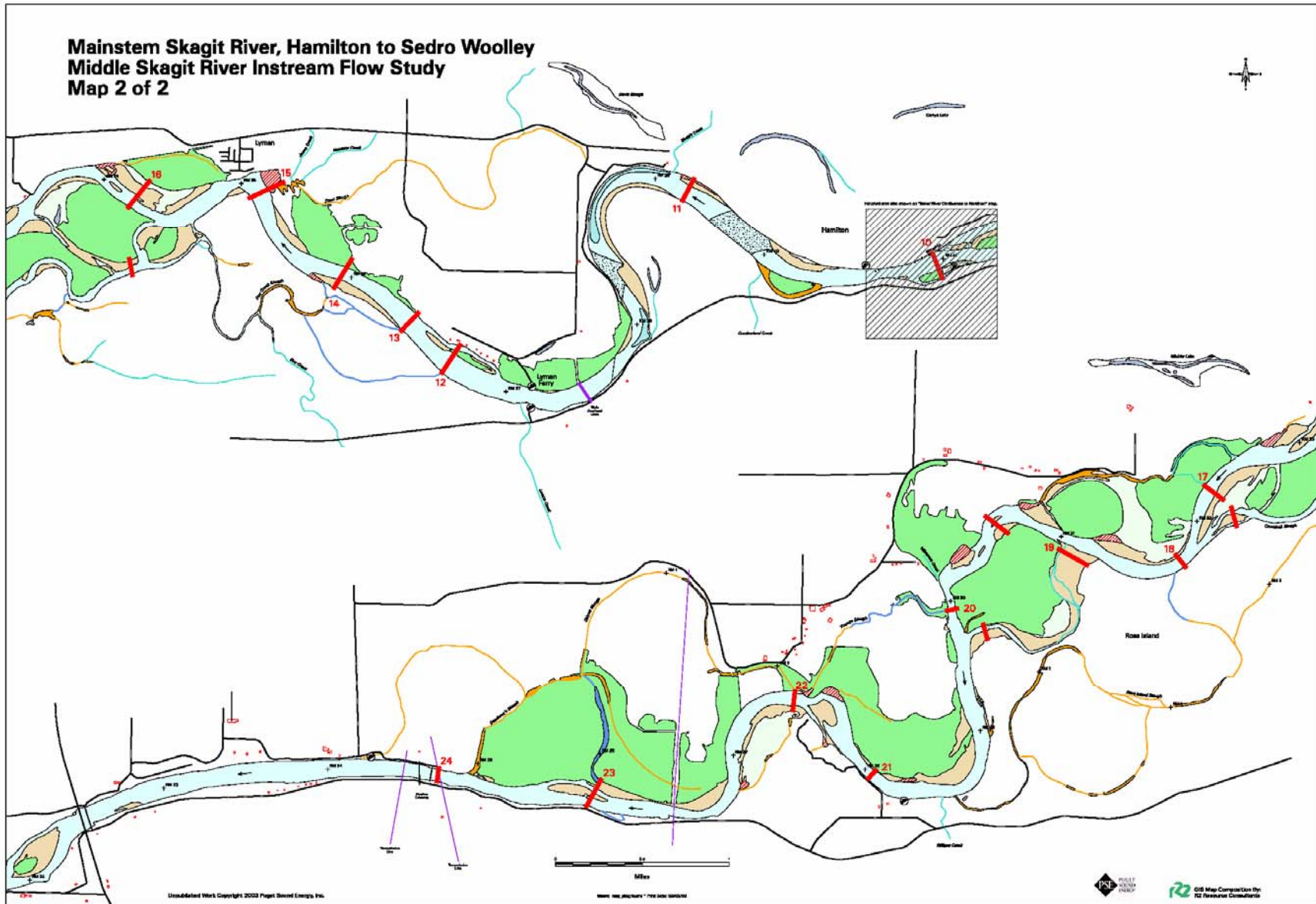


Figure 3. Mainstem Skagit River, Hamilton (RM 40.5) to Sedro Woolley (RM 24.5) and location of Baker relicensing instream flow transects.

Redd depths and elevations were recorded at the level of the undisturbed gravel around the redd (Figure 4). Undisturbed gravel depth reflects the water depth prior to redd construction, and was measured adjacent to the redd on substrate not impacted by redd excavation. The depth of egg pockets within a redd are typically estimated in relation to the disturbed tailspill or to the level of original, undisturbed substrate. Redd depth in relation to the level of adjacent, undisturbed gravel provided a consistent repeatable measurement, whereas measurement of the depth of the pit or tailspill could be greatly affected by operator selectivity or by antecedent water velocities in the vicinity of the redd. Any dewatered Chinook redds observed during the surveys were marked with painted bricks to avoid duplicate redd measurements.

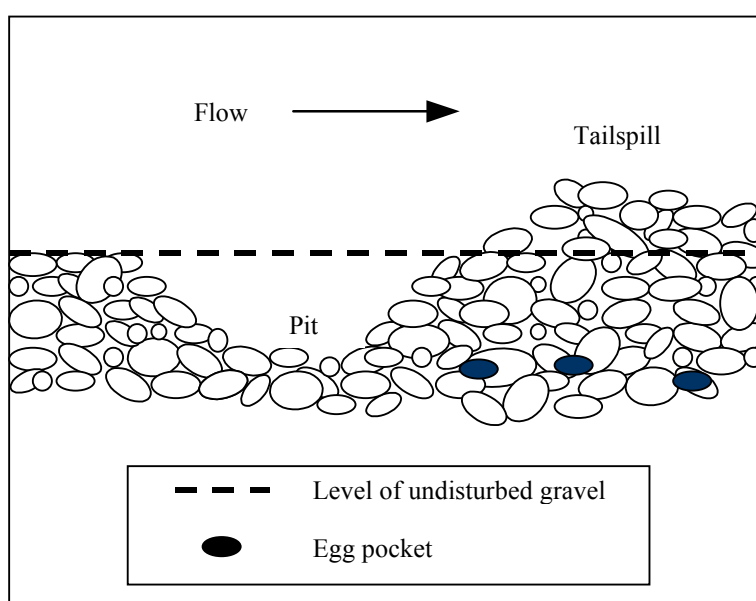


Figure 4. Depth of salmonid redd to be measured at surface level of undisturbed gravel (adapted from DeVries 1997).

Where mass-spawning activity prevented accurate measurement of individual redds, a rough estimate of the proportion of redds potentially dewatered under various flows was developed from measurement of salmon spawning areas. In response to a suggestion from Stan Walsh of the Skagit River System Cooperative, an estimate of the proportion of wetted:dewatered redds in mass spawning areas was developed for the middle Skagit River using procedures employed by surveyors in upper mainstem Skagit River habitats. Rather than measuring individual redds, several areas of dense spawning activity were identified based on aerial surveys. Measurement of redd depths, distance from the channel margin, and elevation in relation to the water surface were collected along transects evenly spaced through the spawning area. Each transect was started at the edge of potential spawning habitat (e.g., river bank), and continued to the edge of

observed redds. Within each transect line, the stationing of and density of redds was recorded and the elevations/depths of redds were surveyed relative to the water surface elevation with an auto level, tripod and stadia rod. Based on measured site dimensions, redd elevations and the calculated middle Skagit River flow at the time of survey, the area of wetted redds was calculated and referenced to a flow at the Skagit River gage near Concrete. Using the site dimensions and the density of redds observed along the transects, the number of redds at risk of dewatering was calculated for incremental changes in mainstem Skagit River flow.

DATA ANALYSIS

Data analysis procedures used in the 2005 spawning survey efforts were similar to those described in the Baker Project relicensing middle Skagit River spawning survey reports (See A-09c interim reports [www.pse.com/hydro/baker/studies/aquaticreports/A09c]). The number of redd measurements obtained during the annual fall surveys is dictated by the escapement for each species and by flow and weather conditions. Dry weather and low flow conditions during the fall of 2002 persisted through mid-November providing excellent survey conditions for Chinook salmon spawning. During the fall of 2002, 605 individual Chinook redds were measured. In contrast, an October 2003 storm event raised flow in the mainstem Skagit River for an extended period and poor visibility conditions persisted through the remainder of the November and December spawning season (Figure 5). Only 62 Chinook redds were measured during the fall of 2003. During the fall of 2005, flows in the middle Skagit River, measured at the USGS gage Skagit River near Concrete, were recorded along with estimates of water clarity observed by PSE on-site staff.

Redd depth measurements were used to calculate the flow that would cause dewatering of each measured redd based on the depth of water over the undisturbed channel bed. No attempt was made to estimate actual egg pocket depths, therefore calculations of redd dewatering flows tended to overestimate the proportion of redds dewatered at a specific flow. The redd incubation flow represents the discharge of the Skagit River at the USGS gage near Concrete at which the redd would remain wetted through the period of egg incubation. Incubation flows were calculated using stage:discharge relationships specific to individual middle Skagit River PHABSIM transects. Stage:discharge relationships were developed at 23 transects in the middle Skagit River between the Baker River confluence (RM 56.5) and the pipeline crossing above Sedro Woolley (RM 24.5), as part of Baker Relicensing study A-09 (Figures 2 and 3). Transect stage:discharge relationships were used to calculate incubation flows at individual redds based on the proximity of the redd to a transect and the type of channel in which the redd and transect were located.

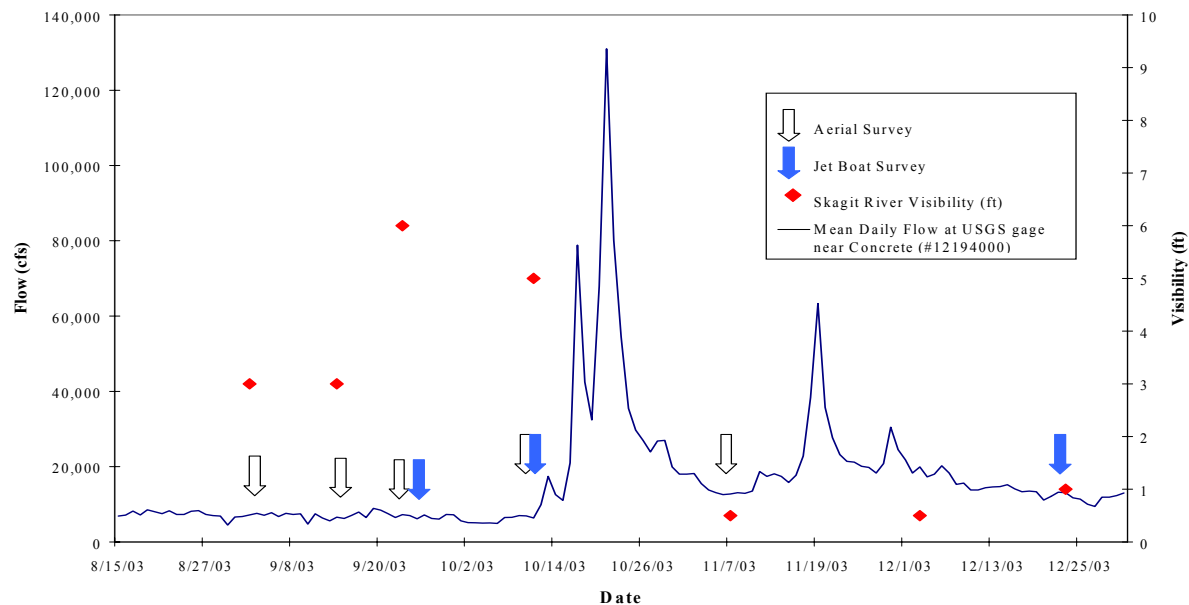


Figure 5. Fall 2003 salmon spawning survey dates in relation to mean daily flow and visibility in the middle Skagit River (USGS gage near Concrete No. 12194000).
(Source: www.pse.com/hydro/baker/studies/aquaticreports/A09c)

During periods of unsteady flow and at redd sites several miles downstream of the USGS gage near Concrete, the flow recorded at the gage does not correspond to the mainstem flow level at the time and location of the redd measurement. Water travel times and accretion flows developed as part of the Baker relicensing instream flow study were used to calculate the Skagit River discharge at the location and time of each redd measurement. Water travel times in the middle Skagit River were calculated using the flow routing model developed as part of the Baker Relicensing instream flow study [www.pse.com/hydro/baker/studies/aquaticreports/A04/ Baker Skagit River FlowGaging]. The flow routing model was also used to approximate the level of flow accretion to individual spawning sites. Flows calculated for individual redd measurement in middle Skagit River reflected flow data for the USGS gage site, adjusted for travel time, and an approximate accretion flow. Once the flow at a redd site at the time of measurement was established, the stage:discharge relationship at the proximal instream flow transect was used to identify the flow at which the redd would be dewatered. This flow was then back-calculated to the USGS gage site to normalize the flow measurement site for all measured redds.

2005 STUDY RESULTS

Weather and flow conditions in the middle Skagit River through much of the 2005 Chinook spawning period precluded the scheduling of aerial or jet boat surveys in the survey reach (Figure 6). Short-term high flow events in middle Skagit River streamflow resulting from heavy rainfall in late September, October, and November hindered survey efforts. Elevated Skagit River stage and reduced water clarity in October and November following the freshets limited surveyors' ability to identify and measure spawning areas. Flow in the survey reach receded in late November and December, but water clarity hindered sampling efforts. An aerial flight was conducted on 6 December and a jet boat survey conducted on 14 December in an effort to take advantage of low flow conditions during December.

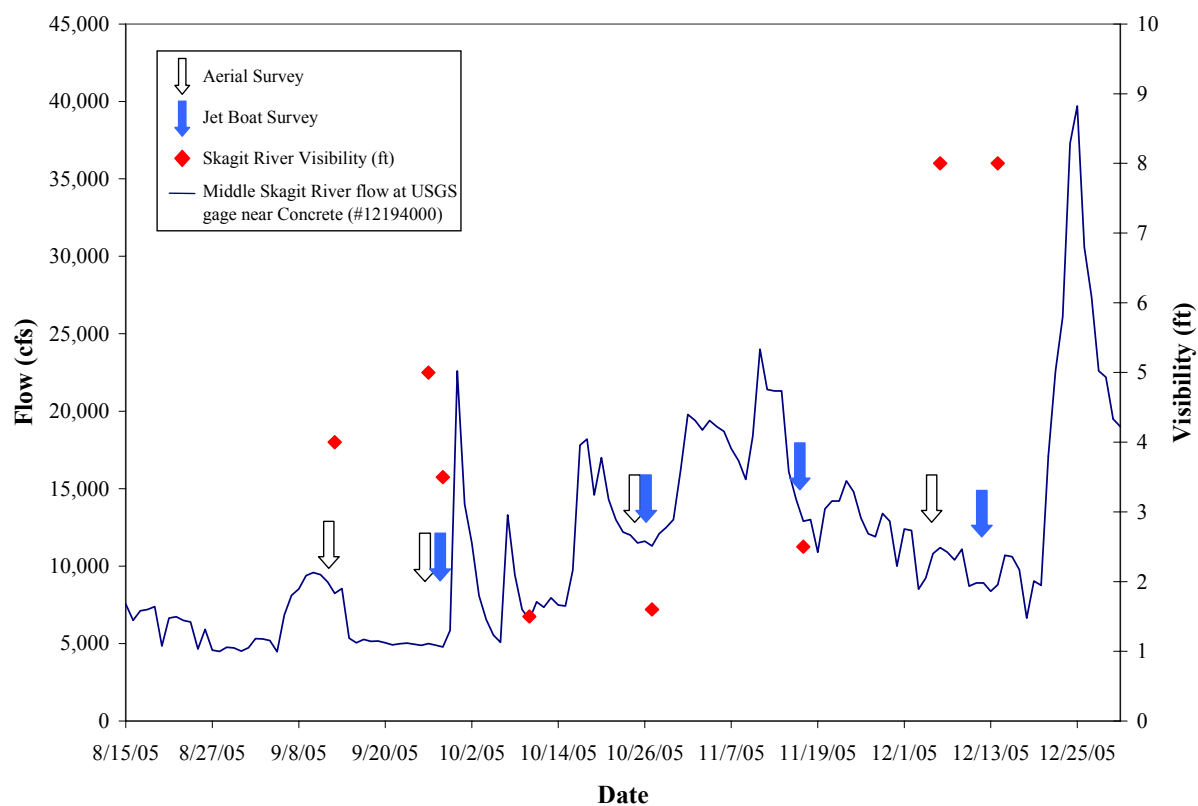


Figure 6. Fall 2005 salmon spawning survey dates in relation to mean daily flow and water clarity in the middle Skagit River (USGS gage Skagit River near Concrete No. 12194000).

A total of four aerial and four jet boat surveys were conducted in 2005 in the middle Skagit River. Spawning surveys in 2005 were initiated on 13 September and continued through 14 December (Table 3). One jet boat survey was conducted on 18 November without a previous aerial survey due to heavy fog and low clouds during the period leading up to the jet boat survey

that prevented surveyors from flying small aircraft in the middle Skagit River survey reach. In the absence of aerial survey observations, surveyors located Chinook and chum redds during the 18 November jet boat survey based on historic spawning locations. Each jet boat survey conducted in 2005 covered the entire survey reach from the Baker River confluence (RM56.5) to the pipeline crossing above Sedro Woolley (RM 24.5), with the exception of the final survey on 14 December which covered from the Baker River confluence (RM 56.5) to the Hamilton boat launch (RM 40.5).

Table 3. Fall salmon spawning survey schedule in 2005 including survey date, type, length, and water depth visibility conditions for each survey.

2005 Survey Date	Survey Type	Survey Length	Visibility (ft)
September 13	Fixed Wing	Sauk River to Sedro Woolley	4
September 26	Fixed Wing	Sauk River to Sedro Woolley	5
September 28	Jet Boat	Baker River to Sedro Woolley	3.5
October 25	Fixed Wing	Baker River to Sedro Woolley	2
October 27	Jet Boat	Baker River to Sedro Woolley	1.6
November 18	Jet Boat	Baker River to Sedro Woolley	2.5
December 6	Fixed Wing	Baker River to Sedro Woolley	8
December 14	Jet Boat	Baker River to Hamilton launch	8

Chinook spawning in 2005 was first observed on the 13 September aerial survey and was observed to continue through October (Table 4). Chinook redds were last observed during the 27 October jet boat survey, however high Skagit River turbidity during this survey limited surveyors' ability to completely assess the degree of Chinook spawning in the survey reach. No Chinook carcasses or active Chinook spawning were observed during the 18 November jet boat survey. It was difficult to discern the peak and end of Chinook spawning since the extent of observations in October and November were restricted by high turbidity levels. However, based on the absence of actively spawning Chinook in the survey reach during the 18 November survey, it is assumed that the end of the 2005 Chinook spawn period was likely in late October or early November.

The longitudinal distribution of Chinook redds in the middle Skagit River in 2005 extended from RM 55.3 downstream to RM 29.0 (Figure 7). Based on the peak aerial redd count on 27 September 2005, in which surveyors recorded 65 redds, the majority of observed Chinook redds (61) were constructed between the Baker River confluence (RM 56.5) and the town of Lyman (RM 35.0). A similar longitudinal distribution of Chinook redds was observed during the peak 2004 redd count recorded on 27 October, in which 368 redds were recorded (Figure 7). Consistent with the distribution of Chinook redds observed in 2002, 2003, and 2004, a large

portion (71%) of the 65 Chinook redds recorded during the 27 September survey were observed to occur between the Finney Creek confluence (RM 47.5) and the town of Lyman (RM 35.0).

Table 4. Number of Chinook redds observed and measured in the middle Skagit River in 2005 during aerial and jet boat surveys.

2005 Survey Date	Survey Type	Survey Length	Number of Chinook Redds	
			Observed	Measured
September 13	Fixed wing	Sauk River to Sedro Woolley	8	-
September 26	Fixed Wing	Sauk River to Sedro Woolley	65	-
September 28	Jet Boat	Baker River to Sedro Woolley	25	25
October 25	Fixed Wing	Baker River to Sedro Woolley	10 ¹	-
October 27	Jet Boat	Baker River to Sedro Woolley	5 ¹	5 ¹
November 18	Jet Boat	Baker River to Sedro Woolley	0	0
December 6	Fixed Wing	Baker River to Sedro Woolley	0 ¹	-
December 14	Jet Boat	Baker River to Sedro Woolley	0 ²	0 ²

¹ Reduced Skagit River visibility limited surveyors' ability to identify redds.

² New redds observed were chum rather than Chinook.

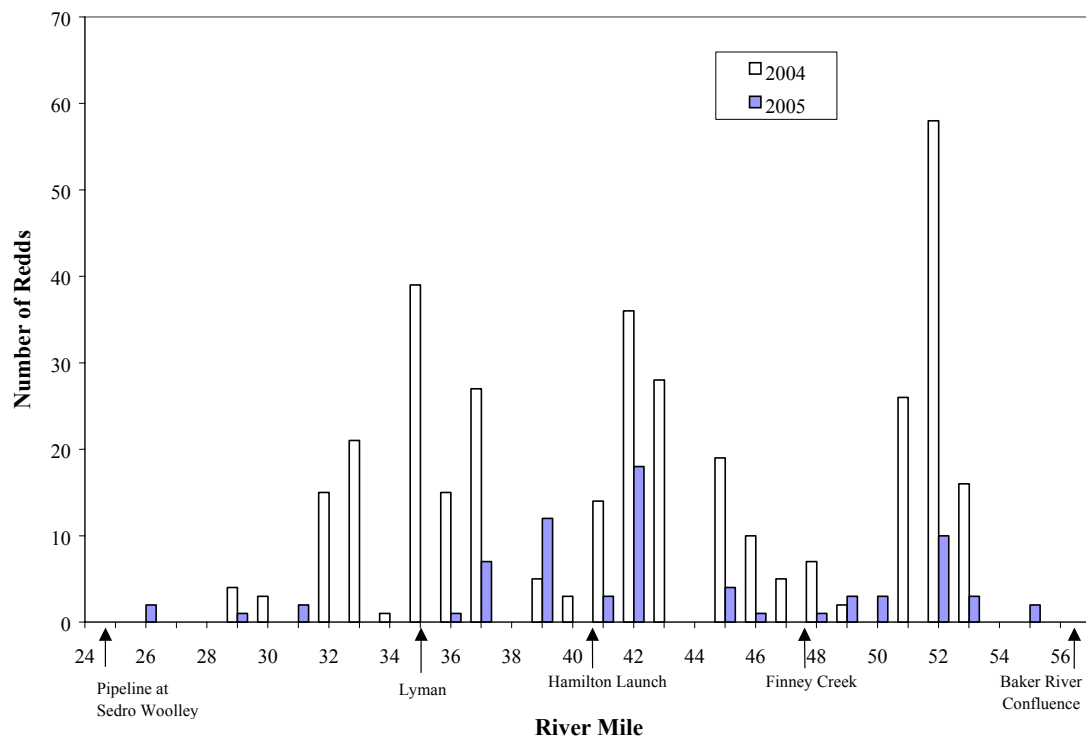


Figure 7. Longitudinal distribution of Chinook redds in the middle Skagit River in 2004 and 2005, between the Baker River confluence (RM 56.5) and the pipeline crossing above Sedro Woolley (RM 24.5).

A total of 30 Chinook redds were measured in 2005 during two jet boat surveys conducted on 28 September and 27 October. Based on calculated redd incubation flows, approximately 87% of Chinook redds measured in 2005 would remain wetted at a middle Skagit River flow of 5,500 cfs (Table 5). Chinook redd incubation flows were calculated based on measured redd depths and stage:discharge relationships developed at instream flow study transects located proximal to individual Chinook redds. No dewatered Chinook redds were observed in the middle Skagit River during the 2005 field surveys. It is believed that the measured depth distribution of Chinook redds in 2005 may be biased based on the assumption that Skagit River turbidity limited surveyors' ability to detect redds located deeper in the water column. A portion of the Chinook redds recorded during the 26 September aerial survey were observed to be located close to the river thalweg and appeared to be deeper, as the altitude of the plane provided good visibility (5 feet). Redds located in deeper areas were difficult to locate during the subsequent jet boat survey on 28 September, when visibility was reduced (3.5 feet). In addition, water clarity during the 27 October jet boat survey was such that surveyors were not able to detect redds deeper than two feet.

Pink salmon spawning was observed during the first two aerial spawning surveys and during the subsequent jet boat survey on 28 September. A total of 30 pink redds were recorded during the 13 September survey flight and an estimated total of 1,223 redds were observed during the 26 September survey. No active pink spawning was observed during the 25 October aerial survey or the 27 October jet boat survey, however high Skagit River turbidity levels during these surveys precluded surveyors from conclusively determining the extent of pink salmon spawning in the survey reach. The period of pink salmon spawning in the middle Skagit River in 2005 is estimated to have begun in early September and continued through late October. Consistent with the observed distribution of pink salmon spawning in 2003, the majority of redds recorded in 2005 were concentrated in the lower portion of the survey reach downstream of Hamilton. Of the 1,223 pink redds observed during the 26 September survey flight, 1,105 were located between the Hamilton boat launch (RM 40.5) and the pipeline crossing above Sedro Woolley (RM 24.5).

Active chum spawning was first observed in the middle Skagit River in 2005 during the 25 October aerial survey, in which eight redds were recorded. Chum spawning was observed to continue through November and mid-December. Active spawning was last observed during the 14 December survey, in which nine (6%) of the approximately 160 wetted chum redds measured were observed to have chum in attendance. An estimated total of 590 chum redds were measured between the Baker River confluence (RM 56.5) and the pipeline crossing above Sedro Woolley (RM 24.5) during the 18 November and 14 December jet boat surveys. Based on the 7 December aerial survey, chum redds were distributed throughout the 32 mile survey reach, with greater concentrations observed between the Finney Creek confluence (RM 47.5) and the town

of Lyman (RM 35.0). No native char were observed during the 2005 surveys in the middle Skagit River.

Table 5. Number and percent of measured Chinook redds wetted at middle Skagit River flow conditions in 2001, 2002, 2003, 2004, and 2005 incorporating accretion, travel time and using stage:discharge relationships developed at individual PHABSIM transects located proximal to spawning sites.

Middle Skagit River Conditions ¹	Wetted Chinook Redds									
	2001 ² (n=77)		2002 (n=605)		2003 (n=62)		2004 (n=608)		2005 (n=30)	
Flow (cfs)	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
7,500	77	100%	605	100%	62	100%	599	99%	29	97%
6,500	74	96%	605	100%	62	100%	581	96%	28	93%
5,500	71	92%	602	100%	62	100%	542	89%	27	90%
4,500	71	92%	600	99%	61	98%	485	80%	26	87%
3,500	70	91%	596	99%	59	95%	429	71%	25	83%

¹ Skagit River flows normalized to the USGS Skagit River gage near Concrete (RM 54.1).

² Redds measured in 2001 represented a partial data set focused on measurement of redds at risk of dewatering subsequent surveys (2002 and later) attempted to measure the representative distribution of redds.

DISCUSSION

Annual surveys conducted during 2002 through 2005 covered 32 miles of the mainstem Skagit River between the Baker River confluence (RM 56.5) and the pipeline crossing above Sedro Woolley (RM 24.5). Spawning surveys completed from 2002 to 2005 consisted of fixed-wing or helicopter aerial surveys followed by jet boat surveys, during which surveyors confirmed and measured redd depths and other redd characteristics. Reconnaissance spawning surveys in 2001 were conducted by river raft and jet boat over the 16-mile reach between the Baker River confluence (RM 56.5) and the Hamilton boat launch (RM 40.5).

The distribution of Chinook observed in 2005 was generally consistent with distributions observed in 2002, 2003, and 2004. Chinook were observed to primarily spawn in mainstem areas, with the greatest proportion of spawning occurring between the Finney Creek confluence (RM 47.5) and the town of Lyman (RM 35.0). The number of Chinook redds measured in 2005 (30) was relatively low in comparison to surveys conducted in 2002 (605) and 2004 (608), due to weather and Skagit River flow conditions. The proportion of redds measured in 2005 calculated

to remain wetted at various middle Skagit River flow conditions was similar to estimates from previous years (Table 5). It is believed however, that redds measured in 2005 may overemphasize shallower redds since field conditions hindered measurement of redds constructed in deeper water. Some redds identified in deeper areas during aerial surveys in 2005 were not located during subsequent jet boat surveys due to high Skagit River turbidity.

Timing of Chinook spawning in 2005 appeared to be generally consistent with the observed spawn periods in 2002, 2003, and 2004, although observations during the latter portion of the 2005 spawn period were limited. Based on aerial survey observations, Chinook spawning is estimated to have initiated in early September. Due to the absence of actively spawning Chinook during the 18 November jet boat survey, it is presumed that the end of the spawn period occurred in late October or early November.

Baker River Project License Implementation

**Aquatics Resource Group Meeting
Final Meeting Notes**

January 10, 2006
9:00 am - 2:00 pm
USFS Mountlake Terrace Office

FINAL MEETING NOTES

Team Leader: Arnie Aspelund, PSE, (arnie.aspelund@pse.com)

PRESENT

Arnie Aspelund, Cary Feldmann, Doug Koens, Doug Bruland, and Nick Verretto (PSE); Phil Hilgert (R2 Resource Consultants); Steve Fransen (NOAA Fisheries); Stan Walsh (SRSC); Jeff McGowan (Skagit County); Rich Johnson by phone, Mike Muller, Ted Thygesen, Gary Sprague, Jed Varney, and Kevin Kurras (WDFW); Scott Lentz (USFS); Jon-Paul Shannahan and Scott Schuyler (Upper Skagit Indian Tribe); Lou Ellyn Jones (USFWS); Arn Thoreen (Skagit Fisheries); Alison Evans (Dept. of Ecology); Bob Helton (Citizen); Stan Zyskowski (NPS); Lyn Wiltse, facilitator, and Jamie Riche, note-taker (PDSA Consulting, Inc).

NEXT MEETING DATES

March 14, 2006, 9:00 – 3:00, ARG (USFS, Mountlake Terrace)

June 6, 2006, 9:00 – 3:00, ARG (USFS, Mountlake Terrace)

***September 12, 2006,** 9:00 – 3:00, ARG (location TBD)

QUOTABLE QUOTES

“ ... intoxicated with the exuberance of your own verbosity.” – Cary Feldmann

“ ... well, I think fish are amazing creatures.” – Phil Hilgert

AGENDA TOPICS

9:00 – 9:15 Review Notes, Agenda

9:15 – 10:30 Fish Facilities Operations Topics

- Sockeye Spawning Beach & Artificial Incubation Operations
- Fish Rearing Inventories & Releases

- Adult Trap Protocol / Changes and Imprinting / Release Sites for Chinook study

10:30 – 10:45 Break
 10:45 – 11:30 Update on Early Implementation Activities (Fish Propagation & Fish Passage)
 11:30 – 12:00 *Lunch (provided)*
 12:00 – 1:30 Relicense Studies Update (A-38 Native Char & A-09 Instream Flow)
 1:30 – 1:45 BRICC / FERC DEIS Update
 1:45 – 2:00 Confirm date (March 14) & agenda for next meeting; evaluate meeting

NEW ACTION ITEMS

- Stan Z – Send Arnie link to for Frasier Radio Tag study. (DONE!)
- Stan W – Work with Scott S. and other co-managers to review artificial incubation planting numbers and get answer to Kevin by Feb. 10.
- Stan W – Give an update on our discussion re: the acclimation problem in the adult trap to the Chinook indicator stock group, and bring their input back to the next meeting.
- Doug B – Start tracking the zero age sockeye fry ... and let the fish go :)
- Arnie – Ask Kevin to email handouts early when possible.
- Cary – Work with Arnie to find a way to summarize BRC activities for the rest (BRC 101).

OLD ACTION ITEMS

- Jed – Look at adult pond designs (*this review has begun with the group looking at round vs. square designs, the group has not yet developed a suggestion*)
- All – Review the Attendee List to ensure your organization has a designated primary and back-up representative listed
- Gary – Come up with directive to handle brook trout, coordinate with other co-managers and bring back to the group
- Gary – Pulled together a research paper on sockeye juvenile survival related to size (*see handout "Proceedings of the 1989 Alaska Sockeye Culture Workshop"*)

FISH FACILITIES OPERATIONAL TOPICS

Fish Rearing Inventories & Releases

Doug Bruland walked us through the fish rearing/release data (see the 'Baker River Fish Inventory' handout), including the numbers and locations of Sockeye, Coho, and Rainbow. PSE will start freeze-branding the hatchery coho (raceway #1) and sockeye (circular #5) next week to repeat the mark-recapture study this spring. PSE will also conduct biological testing this spring at Upper Baker utilizing approx. 2,600 of the remaining hatchery-origin coho (raceway 2). The rainbow (~ 20,000) have been moved into the trout pond in advance of the Troutfest Derby and other charity events hosted by PSE.

Artificial Incubation Operations & Sockeye Spawning Beach

We discussed the allocation of artificial incubation Sockeye planting numbers to the two reservoirs: Baker and Shannon, and confirmed a split of 70% to Baker and 30% (not to exceed 300,000) to Shannon. Baker fish are delivered first to look for a possible IHN outbreak. The agreements regarding this topic were made years ago and need to be revisited in light of current conditions. The co-managers will review the artificial incubation planting numbers policy.

Kevin Kurras walked us through the 'draft (preliminary) Incubation Worksheet' handout. They achieved

939,000 eyed-eggs from the incubation program and overall egg loss is currently just 7 percent. Typically, some of the earlier egg takes suffer higher losses. Next year, Kevin's group will be changing the spawning/incubation protocol by increasing contact time and adding a saline solution to the water the eggs are fertilized in, which should be a benefit to egg fertilization and survival. He will have a finalized report on the Incubation Worksheet data at the next meeting in March.

With the recently heavy and prolonged rains (24 consecutive days, and rainfall well above average), Kevin reported the intake at Beach 4 has been unstable. There have been several turbidity alarms and the procedures for response have been followed. However, the hillside above the intake continues to slough, some silt has been observed in the trout pond and Kevin is concerned about the hits of turbidity we are taking. *(Following this meeting, they prepared to switch to the alternate water source tied into the Depression Lake overflow channel, however the turbidity spikes have passed and the accumulation of sediments in the trout pond were in fact minor- they remain on the Sulphur Springs water supply which is presently clear. They have also adjusted the turbidity notification alarm threshold upward from 30 NTUs - which is an insignificant level of turbidity detection to 50 NTUs - a more representative level for alarm notification).*

Kevin reported at the end of the spawning season, when they emptied the beach, they were able to spawn an additional 37 more females. From the adult sockeye recoveries for the 2005 brood year, he reported a season total of 194 marked fish (those with adipose clips that originated from the delayed release program).

Adult Trap Protocol / Changes & Imprinting / Release Sites for Chinook Study

Kevin walked us through the 'Baker River CWT (coded wire tag) Info' handout. After Oct. 10, they sampled every 10th Chinook because Marblemount Hatchery no longer needed fish.

The group discussed the juvenile Chinook from the acclimation study (of last summer) that aren't leaving the trap. When the water is lower, the fish can't make it over the top. Since spilling has been happening at Baker, it is unlikely that PSE would be able to take an outage to evacuate the trap. Even if we took an outage, we would still have to bucket them out and wouldn't be able to get them all. The group discussed that the use of buckets would defeat the purpose of de-stressing the fish.

A temporary raceway was discussed as another option. This would require an alarmed water source. Putting fish in the river above the weir would be preferable to using the trap. Timing and feeding issues are a concern. Question to consider: When do the hatchery fish smolt (compared to wild fish)?

FYI: There is 2-3 week outage planned for the beginning of April. The flow continuation valve will be providing 80 cfs (plus leakage). Is the best chance of imprinting at the tailrace? Could we set up a net pen or holding facility in the tailrace during the outage, then "flush them out" when start to generate? Stan W. will give an update on our discussion re: the acclimation problem in the adult trap to the Chinook indicator stock group, then bring their input back to us at the next meeting.

WATER QUALITY CERTIFICATION

Alison reported that the Water Quality Certification is available online for public review; comments are welcome and due by January 27th.

UPDATE ON EARLY IMPLEMENTATION ACTIVITIES

Fish Passage TWG

Nick Verretto reported that the FSC design continues; the adult trap is being designed to the 15% level; the biological performance evaluation for the FSC is being formulated and studies are being conducted this year in advance of the FSC's installation at Upper Baker in March of 2008.

The Lower Baker FSC will be installed 4 years later, with lessons learned from the Upper Baker installation integrated. PSE had a design level of 45-50% on the FSC as of last June, which was put on hold due to significantly escalating costs (see notes from earlier meetings). The current design is significantly smaller through adjustments of the engineering assumptions and criteria. Nick walked us through the FSC Design Comparison (6/10/05 – 10/25/05), including design adjustments and rationale. The major differences are a decrease in the primary screen size, a significant decrease in the size of the secondary screens, a decrease in the capture velocity (from 8 to 7 ft./second), and a reduction in the capture area. Agency folks are most nervous about the reduced capture area (from 9 sq. ft. to 3.75 sq. ft.)

Nick reported that there are multiple contractors and subcontractors involved in the various design elements: Washington Group is designing the FSC, and Westmar (out of Kirkland) is designing the Net Transition Structure and the modifications of the log boom.

Nick also reported that PSE will be releasing six separate weekly batches of 125 pit-tagged fish above the FSC to study the recapture rate in an attempt to distinguish the rate of return of native fish. The next meetings of the Fish Passage TWG are January 31 and March 21.

Fish Propagation Facilities

At the last meeting, PSE's contractors shared some initial looks for the hatchery design and gathered feedback to incorporate. Arnie, the contractors and some agency folks met to review design alternatives and operations, and to discuss design criteria. Work continues with HDR. Arnie reported that this group will have a more in-depth report for the next meeting.

LICENSE STUDIES UPDATE

A-38 Native Char (2005 Field Results)

Phil Hilgert (R2) updated us on the Native Char Field Study activities since our last meeting. He reported that there were surveys on Nov. 23rd, 30th, and a night survey on Dec. 13th. Interestingly, some fish were found to be actively spawning. Since they found fish during the Dec. 13th survey, they went out one more time on Dec. 16th.

He walked the group through the 'Native Char Investigations at the Baker River Hydroelectric Project' handout, pointing out that the group again saw two influxes of fish, one in September and one in late October / early November. He highlighted a correlation between a drop in water temperature and an influx of fish. While the data show an interesting correlation, he was careful to state that cause and effect have not been established. We should keep this in mind as we get closer to the connectivity issue (Article 104). Studies continue in order to better understand the system.

In summary, we are learning. We have the tissue samples and are waiting to get them analyzed. *In*

response to a suggestion from Scott Lentz, R2 will include air temperature and flow data with the 2005 survey results. For 2006, R2 will develop a study plan with *USFWS and other interested parties.* They will be looking to see if there is that same bi-modal distribution of upstream migration in Sulphur Creek.

Middle Skagit River Salmon Spawning Surveys

Phil walked the group through the 'Middle Skagit River Salmon Spawning Survey' handout, showing mean daily flows and water clarity for the surveys conducted. For 2005, R2 observed Chinook through aerial surveys and measured them through jet boat surveys. They found that the Chinook dropped off by mid Oct. / early Nov. By Nov. 18, there were no more fresh Chinook carcasses, which indicated an end to the spawning. The number of measured Chinook redds at the Middle Skagit were lower in 2005 than in previous *non-pink* salmon return years; *if the pattern holds*, we can anticipate an increased return next year. All the information in the handouts, along with additional information, will be posted to the website for your review. Let Arnie know if you would prefer to have it emailed to you as a PDF file.

BRICC UPDATE

Nothing new here. Lyn let the group know that the BRICC (Baker River Interim Coordinating Committee) has not met since June 2005 because they are still awaiting the DEIS from FERC. FERC now says the DEIS will be out by the end of January. The next BRICC meeting is tentatively scheduled for February 14. The purpose of that meeting will be to walk through the DEIS and formulate initial comments. Keep staying tuned.

HANDOUTS

- Agenda & Notes
- Spawning Beach Update
- Baker River Trap CWT Info
- Adult Recoveries Brood Year 2005 Baker Sockeye
- Incubation Worksheet
- Baker Project Fish Inventory
- Native Char Investigations at the Baker River Hydroelectric Project
- Proceedings of the 1989 Alaska Sockeye Culture Workshop

MEETING EVALUATION

What Went Well

- Got out early
- Rich on phone
- Good crowd
- Keep including Ops Mtg.
- ARG folks appreciate Ops folks' patience

What to Do Differently

- ARG folks would appreciate more context for BRC topics
- Chuck's finger surgery ... barnacle news?
- Room too warm
- We NEEDED deviled eggs!
- Mudslide on I-5

- Review draft norms with whole group

AGENDA FOR NEXT ARG MEETING

March 14, 2006 at Mountlake Terrace

9:00 a.m. - 3:00 p.m.

1. Welcome, review notes, action items, agenda
2. Review Norms with the Ops Folks
3. Fish Facilities Operational Topics
4. BRICC/FERC DEIS update
5. Early Implementation Activities Update (Fish Passage/Fish Propagation Facilities)
6. Relicense Studies Update
7. Evaluate meeting, set next meeting (June 6, 2006) agenda