Economics/Operations Working Group

February 12, 2003
9:00 am – 2:00 pm
USFS
810 State Route 20, Sedro Woolley, WA

Meeting Agenda

The Economics Working Group Mission Statement:
"To ensure that alternative project proposals, operations and emergency plans for the Baker River Project and its components provide for: 1. Public health and safety; and 2. Thorough analysis and evaluation of the economic costs and benefits (including non-market and economic impacts.)"

ITEMS

1. Introductions
2. Review/revise minutes and agenda
3. Action Items
4. Presentation: Skagit County Avon Bypass by Dave Brookings, Skagit County
5. FERC call: Linda Lehman
6. Study Requests:
   R-01 Low Flow Augmentation From Baker Project
   R-02 Evaluation of Optimal Flood control Storage in Upper Baker Reservoir
   R-03 Examination of Spawning and Incubation Flows in the Skagit River below the Baker Confluence during Brood year 2000.
7. PM&Es
   5.01 CZMA DOE
   5.02 Instream Flows and Water Rights
   5.03 Submerged Lands
   5.04 Reservoir Rule Curve (acquatics)
   5.05 Power Production (acquatics)
   5.06 Flood Control
8. Review of HYDROPS output example scenario
9. FERC Developmental Analysis example: Mark Killgore, PDEA, Berger Group
10. Prepare agenda for March 12th meeting at PSE office Mt. Vernon
11. Evaluate meeting

BAKER RIVER PROJECT RELICENSE

Economics/Operations Working Group

FEBRUARY 12, 2003

9:00 a.m. through 2:30 p.m.

USFS Office
810 State Route 20, Sedro Woolley, WA

FINAL MEETING NOTES

The Economics Working Group Mission Statement:

"To ensure that alternative project proposals, operations and emergency plans for the Baker River Project and its components provide for: (1) Public health and safety; and (2) Thorough analysis and evaluation of the economic costs and benefits (including non-market and economic impacts.)"

Team Leader: Lloyd Pernela (PSE), 425-462-3507; lloyd.pernela@pse.com

Note: Please let the team leader know if you are unable to attend a meeting. If something comes up at the last minute, please call Lyn prior to the meeting. Lyn's cell phone is 425-890-3613.

PRESENT

Linda Lehman and Keith Brooks (FERC) by phone, Mark Killgore (Louis Berger Group), Jon Vanderheyden and Rod Mace (USFS), Bob Helton (interested citizen), Stan Walsh (Skagit Systems Cooperative), Ken Brettmann (Corps), Jerry Louthain (City of Anacortes, Skagit Co. PUD and Town Concrete), Dave Brookings (Skagit County Public Works Department), Gary Sprague (WA Dept. Fish & Wildlife), Chuck Howard, (Consultant), Lloyd Pernela, Joel Molander, Paul Wetherbee (PSE), Bruce Freet (Agreement Dynamics), Mary Jean Bullock, note-taker, and Lyn Wiltse, facilitator (PDSA Consulting Inc.)

INTRODUCTIONS

Linda is FERC's liaison with our Economic/Operations Group. Paul is a hydrologist with PSE and will be working on models.

DATES OF FUTURE MEETING DATES/LOCATION

March 12, April 9, May 14, June 11, July 9, August 13, September 10, October 8, November 12, December 10, 2003 at PSE Office, 1700 East College Way, Mount Vernon.

Agenda for February 12, 2003 at USFS Office, Sedro-Woolley, WA
9:00 to 2:30 PM

1. Introductions
2. Review/revise minutes and agenda
3. Action Items
4. Presentation: Skagit County Avon Bypass by Dave Brookings, Skagit County
5. FERC call: Keith Brooks and Linda Lehman
6. Flood teamlet:
   Corps BA Upper Baker Flood Control, August 2000: Ken Brettman
7. Study Requests:
   R-01 Additional flow releases for mitigation of water use
   R-02 Evaluation of Optimal Flood Control Storage in Upper Baker Reservoir
   R-03 Examination of Spawning and Incubation Flows in the Skagit River below the Baker Confluence during Brood year 2000
8. PMEs
   5:01 CZMA Consistency
   5:02 Additional flow releases for mitigation of water use
   5:03 Submerged Lands
   5:04 Reservoir Rule Curve (move to acquatics)
   5:05 Power Production (move to acquatics)
   5:06 Flood Control
9. Review of HYDROPS output an example scenario
10. Report on USFS HYDROPS review
11. FERC PDEA development analysis example: Mark Killgore, Louis Berger Group
12. Prepare agenda for March 12th meeting at PSE office in Mt. Vernon
13. Evaluate meeting

NEW ACTION ITEMS

- ALL: Send Lloyd feedback by February 28, on Mark's draft economic considerations list.
- ALL: Review R-01 (Additional flow releases for mitigation of water use) for discussion at our March 12 meeting – Give feedback to Jerry.
- ALL: Review (optimal flood control storage) for discussion with our March meeting. Give feedback to Dave.
- Dave: Flood Study Plan. Get with Mark K., Ken, and others to work on study plan for R02.
- Keith: Issue on February 19th FERC's interpretation of the legal interpretation (preliminary analysis) on flood control, and how FERC would respond if the settlement agreement included a request to change the existing amount of flood storage [e.g. through Flood Control Act or amount in addition to Congressional authorization]. Also comment on which Act's trump FCA, etc.
- Lloyd: Send Keith distribution list of working group participants so he can send out his paper on Feb. 19.
- Lyn: Add estimated time frames to March agenda.

PLAN FOR MARCH CROSS-RESOURCE WORKSHOP

Prior to the Workshop

A CD listing all the PMEs that each research Working Group is considering along with a draft agenda for the March Workshop will be out by February 18th.

Participants will be asked to fill out a pre-workshop worksheet to consider how to resolve conflicts, etc. PSE will send out their proposal (with elements of Working Group PMEs) for review on Feb. 26.

March 4, Tuesday (afternoon only)

1:00-5:00 High level PMEs presentations by a member of each Working Group (Cultural, Terrestrial, Aquatics, Recreation, Economics/Operations)
Jerry has graciously accepted our request that he do our presentation.
Probable Attendees: Jerry (presenter), Jon, Bob, Gary (not sure when he will arrive), Rod M., Lloyd

March 5, Wednesday (all day)

Dee will begin with a review of the background of our process to date. She will then do a brief training session on interest-based negotiations to kick things off.

Then we will walk through PSE's Proposal, highlighting pieces that have cross-resource implications e.g. the proposed reservoir management regime. Joel Molander of PSE will explain how PSE came up with its reservoir management plan (share outputs from HYDROPs model runs, etc.)

Then we will split up into distinct resource areas to:

- Flag impacts on resource (add conflicts to lists already posted from Feb. Working Group meeting)
- List how it affects the organizational interests
- Report back to the larger group

Probable Attendees: Jerry, Jon, Bob, Gary, Rod M., Lloyd, Joel

March 6, Thursday (all day)

- Finish PSE Proposal (pieces with cross resource implications)
- Review other PMEs with cross resource implications
- Review (amended) list of conflicts
- Brainstorm to resolve conflicts
- Review (amended) list of conflicts
- Brainstorm to optimize synergies
- Plan next steps

Probable Attendees: Jerry, Jon, Bob, Gary, Rod M., Lloyd, Joel

After discussing the plan for the three-day workshop, some expressed concern that a "PSE proposal" feels positional rather than collaborative-interest based. Bruce explained the effort he saw by PSE in creating a proposal that pulled the group's PMEs together and addressed the interests of each working group participant. Group concluded great care should be taken to ensure that people understand the background (PME-tie) to what is included in this "straw man." Lloyd pointed out that in the ICD and Scoping documents, PSE stated it would define PSE's proposed action thru collaborative process identifying desirable changes in the project. This is a first effort in defining group's collective preferred alternative. The process needs to identify quickly proposals for the PDEA.

Jerry will present the Economics/Operations group PME proposals on March 4th. It was also suggested that the each breakout group include members from all resource areas.

PMEs from this group will include 5.01 – CZMA Consistency; 5.02 – Additional flow releases for mitigation of water use; 5.03 Submerged Lands; and 5.06– Flood Control

FERC CALL: (Keith Brooks and Linda Lehman)
Keith will draft a preliminary analysis of legal issues surrounding flood control within the context of the Baker River Project Relicensing Process. He will do this by February 19th and send it to all Working Group members for review. Group decided to use the term "flood control" and not "flood management."

Following inserted by Team Leader with review by Dave, Ken and Keith.

- *FERC cannot reduce the current Baker flood control below that specified in-the 1977 congressional resolution. In general, specific legislation usually trumps general legislation. The 1977 Corps report 95-149 on Baker flood control report to Congress is clear and precise.*
- *Until changed by Congress, the current Corps flood control regime and compensation at Baker is permanent.*
- *To change from the current Corps flood control policy, the Corps would conduct appropriate studies and submit a request to Congress to adopt a new regime. [FERC's assessment is that there is not enough time for this in the context of relicensing– it would have to occur after License. Skagit County believes the work can be completed within the relicensing process.]*
- *FERC has no jurisdiction over the Corps.*
- *FERC can order additional Flood Control Storage beyond the current Corps 74k acre-feet as part of a settlement agreement, provided it is in the public interest and is consistent with resource balancing.*
- *The Corps has been responsible for their Baker flood control project's EA/BA. The Corps wrote the initial EA for Baker flood control and in 2000 conducted a BA of Upper Baker, a subsequent study on bull trout was done by USFW and Corps issued a supplement issued in 2001. Puget was not a party to the BA or other studies.*
- *PSE is responsible for the projects BA in relicensing except that portion that addresses Corps flood control.*

PMEs

5.01 CZMA Consistency.
Lloyd distributed the paper Rod Sakrison put together on CZMA consistency. We agreed that this is a very helpful checklist of things we need to do to ensure compliance.

5.02 Additional flow releases for mitigation of water use.
Jerry explained that this PME refers to a relatively new regulation adopted by DOE relating to water rights and minimum instream flows for WRIA-3 and WRIA-4 Skagit River. The aim of this PME is to try to mitigate for this regulation which states that water supply could be interrupted.
The idea is for PSE to provide additional releases from the Baker River Project when the Skagit River at Mt. Vernon falls below minimum instream flow requirements.
This would mitigate for the amount of water taken out of the system that is subject to this regulation. This would make it possible for folks to have an uninterrupted water supply. The maximum amount we might mitigate for would be 200 cfs.

PSE expressed concern about going forward with this PME (as an enhancement). They questioned the legality of the enhancement: (1) the current regulation specific excludes hydroelectric facilities and (2) no current DOE regulation links consumptive and non-consumptive water rights. These would require changes in DOE regulations. Also the minimum instream flow is set at mere 26% exceedance in critical months.
All will review this Study Request and PME for discussion this at our March meeting.

5.03 Submerged Lands.
Lloyd will write up a PME addressing the ownership of the original Baker Lake and the Baker River bed.

5.06 Flood Control.
Lloyd will write up a PME as a "place holder" reflecting the current License article.

PME's to be included on the February 18th CD for the Economics Working group are: 5.01 – CZMA – Department of Ecology; 5.02 –Flow Augmentation; 5.03 Submerged Lands; and 5.06– Flood Control

STUDY REQUESTS
R-01 Additional flow releases for water use mitigation.
See the discussion above under PME's. Joel and Lloyd's comments are incorporated as revisions.

R-02 Evaluation of Optimal Flood Control Storage in Upper Baker Reservoir
Dave incorporated the comments he received on this. All will review it and be ready to discuss next Steps at our March meeting. We agreed to move this to the Study Plan phase.

R-03 Examination of Spawning and Incubation Flows in the Skagit River below the Baker Confluence during Brood year 2000.
This provides an opportunity to study low season flows. This was tabled. Stan will follow up with PSE and we'll discuss how to proceed at out March meeting.

HYDROPS MODEL REPORT
Rod Mace reported that about 18 issues have been identified by Stetson Engineering re: the specifications they felt were necessary to do an adequate evaluation. Modifications are being made to the model to address 5 or 6 of those. Most of the remaining points now meet USFS analysis needs. Joel reported that they are aiming to have these revisions complete and tested by early March. They hope to also by that time to make sure it easily links with the model that R-2 is putting together. Gary reported that R-2 has not yet completed its high flow data collection (completing only 8 out over 20 transects during recent high flows) and that they are working to calibrate their model.

REPORT ON OLD ACTION ITEMS
- ALL: Give Jerry feedback on Study Request R01: Additional Flow Releases for mitigation of water releases by January 17th so he can incorporate them and send out a new version of the request prior to our Feb. meeting. *Only Joel and Lloyd gave comments. Additional comments on the request and related PME can be given to Jerry prior to March meeting.*
- ALL: Give Dave feedback on Study Request R02: Evaluation of Optimal Flood Control Storage in Upper Baker Reservoir (Baker Lake) by January 17th so he can incorporate them and send out a new version of the request prior to our Feb. meeting.

- ALL: Gave Stan feedback on Study Request R03: An examination of spawning and incubation flows in the Skagit River below the Baker confluence during brood year 2000 by January 17th so he could incorporate them and send out a new version of the request prior to our Feb. meeting.
- Mark: By February 6, sent out draft outline of economic guidelines that Working Groups could use to do economic analysis of working group recommendations. No comments were received due to time constraints.

HYDROPS OUTPUT

Joel distributed a sample scenario for a HYDROP's run to demonstrate our process of fleshing out viable alternatives. Scenario was defined using the HYDROPS MODEL Study Request form. Attached was the output from the run. This output format does yet not include model modifications made at the request of the Forest Service.

PRESENTATION OF SKAGIT COUNTY AVON BYPASS

Dave showed us a video explaining the background of the Skagit River feasibility study and the recommendations of the Skagit Flood Risk Working Group. They are proposing a 5-mile (Westerly) diversion channel "the Swinomish Floodway" that could contain 80,000 cfs. The benefit/cost ratio of 4 to 1 is very favorable.

They are also looking at providing adequate channel capacity to pass the 100-year flood flow through the 3-bridge corridor. Dave distributed a letter from the Skagit County Board of Commissioners to Corps Colonel Graves expressing their concern re: current levels of flood control. This letter points out the benefits of Baker Project for flood control. He also distributed a list of flood issues and costs associated with various phases of this project.

FERC DEVELOPMENTAL ANALYSIS EXAMPLE

Mark distributed a chapter from the Draft EIS for the Cowlitz River Project as an example of what we might include in our Developmental Analysis, noting that this was taken from a municipal utility as opposed to investor owned utility NEPA document.
He encouraged us to look at this along with the 14 points of economic consideration that he distributed at an earlier meeting.
He and Joel are working on putting together a template for Working Group members to use for economic analysis.

HANDOUTS (bolded handouts will be posted on the website)

- Draft -Cross section workshop, Baker River Hydroelectric Project 2150
- Coastal Zone Management Act – DOE, January 31, 2003
- Draft PME – Additional flow releases for mitigation of water use. Prepared by Jerry Louthain, February 4, 2003
- Baker River Project Re-licensing Study Request. Study Title: Additional flow releases from the Baker River Project
- Draft Environmental Impact Statement – Cowlitz River Hydroelectric Project (No. 2016-044) Washington – Applicant: City of Tacoma
- Letter from the Skagit County Board of Commissioners to Colonel Ralph H. Graves, District Engineer (U.S. Army Corps of Engineers)

- Skagit County, Washington Flood Issues – February 28, 2003

PARKING LOT
- Forest Service Watershed Analysis
- New Baker EAP Inundation maps are available at end October 2002
- Consider who will be the number cruncher for this team: PSE? Other?
- GANNT chart with due dates, etc.
- Presentations:
  Wild and scenic river 101 Jon Vanderheyden
  Fisheries/Hydraulics 102
- How will we define and share economic analysis (methods, assumptions re: unit costs, etc.) across Working Groups

EVALUATION OF THE MEETING
Well-Dones
- Lunches
- Phone seemed to work well
- Great participation
- Thanks to USFS for hosting
- Good discussion with FERC
- Dave's flood control presentation
- Got through a lot!

Change for Next Time
- Packed agenda
- Ran late

What's Hot?
- Flood control
- HYDORPS Model results
- Low Flow "thang"

Summary of Studies to Share with Solution Team
- R-01 –Low Flow Augmentation from Baker Project – Continuing discussion
- R-02-Evaluation of Optimal Flood Control Storage in Upper Baker Reservoir –Moved from Study Request to Study Plan
- R-03 –Examination of Spawning and Incubation Flows in the Skagit River below the Baker Confluence during Brood year 2000 – Tabled for discussion in March

TENTATIVE AGENDA FOR NEXT MEETING
March 12, 2003 at PSE Office, Mount Vernon, WA
9:00 to 2:00 PM
9:00 - 9:05 Introductions

9:05 – 9:05 Review/revise minutes and agenda

9:05 – 9:10 Review Action Items

9:15 – 10:45 Debrief of Cross Resource Workshop and review of Econ/Ops PMEs

- Review output and next steps from workshop
- Status of 5.01: CZMA Consistency, 5.02: Additional Flows for Mitigation of water use, 5.03: Submerged lands, and 5.06: Flood control
- Economic considerations
- Role of this Working Group in assisting with PDEA

10:45 – 11:00 Break

11:00 – noon FERC Conference call (Keith Brooks and Linda Lehman)

- Review of Keith's paper including his analysis of legal mandate and response if settlement agreement proposes alternative flood control regime
- Plan for next steps (Share with Solution Team, etc.)

Noon – 12:20 Lunch

12:20 – 12:45 Review Study Plan:

- R-E02-Evaluation of Optimal Flood Control Storage in Upper Baker Reservoir –study plan review.

12:45 – 1:10 Review Study Requests:

- R-E01 –Additional flow releases for mitigation of water use – Continuing discussion
- R-E03 –Examination of Spawning and Incubation Flows in the Skagit River below the Baker Confluence during Brood year 2000 – discussion tabled .

1: 10 – 1:30 HYDROPS Report

1:30 – 1:40 FERC Development Analysis Baker Project

1:40 – 1:50 Set April 9, 2003 agenda (at PSE Office in Mt. Vernon at USFS)

1:50 – 2:00 Evaluate Meeting

- What's hot?
- Studies report for Baker Solution Team

Baker River HYDROPS Model

Revised June 11, 2002

Study Request Form

Requested By	**Date Requested**
Joel Molander, Puget Sound Energy	January 15, 2003

Scenario Title

Batch 2, Scenario 8 - Instream Flow and Ramping Analysis with Valve

Purpose of Scenario

To evaluate the effects of ramping and instream flow requirements as specified by sheet Input-2 on the operation of the Baker River Hydroelectric Project with Lower Baker project modifications to include a 600-cfs instream release valve.

Description of Reservoir Operating Level Constraints

Upper Baker

Operate Upper Baker reservoir using existing Corps of Engineers and voluntary recreational rule curves.:

Lower Baker

Operate Lower Baker reservoir using existing maximum and minimum operating level constraints. No additional restrictions.

Description of Release Constraints (turbine and/or spill releases, ramping)

Upper Baker

None.

Lower Baker

May through November, 500-cfs minimum discharge from Lower Baker. December through April, the greater of 500-cfs or 60% of average calculated from the ten peak daily discharge values during the period September through November.

Skagit River at Baker River Confluence

Down ramp rate requirement of 1"/hour as measured at the Skagit River at Concrete gage.

Other Considerations

No other constraints are proposed as part of this scenario.

Baker River HYDROPS Model

Study Request Form

Constraint Definition Sheet

Scenario Title: Batch 2, Scenario 8 - Instream Flow and Ramping Analysis with Valve													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Reservoir Elevation													
Baker Lake													
Maximum	Hard	724.0	724.0	724.0	724.0	724.0	724.0	724.0	724.0	724.0	724.0	724.0	724.0
	Soft												
Minimum	Hard	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0	670.0
	Soft							720.0	720.0				
Lake Shannon													
Maximum	Hard	438.6	438.6	438.6	438.6	438.6	438.6	438.6	438.6	438.6	438.6	438.6	438.6
	Soft												
Minimum	Hard	355.0	355.0	355.0	355.0	355.0	355.0	355.0	355.0	355.0	355.0	355.0	355.0
	Soft												
Releases													
Baker River @ Warning Sign													
Maximum	(CFS)	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100	5,100
Minimum	(CFS)	0	0	0	0	0	0	0	0	0	0	0	0
Baker River @ USGS Gage													
Maximum	(CFS)	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400	4,400
Minimum	(CFS)	500	500	500	500	500	500	500	500	500	500	500	500
Skagit River @ Baker River													
Maximum	(CFS)												
Minimum	(CFS)												
Spill													
Lower Baker Dam													
Maximum	(CFS)												
Minimum	(CFS)												
Upper Baker Dam													
Maximum	(CFS)												
Minimum	(CFS)												
Down Ramping													
Lower Baker Powerhouse													
Ramp Value													
Unit	(Inches/CFS)												
Time Period	(Hours)												
Skagit River @ Baker River													
Ramp Value		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Ramp Unit	(Inches/CFS)	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches
Time Period	(Hours)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Run Title: IF Batch 2 Scenario 8 Run 2
Total System Gen. (MWh) 701,476
Total System Revenue ($) 30,732,610

	Upper Baker						Lower Baker						Skagit R.
Date	[redacted]												
1-Dec-99	0.55	705.93	0.1	0	0.1	30	1,062	433.39	760	55	815	57,760	17354
8-Dec-99	9,415	705.02	2522	0	2522	491,420	8,815	438.07	2776	55	2831	454,432	19000
15-Dec-99	10,613	707.69	2800	0	2800	541,478	13,817	438.6	4100	142	4242	681,643	28863
22-Dec-99	10,773	704.22	2888	0	2888	554,021	13,637	433.67	4100	55	4155	672,931	18158
29-Dec-99	2,433	707.24	643	0	643	132,320	4,291	430.22	1633	55	1688	210,559	15661
5-Jan-00	5,046	707.04	1324	0	1324	199,315	7,468	426.2	2438	55	2493	264,678	16209
12-Jan-00	3,321	707.24	869	0	869	131,172	7,295	417.26	2438	55	2493	258,566	14370
19-Jan-00	2,568	707.49	669	0	669	101,420	7,053	406.19	2438	55	2493	249,972	13596
26-Jan-00	2,711	708	708	0	708	111,395	6,769	394.97	2438	55	2493	245,041	13288
2-Feb-00	4,219	708.41	1105	0	1105	186,696	6,588	387.56	2438	55	2493	271,688	14786
9-Feb-00	5,111	707.54	1336	0	1336	224,437	6,417	380.72	2438	55	2493	264,619	13379
16-Feb-00	3,986	706.62	1046	0	1046	176,365	6,149	369.29	2438	55	2493	253,592	11716
23-Feb-00	8,663	701.83	2288	0	2288	370,959	6,001	370.36	2438	55	2493	247,479	11786
1-Mar-00	7,737	698.33	2067	0	2067	337,308	6,015	370.74	2438	55	2493	248,761	12109
8-Mar-00	7,409	693.64	2017	0	2017	320,934	6,021	369.39	2438	55	2493	249,024	11086
15-Mar-00	7,749	689.39	2139	0	2139	336,415	6,015	370.75	2438	55	2493	248,753	12469
22-Mar-00	6,814	686.49	1910	0	1910	298,216	6,047	370.13	2438	55	2493	250,081	13135
29-Mar-00	7,094	683.24	2016	0	2016	307,576	6,026	369.44	2438	55	2493	250,363	12252
5-Apr-00	7,386	680.94	2118	0	2118	323,005	6,016	370.25	2438	55	2493	251,041	13106
12-Apr-00	8,113	685.44	2306	0	2306	353,094	7,345	372.11	2950	55	3005	310,375	19213
19-Apr-00	11,020	681.64	3181	0	3181	467,510	10,060	368.71	4100	55	4155	419,787	18107
26-Apr-00	5,038	684.29	1454	0	1454	218,505	4,293	369.73	1880	55	1935	177,109	13684
3-May-00	0.7	693	0.2	0	0.2	29	0	372.85	445	55	500	0	12920
10-May-00	0.67	701.16	0.2	0	0.2	28	0	374.78	445	55	500	0	12291
17-May-00	10,658	703.67	2905	0	2905	406,986	10,202	370.52	4100	55	4155	367,995	22160
24-May-00	12,262	704.92	3331	0	3331	458,324	10,015	369.64	4100	55	4155	361,423	21129
31-May-00	12,966	705.09	3492	0	3492	459,088	10,004	369.65	4100	55	4155	347,340	21231
7-Jun-00	12,697	710.14	3382	0	3382	445,786	10,027	371.43	4100	55	4155	344,926	23925
14-Jun-00	15,386	713.21	4052	0	4052	532,349	10,318	379.27	4100	55	4155	354,927	26978
21-Jun-00	13,275	715.17	3461	0	3461	465,920	10,417	377.64	4100	55	4155	358,472	23386
28-Jun-00	8,546	719.21	2194	0	2194	362,079	8,242	369.27	3382	55	3437	336,766	23903
5-Jul-00	11,176	718.86	2887	0	2887	501,987	0	392.85	445	55	500	0	15619
12-Jul-00	5,614	723.25	1414	0	1414	273,699	0	402.07	445	55	500	0	15776
19-Jul-00	16,090	721.44	4130	0	4130	707,523	2,088	426.24	1025	55	1080	101,775	17538
26-Jul-00	11,000	722.63	2814	0	2814	515,700	4,244	435.18	1578	55	1633	213,232	15268
2-Aug-00	11,056	722.22	2825	0	2825	556,990	7,093	438.44	2365	55	2420	375,701	14660
9-Aug-00	7,456	721.56	1892	0	1892	403,574	5,703	438.58	1916	55	1971	308,698	11160
16-Aug-00	4,671	723.05	1175	0	1175	252,856	3,619	437.76	1446	55	1501	195,898	7983
23-Aug-00	6,239	722.57	1567	0	1567	337,721	7,014	433.11	2343	55	2398	372,147	9422
30-Aug-00	4,242	722.49	1064	0	1064	227,747	0	437.86	445	55	500	0	6682
6-Sep-00	5,925	724	1495	0	1495	314,051	13,397	421.52	4100	55	4155	624,114	12428
13-Sep-00	8,490	722.37	2166	0	2166	441,913	12,518	407.62	4100	55	4155	583,245	12045
20-Sep-00	4,287	722.19	1075	0	1075	227,221	11,394	383.41	4100	55	4155	530,997	10346
27-Sep-00	6,067	724	1551	0	1551	317,145	5,141	380.25	2172	55	2227	262,842	11919
4-Oct-00	10,145	719.33	2594	0	2594	481,932	2,740	391.8	1355	55	1410	136,274	8669
11-Oct-00	0.71	722.99	0.2	0	0.2	35	0	389.33	445	55	500	0	6002
18-Oct-00	17,441	720.69	4588	0	4588	777,078	9,609	403.13	3446	55	3501	436,012	15622
25-Oct-00	17,034	710.03	4621	0	4621	760,776	8,255	417.19	2883	55	2938	385,923	10034
1-Nov-00	5,034	709.79	1310	0	1310	249,189	0	424.42	445	55	500	0	7450
8-Nov-00	164.3	712.32	42	0	42	8,131	0	422.6	445	55	500	0	7301
15-Nov-00	10,071	706.73	2681	0	2681	476,006	21.05	438.6	459	55	514	1,042	6696
22-Nov-00	863.2	709.88	223	0	223	42,139	141.9	438.6	507	55	562	7,024	7267
Average	7,425	708.38	1968	0	1968	330,531	6,065	399.49	2342	57	2399	260,481	14445
Total	386,075		102340	0	102340	17,187,590	315,401		121775	2950	124726	13,545,020	751137

Scenario Title: Batch 2 Scenario 8
Run Title: IF Batch 2 Scenario 8 Run 2
Total System Gen. (MWh) 701,476 On-peak: 457,750 Off-peak: 243,728
Total System Revenue ($) 30,732,620 On-peak: 21,638,366 Off-peak: 9,094,251

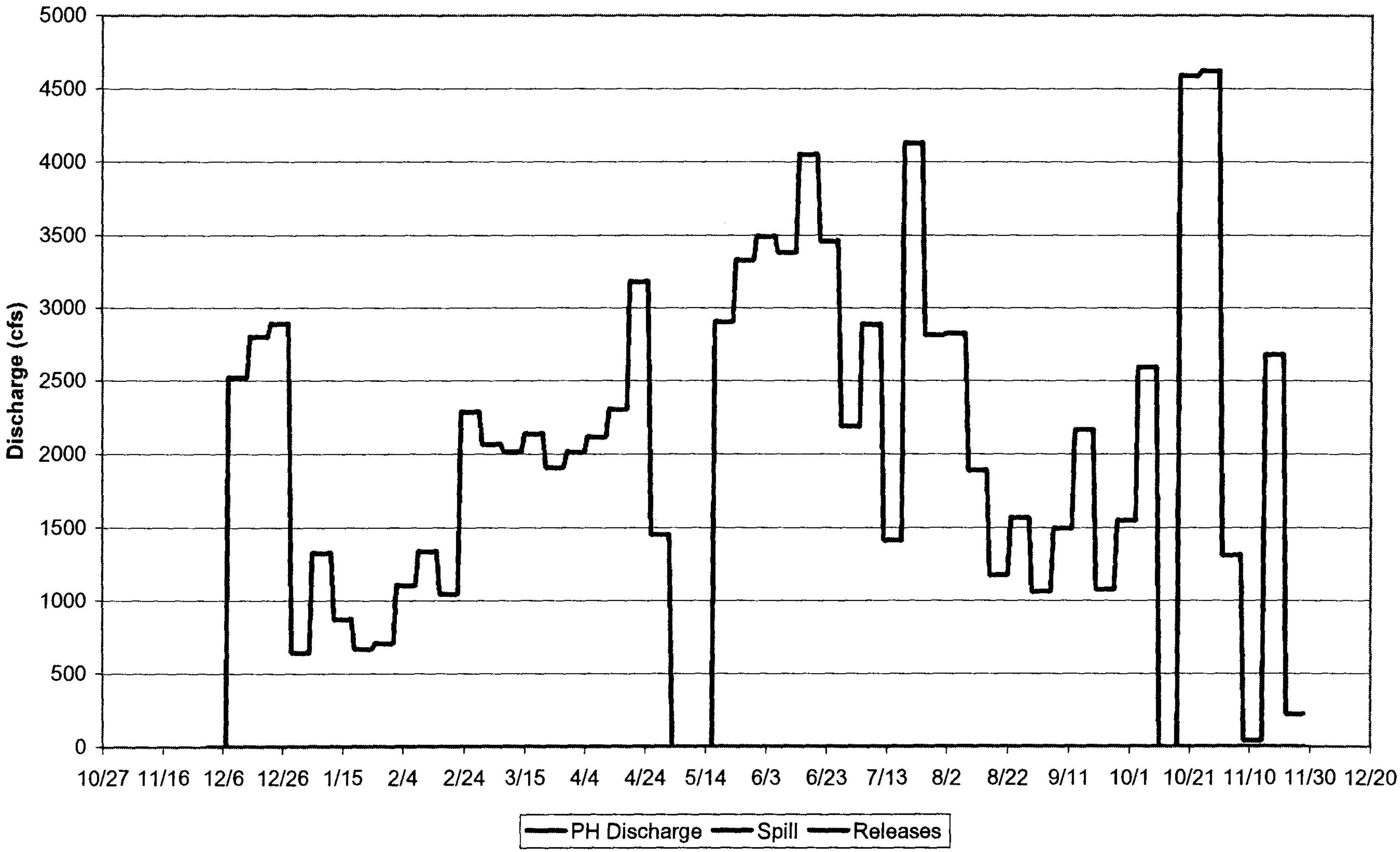
Date	[redacted]																	
1-Dec-99	57,790	0	57,790	1,063	0	1,063	30	0	30	0.55	0	0.55	57,760	0	57,760	1,062	0	1,062
8-Dec-99	734,526	211,326	945,852	13,507	4,722	18,230	395,843	95,577	491,420	7,279	2,136	9,415	338,683	115,749	454,432	6,228	2,587	8,815
15-Dec-99	733,544	489,577	1,223,121	13,489	10,940	24,429	375,884	165,594	541,478	6,912	3,700	10,613	357,660	323,983	681,643	6,577	7,240	13,817
22-Dec-99	760,215	466,737	1,226,952	13,980	10,430	24,410	406,275	147,745	554,021	7,471	3,302	10,773	353,940	318,991	672,931	6,509	7,128	13,637
29-Dec-99	340,849	2,030	342,880	6,660	63.95	6,724	132,320	0	132,320	2,433	0	2,433	208,529	2,030	210,559	4,227	63.95	4,291
5-Jan-00	339,859	124,134	463,993	8,604	3,910	12,514	199,315	0	199,315	5,046	0	5,046	140,544	124,134	264,678	3,558	3,910	7,468
12-Jan-00	268,494	121,243	389,738	6,797	3,819	10,616	131,172	0	131,172	3,321	0	3,321	137,323	121,243	258,566	3,477	3,819	7,295
19-Jan-00	234,106	117,286	351,392	5,927	3,694	9,621	101,420	0	101,420	2,568	0	2,568	132,686	117,286	249,972	3,359	3,694	7,053
26-Jan-00	241,781	114,654	356,435	5,936	3,544	9,480	111,395	0	111,395	2,711	0	2,711	130,386	114,654	245,041	3,225	3,544	6,769
2-Feb-00	325,576	132,807	458,384	7,358	3,450	10,807	186,696	0	186,696	4,219	0	4,219	138,880	132,807	271,688	3,139	3,450	6,588
9-Feb-00	348,175	140,881	489,056	7,868	3,659	11,528	213,013	11,424	224,437	4,814	296.7	5,111	135,162	129,457	264,619	3,055	3,363	6,417
16-Feb-00	305,975	123,982	429,957	6,915	3,220	10,135	176,365	0	176,365	3,986	0	3,986	129,610	123,982	253,592	2,929	3,220	6,149
23-Feb-00	414,498	203,940	618,438	9,367	5,297	14,664	287,941	83,018	370,959	6,507	2,156	8,663	126,557	120,922	247,479	2,860	3,141	6,001
1-Mar-00	420,050	166,019	586,069	9,439	4,312	13,752	292,541	44,768	337,308	6,574	1,163	7,737	127,509	121,252	248,761	2,865	3,149	6,015
8-Mar-00	392,275	177,683	569,958	8,815	4,615	13,430	264,635	56,299	320,934	5,947	1,462	7,409	127,640	121,384	249,024	2,868	3,153	6,021
15-Mar-00	409,968	175,201	585,168	9,213	4,551	13,763	282,467	53,949	336,415	6,348	1,401	7,749	127,501	121,252	248,753	2,865	3,149	6,015
22-Mar-00	394,342	153,955	548,297	8,862	3,999	12,860	266,201	32,015	298,216	5,982	831.6	6,814	128,141	121,940	250,081	2,880	3,167	6,047
29-Mar-00	376,879	181,060	557,939	8,436	4,684	13,119	248,528	59,047	307,576	5,564	1,529	7,094	128,351	122,013	250,363	2,871	3,154	6,026
5-Apr-00	393,837	180,209	574,046	8,752	4,651	13,402	264,879	58,126	323,005	5,886	1,500	7,386	128,958	122,083	251,041	2,866	3,151	6,016
12-Apr-00	464,148	199,321	663,469	10,314	5,144	15,458	278,789	74,305	353,094	6,195	1,918	8,113	185,358	125,017	310,375	4,119	3,226	7,345
19-Apr-00	507,219	380,078	887,298	11,272	9,808	21,080	291,504	176,006	467,510	6,478	4,542	11,020	215,716	204,072	419,787	4,794	5,266	10,060
26-Apr-00	245,037	150,577	395,614	5,445	3,886	9,331	167,639	50,866	218,505	3,725	1,313	5,038	77,398	99,711	177,109	1,720	2,573	4,293
3-May-00	29	0	29	0.7	0	0.7	29	0	29	0.7	0	0.7	0	0	0	0	0	0
10-May-00	28	0	28	0.67	0	0.67	28	0	28	0.67	0	0.67	0	0	0	0	0	0
17-May-00	503,218	271,762	774,980	12,199	8,660	20,860	303,156	103,830	406,986	7,349	3,309	10,658	200,063	167,932	367,995	4,850	5,352	10,202
24-May-00	504,352	315,395	819,747	12,227	10,051	22,278	307,319	151,005	458,324	7,450	4,812	12,262	197,033	164,389	361,423	4,777	5,239	10,015
31-May-00	467,615	338,813	806,428	12,095	10,875	22,970	283,583	175,506	459,088	7,334	5,632	12,966	184,033	163,307	347,340	4,762	5,242	10,004
7-Jun-00	460,953	329,759	790,712	12,130	10,593	22,723	279,534	166,252	445,786	7,356	5,341	12,697	181,419	163,507	344,926	4,774	5,252	10,027
14-Jun-00	481,749	405,527	887,276	12,678	13,027	25,704	295,218	237,131	532,349	7,769	7,617	15,386	186,531	168,396	354,927	4,909	5,409	10,318
21-Jun-00	480,435	343,957	824,392	12,643	11,049	23,692	291,349	174,572	465,920	7,667	5,608	13,275	189,087	169,385	358,472	4,976	5,441	10,417
28-Jun-00	410,035	288,810	698,845	9,370	7,419	16,789	217,198	144,881	362,079	4,831	3,715	8,546	192,837	143,930	336,766	4,539	3,704	8,242
5-Jul-00	330,553	171,434	501,987	6,781	4,396	11,176	330,553	171,434	501,987	6,781	4,396	11,176	0	0	0	0	0	0
12-Jul-00	273,699	0	273,699	5,614	0	5,614	273,699	0	273,699	5,614	0	5,614	0	0	0	0	0	0
19-Jul-00	501,829	307,469	809,299	10,294	7,884	18,178	400,054	307,469	707,523	8,206	7,884	16,090	101,775	0	101,775	2,088	0	2,088
26-Jul-00	606,001	122,931	728,932	12,117	3,126	15,244	394,101	121,598	515,700	7,906	3,094	11,000	211,900	1,332	213,232	4,211	32.7	4,244
2-Aug-00	781,295	151,396	932,691	14,434	3,715	18,149	430,645	126,345	556,990	7,956	3,100	11,056	350,649	25,052	375,701	6,478	614.8	7,093
9-Aug-00	712,214	59	712,272	13,157	1.44	13,159	403,515	59	403,574	7,455	1.44	7,456	308,698	0	308,698	5,703	0	5,703
16-Aug-00	448,754	0	448,754	8,290	0	8,290	252,856	0	252,856	4,671	0	4,671	195,898	0	195,898	3,619	0	3,619
23-Aug-00	686,998	22,869	709,867	12,692	561.2	13,253	337,721	0	337,721	6,239	0	6,239	349,278	22,869	372,147	6,453	561.2	7,014
30-Aug-00	227,747	0	227,747	4,242	0	4,242	227,747	0	227,747	4,242	0	4,242	0	0	0	0	0	0
6-Sep-00	652,400	285,764	938,164	12,309	7,013	19,322	314,051	0	314,051	5,925	0	5,925	338,349	285,764	624,114	6,384	7,013	13,397
13-Sep-00	731,506	293,652	1,025,158	13,802	7,206	21,008	415,154	26,759	441,913	7,833	656.7	8,490	316,352	266,893	583,245	5,969	6,550	12,518
20-Sep-00	515,761	242,458	758,219	9,731	5,950	15,681	227,221	0	227,221	4,287	0	4,287	288,539	242,458	530,997	5,444	5,950	11,394
27-Sep-00	568,940	11,048	579,988	10,935	272.4	11,208	317,145	0	317,145	6,067	0	6,067	251,795	11,048	262,842	4,868	272.4	5,141
4-Oct-00	527,465	90,741	618,206	10,602	2,283	12,885	391,443	90,489	481,932	7,868	2,276	10,145	136,022	252	136,274	2,734	6.35	2,740
11-Oct-00	35	0	35	0.71	0	0.71	35	0	35	0.71	0	0.71	0	0	0	0	0	0
18-Oct-00	685,864	527,225	1,213,089	13,786	13,264	27,050	416,963	360,115	777,078	8,381	9,059	17,441	268,902	167,110	436,012	5,405	4,204	9,609
25-Oct-00	703,893	442,806	1,146,699	14,149	11,140	25,288	416,381	344,395	760,776	8,369	8,664	17,033	287,511	98,411	385,923	5,779	2,476	8,255
1-Nov-00	249,189	0	249,189	5,034	0	5,034	249,189	0	249,189	5,034	0	5,034	0	0	0	0	0	0
8-Nov-00	8,131	0	8,131	164.3	0	164.3	8,131	0	8,131	164.3	0	164.3	0	0	0	0	0	0
15-Nov-00	362,369	114,679	477,048	7,321	2,771	10,092	361,327	114,679	476,006	7,300	2,771	10,071	1,042	0	1,042	21.05	0	21.05
22-Nov-00	46,166	2,997	49,163	932.6	72.44	1,005	39,142	2,997	42,139	790.7	72.44	863.2	7,024	0	7,024	141.9	0	141.9
Total	**21,638,366**	**9,094,251**	**30,732,620**	**457,750**	**243,728**	**701,476**	**13,259,339**	**3,928,255**	**17,187,593**	**280,814**	**105,259**	**386,076**	**8,379,029**	**5,165,997**	**13,545,027**	**176,938**	**138,467**	**315,403**

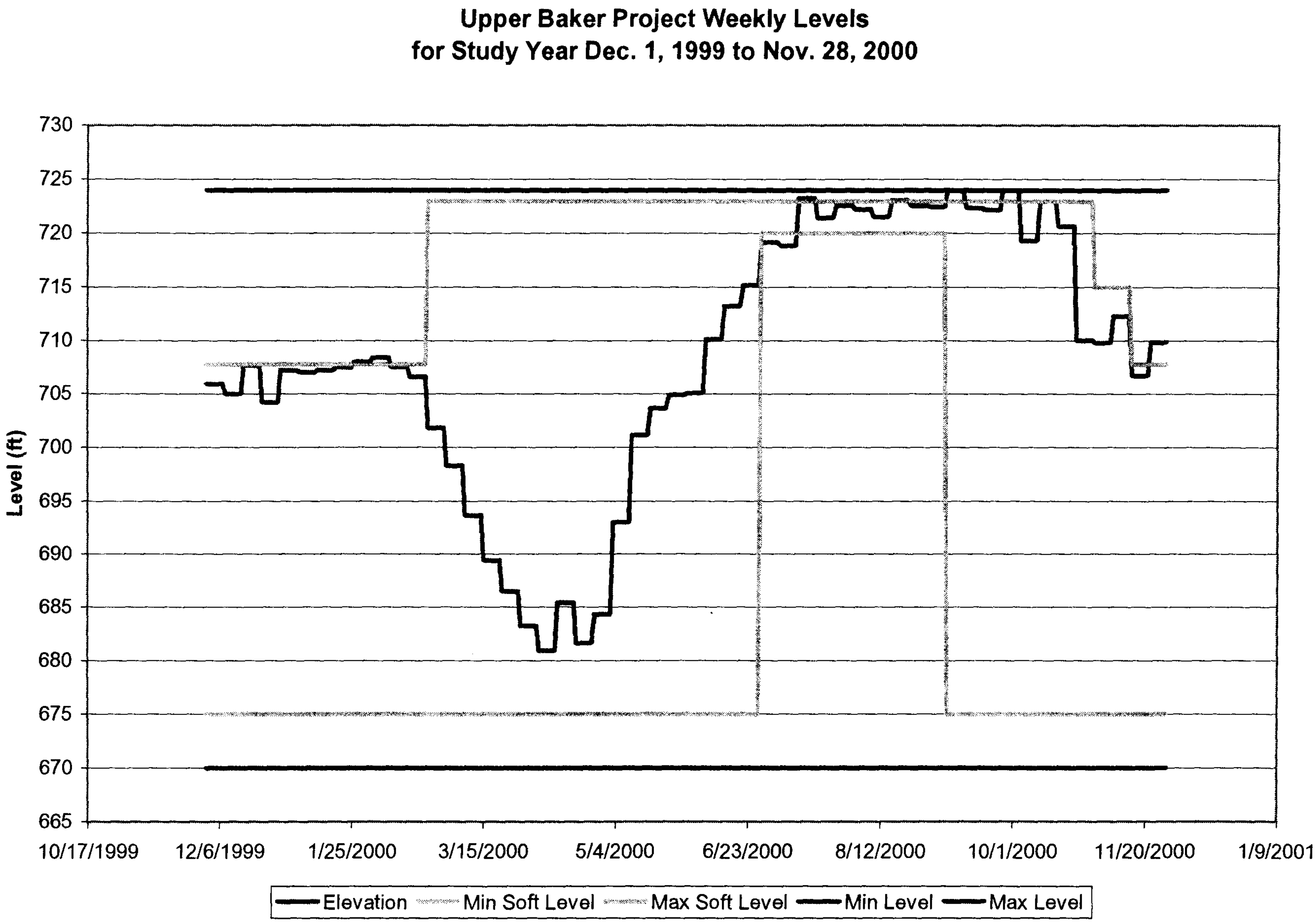
Scenario Title: Batch 2 Scenario 8
Run Title: IF Batch 2 Scenario 8 Run 2

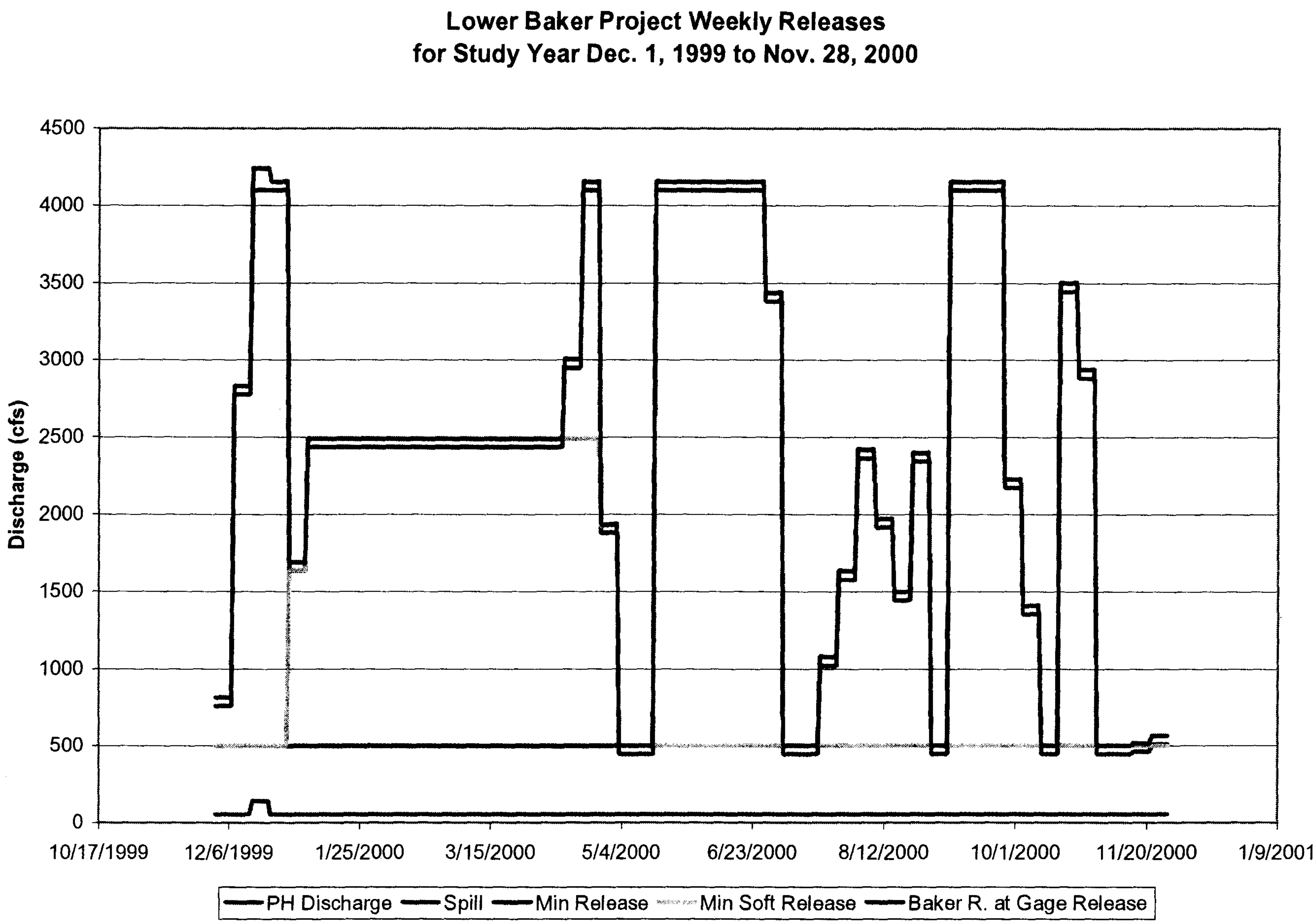
Constraints Violation Frequency in hours

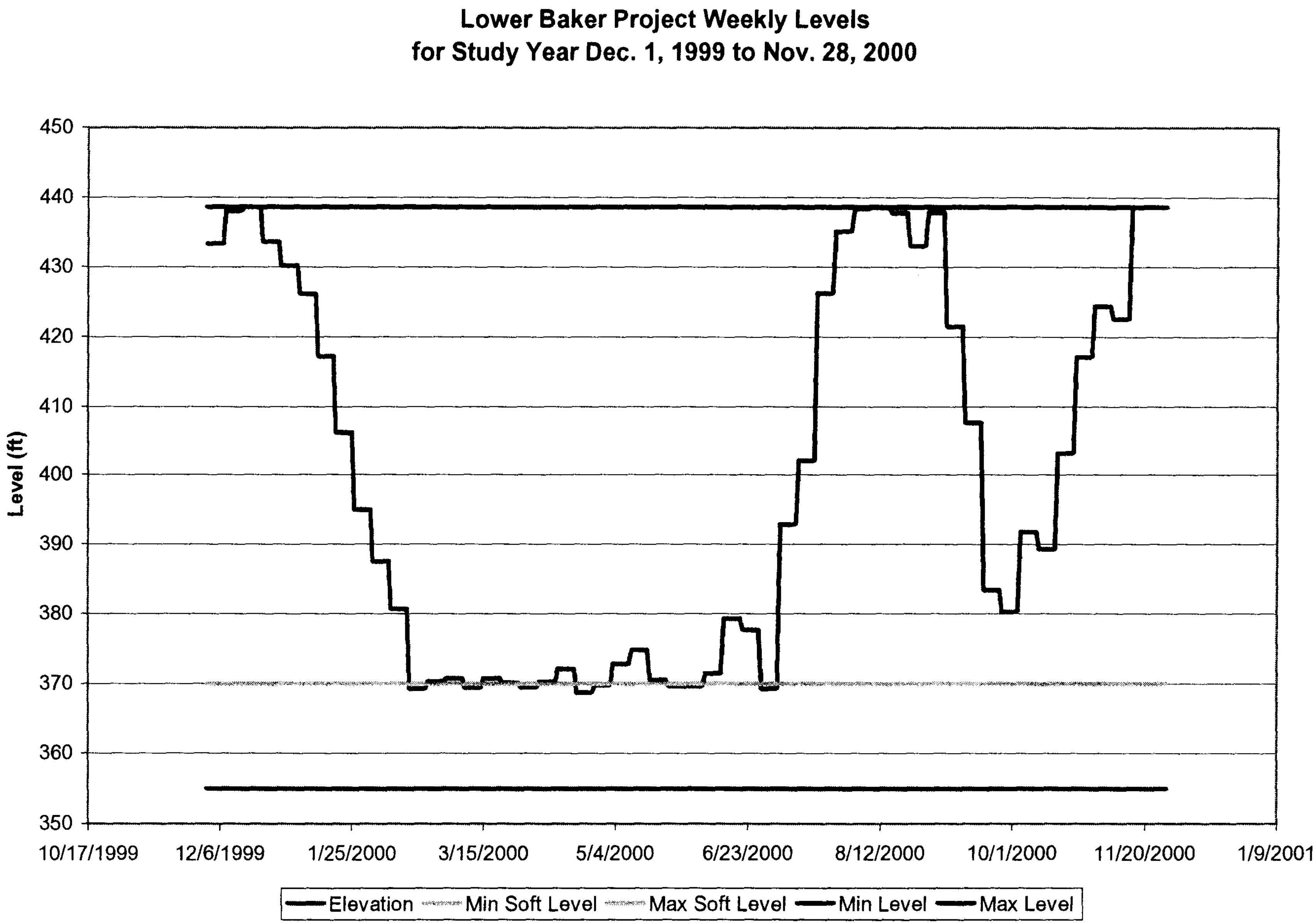
Month	Upper Baker			Lower Baker			Baker R. at Skagit R.	Skagit R. at Baker R.	
	Maximum Elevation	Minimum Elevation	Minimum Discharge	Maximum Elevation	Minimum Elevation	Minimum Discharge	Minimum Release	Level Down Ramping	Level Up Ramping
January	29						65	73	75
February	100				37		0	91	97
March					123		0	97	115
April					116		0	82	78
May					90		0	101	105
June					53		0	101	121
July	25	197			56		0	95	99
August	44						1	63	94
September	115						0	90	114
October	168						0	108	109
November	199						0	118	103
December	93						0	144	123
Annual Total Violations	773	197			475		**66**	**1163**	**1233**

Upper Baker Project Weekly Releases for Study Year Dec. 1, 1999 to Nov. 28, 2000




Upper Baker Project Weekly Levels
for Study Year Dec. 1, 1999 to Nov. 28, 2000
730
725
720
715
710
705
700
695
690
685
680
675
670
665
Level (ft)
10/17/1999
12/6/1999
1/25/2000
3/15/2000
5/4/2000
6/23/2000
8/12/2000
10/1/2000
11/20/2000
1/9/2001
Elevation
Min Soft Level
Max Soft Level
Min Level
Max Level


Lower Baker Project Weekly Releases
for Study Year Dec. 1, 1999 to Nov. 28, 2000
Discharge (cfs)
4500
4000
3500
3000
2500
2000
1500
1000
500
0
10/17/1999
12/6/1999
1/25/2000
3/15/2000
5/4/2000
6/23/2000
8/12/2000
10/1/2000
11/20/2000
1/9/2001
PH Discharge
Spill
Min Release
Min Soft Release
Baker R. at Gage Release


Lower Baker Project Weekly Levels
for Study Year Dec. 1, 1999 to Nov. 28, 2000
Level (ft)
450
440
430
420
410
400
390
380
370
360
350
10/17/1999
12/6/1999
1/25/2000
3/15/2000
5/4/2000
6/23/2000
8/12/2000
10/1/2000
11/20/2000
1/9/2001
Elevation
Min Soft Level
Max Soft Level
Min Level
Max Level

DON MUNKS
FIRST DISTRICT

KENNETH A. DAHLSTEDT
SECOND DISTRICT

TED W. ANDERSON
THIRD DISTRICT

SKAGIT COUNTY
BOARD OF COMMISSIONERS
Skagit County Administration Building
700 S. Second, Room 202
Mount Vernon, Washington 98273
(360) 336-9300
FAX # (360) 336-9307

February 4, 2003

Colonel Ralph H. Graves, District Engineer
U.S. Army Corps of Engineers, Seattle District
4735 E. Marginal Way South
Seattle, WA 98124-2255

RE: Baker Dam Flood Control Storage

Dear Colonel Graves:

Skagit County has been actively participating in the relicensing process sponsored by Puget Sound Energy (PSE) in their efforts to relicense their Baker Dam Project. PSE is following an "Alternative vs. Traditional" licensing process where it hopes to listen to stakeholders, resolve disputes and define the conditions of settlement as part of their license application which has been tentatively scheduled for submission in April of 2004.

Skagit County is participating in this process to look after the best interests of its citizens as it relates to optimizing flood control, maintaining recreational opportunities, providing affordable and reliable energy and protecting the ability of downstream users to secure and maintain water rights for residential, commercial, agricultural and salmon restoration uses.

The purpose of this letter is to primarily address the issue of flood control and to specifically request that the Army Corps of Engineers initiate the required studies to obtain the remaining 26,000 AF of storage available at the Baker Dam Project.

<u>Background</u>

Article 32 of the 1956 FERC License for the Upper Baker states:

"The Licensee shall so operate the Upper Baker reservoir as to provide each year 16,000 AF of space for flood regulation between 1 November and 1 March as replacement valley storage eliminated by the development. Utilization of this storage space shall be directed by the District Engineer, Corps of Engineers, Seattle, Washington."

Article 32 further states:

"In addition to the above-specified 16,000 AF, the Licensee shall provide in the Upper Baker reservoir space for flood control during the storage drawdown season (about 1 September to April 15) up to a maximum of 84,000 AF as may be requested by the District Engineer, provided that suitable arrangements shall have been made to compensate the Licensee for reservation of flood control space other than the 16,000 AF specified herein."

In 1976, the Seattle District submitted a report to Congress recommending an additional 58,000 AF of additional flood control storage space be provided in the Baker Reservoir. This recommendation was supported with a B/C ratio of 2.2 using 1976 price levels and was authorized by Congress in 1977. Today the Baker Reservoir currently provides 74,000 AF with the **provision that the additional 26,000 AF could be utilized under the provisions of Article 32.**

Current Level of Risk and Flood Protection

As you know by way of the Army Corps participation in the current Skagit River Feasibility Study (SRFS), there is a significant risk of life, safety and critical infrastructure in the upper and lower valley due to the lack of adequate flood protection. The Army Corps of Engineers recently calculated that our current level of flood protection in the lower valley is for a 25 year event and that the expected damages from a 100 year event would exceed a billion dollars and would have significant impacts upon our regional economy. In 2000, a visiting FEMA official told a local audience that the Skagit River was "potentially the most damaging river in the State and Region".

Skagit County and the Army Corps, along with financial assistance from the State of Washington and local cities, have spent over $4 million dollars over the last seven years to evaluate the list of long-term lower valley flood control alternatives. The alternatives under consideration include diversion, set-back levees, or overtopping levees, all of which are dependent upon the existing flood control storage at all upper valley dams. Each alternative is being analyzed from an engineering, economic and environmental perspective and we remain optimistic that a flood control alternative will evolve from this tedious and expensive investment.

Thanks to the work of your agency, the Skagit River Feasibility Study has generated several key products relevant to this discussion including a state-of-the-art hydrology and hydraulic model, current economic figures, stage-damage curves and environmental information.

Local Government Request

Due to the existing flood risk to our residents and local economy, the Board of County Commissioners feel it is critical that we utilize the current economic, environmental and engineering information generated from these two major projects (SRFS and Baker Dam Relicensing) to optimize the flood control storage at the Baker Project as specified within Article 32. After reviewing the Army Corps of Engineers 1976 EIS & (Title) used to justify the additional 58,000 AF, we have concluded that the bulk of the information required for such an analysis has been or will be completed as a result of these two major efforts taking place in Skagit County. This request is also consistent with the adopted Skagit County Comprehensive Flood Hazard Management Plan which identifies the need to pursue additional upstream storage in conjunction with downstream flood control improvements.

More specifically, the Board of County Commissioners respectfully requests that the Seattle District work closely with PSE and Skagit County to immediately begin the development of the documentation necessary to obtain this additional storage for flood control as part of the Baker Project Relicensing effort. Through this collaboration, each agency and the citizens they represent should benefit in the overall savings of utilizing current information offered by these studies and the Alternative Relicensing structure that is currently in-place for such negotiations. We appreciate your consideration of this very important project and will look forward to further discussion.

If you have any further questions related to this request please contact our chairman, Commissioner Ken Dahlstedt at (360)336-9300. Thank you for your time and consideration.

Sincerely,

BOARD OF COUNTY COMMISSIONERS
SKAGIT COUNTY, WASHINGTON

Kenneth A. Dahlstedt
KENNETH A. DAHLSTEDT, Chairman

Ted W Anderson
TED W. ANDERSON, Commissioner

Don Munks
DON MUNKS, Commissioner

BCC:DB/djm

Skagit County, Washington
Flood Issues

Meeting with Major General Griffin
Director of Civil Works, United States Army Corps of Engineers
2/28/03

1. Skagit River Flood Feasibility Study (Seattle District)

- Initiated 1996
- Total expenditures to date: $4 million. Expected feasibility study cost: $6.5 million
- Total project cost: $200 - $300 million
- EIS underway
- Environmental issues and low Federal funding levels slowing progress
- Current initiative: gain funding from TEA-21 reauthorization to extend bridges
    - Concept has support from Tribes, local governments, dike districts and legislative delegation
    - Minimal environmental issues for this part of the project
    - Seattle District staff is on board, looking for ways to help

2. Additional flood storage for the Puget Sound Energy, Inc. Baker Hydroelectric / Flood Storage Project

- Project currently undergoing FERC relicensing, due in 2006
- Congress has authorized 100,000 acre-feet of storage; 74,000 currently in use
- Skagit County goal: obtain additional 26,000 acre-feet as part of the relicensing process
    - This additional flood storage is very cost effective
    - Critical issue to our "upriver" constituents
- Col Graves, Seattle District, is working on this

Modifying Skagit County's Flood Project Proposal: Make Essential Upstream Improvements First

Concept: Phase the project

- Phase 1:
  - provide 100 year flow through the 3-bridge corridor
  - protect major population centers
  - overtop in Riverbend area
- Phase 2:
  - provide additional incremental flood protection as financially and environmentally feasible. Potential to dovetail with FEMA Floodway and environmental studies being completed by COE's Puget Sound Near Shore Project.

Expense Components, Phase 1

- *Upstream Improvements*		
- Sterling levee, other minor treatments		$10M
- Levee Setback incl real estate		$15M
- Bridges:	-- I-5	$17M
	-- Skagit	$ 5M
	-- Burlington Northern RR	$12M
- *Downstream / Overtopping Improvements*		
-- Various Infrastructure		$ 5M
-- Flood Easements		$10M
-- FHM Flood proofing residences		
-- Development restrictions		
		$74M

Revenue Possibilities, Phase 1

- Federal 65% (TEA-21 follow-on; WRDA)	$48M
- Credit for DD12 and DD17 levee setback	$13M
- Private BNSF	6M
- Balance to pay (PWTF $430k/year @ 2%, 20 yrs)	$ 7M
	$74M

Discussion

1) Rural Community wants ag land left in flood plain to a) discourage development, b) retain critical mass of ag land needed for viable ag industry, and c) protect rural character/heritage
2) Focus on 3-bridge corridor in phase 1 would help simplify concept, focus resources
3) Simplifies nature of ag/fish discussion, dovetails into county-wide watershed management plan
4) Emphasizes most important project component (3 bridge corridor) instead of least important (bypass)
   - Cost/benefit: Phase 1 would protect 70% of total property value for $7 million additional local $$
5) Looks to be affordable with no public vote/excess levy (see above)
6) Potential to tap next federal 6-year transportation bill and further reduce appropriation needed in WRDA
7) Meets federal legislators' request to save money
8) Potential to garner firm support from all elected officials in the County
9) Would diminish Federal Resource Agency veto influence over project because of lack of an issue
10) Current feasibility study could be adjusted to accommodate
11) Issue: concentrates more water at the Riverbend area; will possibly increase damage there
12) Issue: cities will be primary beneficiaries -- therefore, County Road Fund use may be limited

Martin / 336-9400 / chalm@co.skagit.wa.us / 1-8-03

BIOLOGICAL ASSESSMENT

UPPER BAKER LAKE FLOOD CONTROL AGREEMENT 2000-2006 EXTENSION

WHATCOM COUNTY, WASHINGTON

August 2000

Baker Lake Vicinity- Whatcom County, Washington

U.S. Army Corps of Engineers
Seattle District

Table of Contents

1.0 Project Location and History

The Upper Baker Dam and Reservoir is an operating hydroelectric project on the Baker River in Skagit and Whatcom counties in Washington State (Figure 1). The project is owned and operated by Puget Sound Energy (PSE) and is located about 8 miles above Concrete, Washington. Upper Baker Dam is a concrete gravity dam about 330 feet high with a spillway crest elevation of 694 feet. The dam was completed and put into service in June 1959. The powerhouse contains two 47,200 kW nameplate turbines, and the reservoir has a capacity of 220,630 acre-feet of usable water storage between normal maximum pool elevation of 724 feet and minimum operating pool elevation of 655 feet. Before October 1980, the dam provided 16,000 acre-feet of flood control storage from November through February. The pool was typically evacuated to elevation 700 feet by the middle of January or occasionally by mid-December, and to 680 feet by February for power generation.

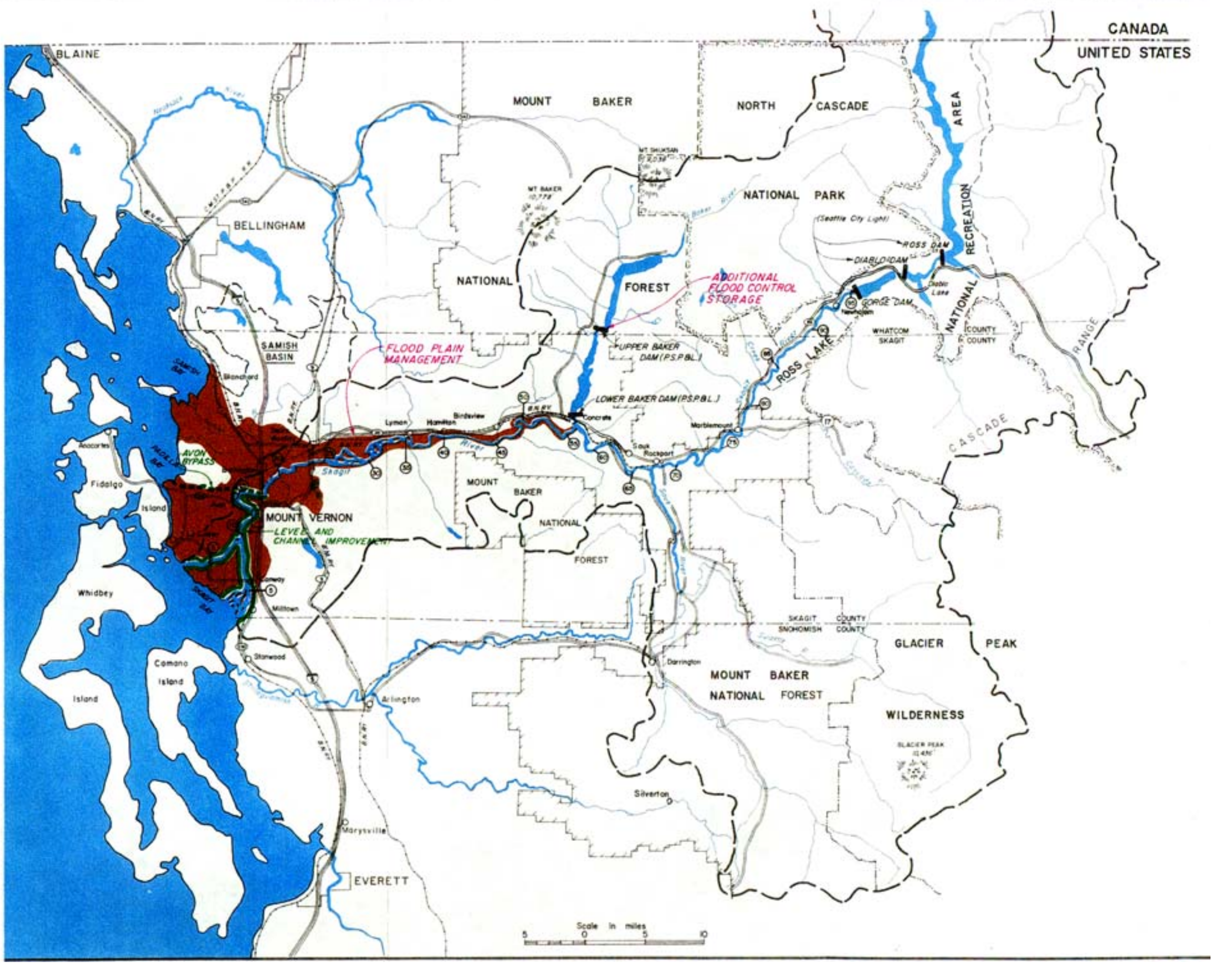


Figure 1. Upper Baker Dam Vicinity Map.

2.0 Project Description

On October 10, 1980, Puget Sound Energy implemented the Corps of Engineers Flood Control Agreement. This agreement modified dam operations to provide additional 58,000 acre-feet of water storage for flood control. To abide by this agreement, the pool elevation is required to be

720.75 feet by 1 November and 707.8 feet (a drop of 12.95 ft.) by 15 November. The 707.8 feet pool elevation is to be maintained from 15 November until 1 March thus providing the additional 58,000 acre-feet and a total of 74,000 acre-feet of reservoir storage (Figure 2).
The Flood Control Agreement (Contract Number DE-MS79-80BP90011) executed on 10 October 1980 expires on September 30, 2000. The Corps of Engineers is proposing to renew and extend the existing agreement until June 2006 to continue flood operations on a timescale more consistent with the FERC re-licensing process required for Upper Baker Dam.

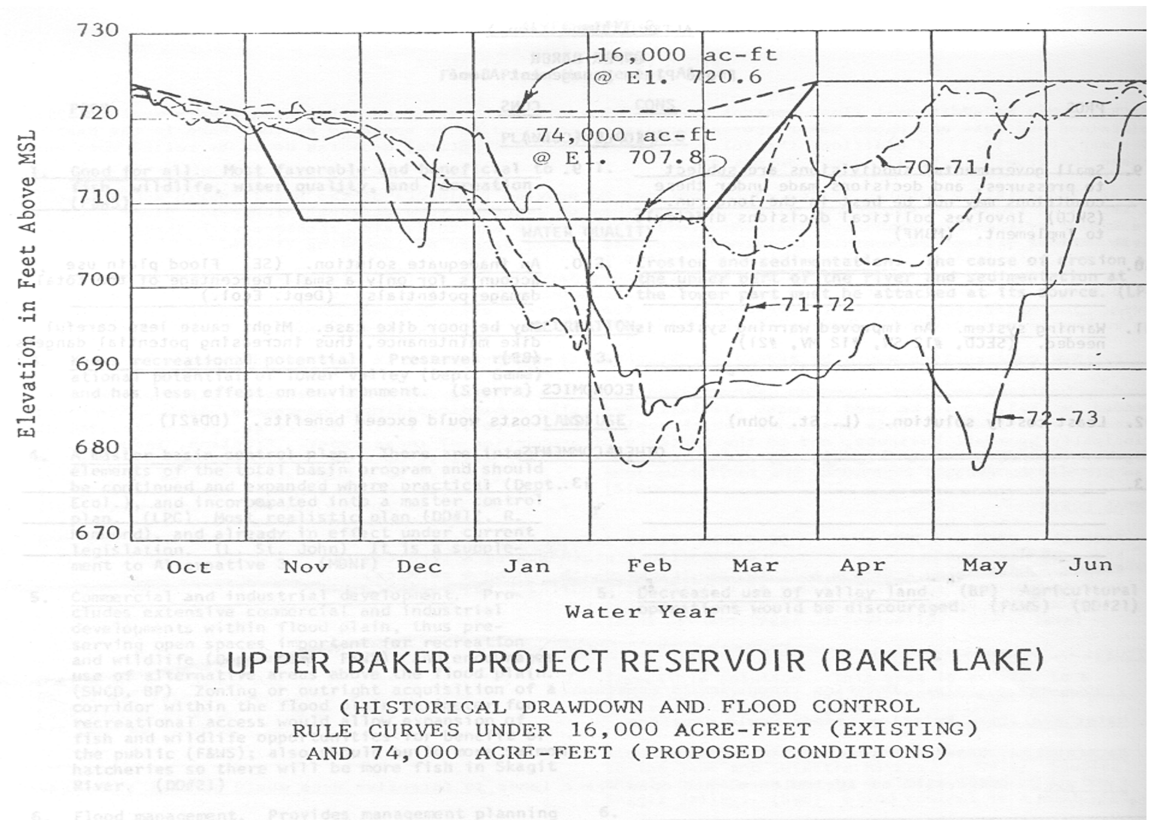


Figure 2. Current Flood Control Rule Curve.

3.0 Action Area

The action area for this agreement encompasses the entire Baker River from its start in the glaciers of Mount Challenger in the Pickett Range, to its confluence with the Skagit River at Concrete, to Skagit Bay on the Puget Sound. Above Baker Dam there is approximately 34 miles of suitable anadromous fish habitat including the 7 mile reservoir known as Baker Lake. The Baker River has numerous tributaries providing inflow and habitat for fish. The major tributaries of the Baker River are Rocky, Sulfur, Boulder, and Park creeks, which flow down the east slopes of Mount Baker, and Swift Creek, which originates from the west side of Mount Shuksam. Some other tributaries of the Baker River system are Crystal and Pass Creeks, that flow into the Baker River above the reservoir, and Noisy Creek that flows into Baker Lake from the southeast. Little Park, Sandy, and Little Sandy, flow into the west side of Baker Lake, Shannon and Chadwick flow into the northwest area of Baker Lake. The last streams to mention are Silver, Anderson and Welker Creeks which flow into the east side of Baker Lake.

Downstream of the Upper Baker Dam some of the Baker Rivers tributaries drain into Lake Shannon. Sulfur and Rocky Creeks that were mentioned above are major tributaries of the Baker River that flow into the west side of Lake Shannon. Bear Creek also flows into the west side of Baker Lake and Thunder Creek flow into the east side of Lake Shannon. The Confluence of the Baker River and the Skagit River occurs approximately 1.0 mile Downstream of Baker Dam on Lake Shannon near the City of Concrete. The action area also includes the 40 miles of the Skagit River from the confluence of the Baker and Skagit Rivers to Skagit Bay in the Puget Sound.

4.0 Methods Used to Prepare BA

The Baker River Project has been studied by the Corps of Engineers and has been the subject of an Environmental Impact Statement dated September 1976. Local experts were telephoned and interviewed regarding the listed species in this BA. Available literature on research, species natural history, and the effects of reservoir drawdown were reviewed to gain an understanding of the potential impacts from the proposed agreement renewal. References are named in the text and are listed at the end of this assessment.

5.0 Bull Trout

5.1 Status of the Species

Bull trout in the Coastal-Puget Sound distinct population segment (DPS) were listed as a threatened species by the USFWS on November 1, 1999. Dolly Varden were not listed as part of this action. However, both bull trout and Dolly Varden are present in the Coastal-Puget Sound DPS, and have been found to coexist in a number of streams in this region. Bull trout and Dolly Varden are very difficult to distinguish based upon physical features, and have similar life history traits and habitat requirements. Because these two species are closely related and have similar biological characteristics, the WDFW manages bull trout and Dolly Varden together as "native char".

5.2 Life History

Bull trout (*Salvelinus confluentus*) is a western North American char in the family Salmonidae. In 1978, bull trout were differentiated from Dolly Varden as a separate species (Cavender 1978). This original work was supported by the further investigations of Haas and McPhail (1991).

Bull trout are known to exhibit four types of life history strategies. The three freshwater forms include adfluvial forms, which migrate between lakes and streams; fluvial forms, which migrate within river systems; and resident forms, which are non-migratory. The fourth strategy, anadromy, occurs when the fish spawn in fresh water after rearing for some portion of their life in the ocean.

In fluvial and adfluvial bull trout populations, adults undergo spawning migrations of up to 225 kilometers (Shepard et al 1984). Adults from fluvial populations are found in rivers and larger streams. Smaller tributaries act as breeding grounds and rearing areas for juveniles. Adfluvial populations are found in regions with lakes or reservoirs. Juveniles may remain from one to six years in nursery streams before migrating to rivers (fluvial) or lakes (adfluvial). As adults, they usually live in rivers or lakes for two to three years before spawning (Allen 1980; Fraley and Shepard 1989).

Bull trout spawning usually takes place in the fall during September and October. Initiation of breeding appears to be related to declining water temperatures. In Washington, Wydoski and Whiting (1979) reported spawning activity was most intense at 5 to 6^{o}C. Spawning occurs primarily at night (Heimer 1965; Weaver and White 1985).

5.3 Habitat Requirements

Juvenile bull trout, particularly young of year (YOY), have very specific habitat requirements. Small bull trout (less than 100mm), are primarily bottom-dwellers, occupying positions above, on or below the stream bottom. Bull trout fry are found in shallow, slow backwater side channels or eddies (Shepard et al. 1984, Elliott 1986). The adult bull trout, like its young, is a bottom dweller, showing preference for deep pools of cold water rivers, lakes and reservoirs (Moyle 1976).

5.4 Distribution

According to the 1992 Washington State Salmonid Stock Inventory (SASSI). for Bull Trout/ Dolly Varden, Baker Lake, now a reservoir, contains a native population of bull trout/Dolly Varden which has been identified as a distinct stock based on its geographic distribution. Bull trout/Dolly Varden are found in both the reservoir and tributary areas, such as the upper Baker River. This population is probably composed of both adfluvial and resident life history forms. Spawning is from early September through mid-November (SASSI 1994). According to the 1992 SASSI the stock status is unknown, but it appears that the population is healthy and very stable. A 1995 pygmy whitefish study conducted by the Washington Department of Fish and Wildlife consistently found Bull trout in their samples and in one sample, Bull trout made up 16.0% of the catch. Anglers have targeted Bull trout at Baker Lake for over 30 years. The stability of the Baker Lake Bull trout population may be, in part, due to the protected nature of their spawning grounds. The majority of potential spawning habitat is located in the North Cascades National Park with the remainder in the Baker National Forest.

6.0 Chinook salmon

6.1 Status of the Species

Puget Sound chinook salmon was listed as a threatened species on March 16, 1999. The ESU includes all naturally spawned populations of chinook salmon from rivers and streams flowing into Puget Sound, including the Straits of Juan De Fuca, from the Elwha River eastward, including rivers and streams flowing into Hood Canal, South Sound, North Sound and the Strait of Georgia in Washington.

6.2 Species Description

The chinook salmon is the largest of the seven species of Pacific salmon. Mature adults can reach weights in excess of 40 kg. Chinook are the least numerous of the five Pacific salmon species that occur in North America. Adults are distinguished by the black irregular spotting on the back and dorsal fins and on both lobes of the caudal or tail fin. Chinook salmon also have a black pigment along the gum line, which gives them the name "blackmouth" in some areas.

In the ocean, the chinook salmon is a deep-bodied fish with a bluish-green coloration on the back which fades to a silvery color on the sides and white on the belly. Colors of spawning chinook salmon in fresh water range from red to copper to almost black, depending on location and degree of maturation. Males are more deeply colored than the females and also are distinguished by their "ridgeback" condition and by their hooked nose or upper jaw. Juveniles in fresh water are recognized by well-developed parr marks which are bisected by the lateral line.

Chinook salmon have been commercially harvested since the mid-nineteenth century. They have been highly valued by indigenous peoples for thousands of years. Individual spawning populations of chinook salmon tend to be relatively small, typically not more than a few tens of thousands. Healey (1991) reports that 80 percent of the chinook populations in British Columbia average fewer than 1,000 spawners. Larger river systems tend to support the largest populations (Healey 1991). According to WDF et al. (1993), there are 26 stocks of chinook salmon in Puget Sound.

6.3 Critical Habitat description

Proposed critical habitat is includes all marine, estuarine and river reaches accessible to chinook salmon in Puget Sound. Critical habitat consists of the water, substrate, and adjacent riparian zone of accessible estuarine and riverine reaches, as well as some marine areas. Puget Sound marine areas include South Sound, Hood Canal, and North Sound to the international boundary at the out extent of the straight of Georgia, Haro Strait and the Straits of Juan De Fuca to a straight line extending north from the west end of Freshwater Bay, inclusive. Excluded are areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 13,761 square mile in Washington. The following counties lie partially or wholly with these basins: Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Kittitas, Lewis, Mason, Pierce, San Juan, Skagit, Snohomish, Thurston, and Whatcom.

6.4 Life History

Chinook are anadromous and semelparous. Within this general life history strategy, however, chinook display a broad array of tactics that includes variation in age at seaward migration, variation in length of freshwater, estuarine, and oceanic residence, variation in ocean distribution and ocean migratory patterns, and variation in age and season of spawning migration. In an extensive review of the literature, Healey (1991) used differences in life history patterns to divide eastern Pacific chinook salmon into two broad races: stream-type populations and ocean-type populations. Stream-type chinook migrate to sea during the first part of their second year of life after rearing in their natal river over winter, spend most of their ocean life (2 to 5 years) in coastal waters, and return to their natal river in the spring, a few days or weeks before spawning. Ocean-type chinook migrate to sea during their first year of life, normally within three months after emergence from spawning gravel, spend most of their ocean life (2 to 5 years) in coastal waters, and return to their natal river in the fall, a few days or weeks before spawning. In the Skagit system both Stream and Ocean types exist. The Ocean-type chinook are the spring run chinook that migrate as yearlings and Stream-type chinook have summer, and fall runs that migrate as sub-yearlings.

Catch records prior to the initiation of hatchery planting in 1955, indicate that Skagit chinook entered the river from April to September with three overlapping peaks in timing. The first peak was a small spring run occurring from April to June, a larger summer run with a July through August peak, and a somewhat smaller fall run with a late August through September peak (Orrell 1976). After spawning, females probably remain on the redd from 4 to 26 days until they die or become too weak to hold in the current (Neilson and Green 1981, Neilson and Banford 1983). During this period, females will vigorously defend the redd against the spawning activity of newly arriving fish. Duration of incubation varies, depending on water temperature and location of redds, but is generally completed in about 2 months. Young spring chinook reside in stream gravel for 2 to 3 weeks after hatching (Wydoski and Whitney 1979) before moving to lateral stream habitats (e.g., sloughs, side channels, and pools) for refuge and food during their migration downstream and out to Puget Sound. Summer and fall chinook reside in the fresh water until the following summer or fall before migrating downstream to the Puget Sound and beyond.

6.5 Distribution

In North America, chinook salmon range from the Monterey Bay area of California to the Chukchi Sea area of Alaska. On the Asian coast, chinook salmon occur from the Anadyr River area of Siberia southward to Hokkaido, Japan. Today, they are also a highly prized sport fish throughout their range in North America. Chinook is the only species of salmon that has been successfully introduced in the southern hemisphere. Naturally reproducing populations have become established in New Zealand from introductions of North American chinook in the early part of the twentieth century (Healey 1991).

The native Upper Baker Chinook are believed to have been extirpated from Baker Lake although the timing of this event is debated. Some believe they were extirpated soon after construction of Upper Baker dam while others believe it may have happened late in the 1980's. Because of the lack of chinook historically in Baker Lake, the species of focus in this system has been sockeye and coho salmon. Sockeye were targeted for maintenance and enhancement for several reasons. First, is that they are believed to be of natural origin. Secondly, they represent the only known self sustaining population of sockeye in the Skagit River drainage. They are also the predominant anadromous fish in the system today. Coho salmon were targeted due to their natural origin and are currently the second largest population of anadromous fish in the reservoir. For the reasons above, juvenile fish collection facilities at Baker Dam were designed mainly for sockeye and coho.

The current juvenile fish passage facility, a surface collecting “Gulper” is not considered highly efficient. The collection efficiency has averaged 55% over the past 10 years for coho, and is generally thought to be even less efficient for passing juvenile chinook. In the late 1980's collection efficiency was estimated at 2-12 % for sockeye and generally thought less for chinook. This trend of low passage efficiency has been documented for several years in the late 1980’s lending credence to the extirpation of any remaining Upper Baker chinook still present at that time. From 1987-1999 the average number of juvenile chinook trapped during the outmigration was 1,399 and the average adult chinook return was 319. In general smolt to adult rates range between <1%-3%. Under these return rates, Baker Lake was experiencing a 23.0% smolt to adult survival. This extremely high survival rate suggests that most or all of the adults returning to the Upper Baker trap were likely strays from the Skagit River or other river systems. Data obtained from coded wire tags found in the adults at the trap also strongly suggests that most or all the adult chinook are from other river systems.

Although the native Upper Baker River chinook have been extirpated, Skagit River chinook are still protected under the Endangered Species Act. To the extent that these are caught in the adult fish trap and placed above the project, those fish and their progeny are afforded protection under ESA. Recently (1999), The Skagit Chinook Technical Workgroup and the Baker River Committee determined that all adult chinook salmon caught in the trap were to be returned to the Skagit River because it was thought that they stood a better chance of reproducing in the mainstem Skagit. However, later in the same year, 2000 excess adult hatchery spring chinook from Marble Mountain hatchery were released into the reservoir above Upper Baker Dam. Some of these fish were found spawning in Park and Swift Creeks (Doug Brouland, Personal Communication., Puget Sound Energy, June 2000). Additionally, chinook have been known to spawn in the Upper Baker River, although in 1999 spawning surveys were not conducted in this area. It can be reasonably assumed that some of these fish spawned in the mainstem of the Upper Baker River and in sections of its larger tributaries. From 1926 to 1999, an average of 219 chinook adults returned annually to the Baker River adult fish trap. From 1926 to 1958, before the Upper Baker Dam was complete, the Baker River adult trap averaged 59 adult chinook per year. In 1959, the newly constructed upper Baker Dam and adult fish trap were put into operation. Since then, the trap has averaged 346 chinook per year.

7.0 BALD EAGLE

7.1 Life History and Habitat Requirements

Throughout the Pacific Northwest, bald eagles exhibit a close association with freshwater, estuarine, and marine ecosystems that provide abundant prey and suitable habitat for nesting and communal roosting (USFWS 1986; Watson et al. 1991). In Oregon, 84 percent of bald eagle nests were within 1.0 mile of water (Anthony and Isaacs 1989) while in western Washington, a sample of 218 bald eagle nests showed an average distance of 282 feet to water (Grubb 1980). Nests are often re-used year after year (60 FR 36000). Snags, trees with exposed lateral branches, or trees with dead tops are often present in nesting territories and are used as perches during nesting, hunting, feeding, resting, preening, mating, and behavioral displays (Stalmaster 1987).

Bald eagles migrate to wintering ranges in Washington in late October. Large winter communal roosts are generally located close to feeding areas on large rivers, as well as along marine waters and in the Columbia Basin (USFWS 1986). Hansen et al. (1980) reported that winter roosts ranged from 0.16 to 1.5 miles from water, although eagles can travel up to 9 miles to feeding areas (Keister and Anthony 1983). Winter communal night roost are usually in old-growth or mature stands (Anthony et al. 1982; Keister and Anthony 1983; Stalmaster and Kaiser 1997) that provide thermal cover and wind protection (USFWS 1986).

7.2 Population Status

The bald eagle is currently listed as a threatened species under the federal ESA in the 48 conterminous states; however, the bald eagle is proposed for removal from the list of endangered and threatened species due to increased numbers of breeding pairs (64 FR 36454). The state of Washington also lists the bald eagle as a threatened species. The bald eagle is found only in North America and ranges over much of the continent, from the northern reaches of Alaska and Canadian to northern Mexico.

7.3. Known Occurrence in Project Vicinity

There are two bald eagle territories in the project area that are commonly active. .There is a nest that has been periodically active near the mouth of Boulder Creek but it has been vacant for 2 years now. Another nest is located near the mouth of the Upper Baker River that is active and this year the pair has produced one chick. Resident fish, anadromous salmon and waterfowl populations most likely provide foraging opportunities for bald eagles.

8.0 NORTHERN SPOTTED OWL

8.1 Life History and Habitat Requirements

On the west slope of the Washington Cascades, the species can be found in forested areas below elevations of 4,200 feet. Preferred habitat is closed-canopy coniferous forests with multi-layered, multi-species canopies dominated by mature and/or old-growth trees (Thomas et al. 1990; Lujan et al. 1992). Nesting and roosting habitat are characterized by moderate to high canopy closure (60-80%), large (>30" dbh) overstory trees, substantial amounts of standing snags, other in-stand decadence (e.g., deformities, cavities, broken tops and dwarf mistletoe infections), and coarse woody debris of various sizes and decay classes on the ground (USFWS 1987, 1989, Thomas et al. 1990). Foraging occurs in nesting and roosting habitat, as well as in coniferous forest with smaller trees and less structural diversity if prey such as the northern flying squirrel (*Glaucomys sabrinus*) are present (Hanson et al. 1993).

Spotted owls do not build their own nests. Most nesting occurs within naturally formed cavities in live trees or snags, but abandoned platform nests of the northern goshawk (*Accipiter gentilis*) and common raven (*Corvus corax*) have also been used (Buchanan et al. 1993; Forsman and Giese 1997). Trees and snags supporting cavity nests are typically large (mean = 55.8 inches on the Olympic Peninsula; Forsman and Giese 1997), and this is often cited as one of the reasons spotted owls are strongly associated with mature and old growth forest. The principal prey of the northern spotted owl over much of its range (the northern flying squirrel) also dens in cavities within large trees, further strengthening the spotted owl's dependence on older forest. Where spotted owls have been found nesting in young forest, such occurrences have been attributed to the presence of large residual trees with cavities (Buchanan et al. 1998), climatic conditions conducive to the use of platform nests (Forsman and Giese 1997), and/or alternate sources of prey that do not rely on cavities for reproduction (Zabel et al. 1995).

At the landscape level, spotted owls select home ranges that emphasize old-growth (Carey et al. 1990). One study on the Olympic Peninsula reported that spotted owl pairs selected home ranges that contained an average of 44 percent old forest (Lemkuhl and Raphael 1993), while home ranges studied in Oregon had an average of 53 percent old forest (Carey et al. 1990, 1992).

Using data from throughout the Pacific Northwest, Bart and Forsman (1992) documented that reproduction declined sharply in habitats with less than 40 percent old forest, and landscapes with less than 20 percent old forest rarely support nesting owls.

8.2 Population Status

The northern spotted owl was federally listed in July 1990 as threatened throughout its entire range in Washington, Oregon and Northern California. The principal cause for the listing was the on-going loss of habitat resulting from the harvest of old-growth forest and conversion to young forest or non-forest (55 FR 26114).

8.3 Known Occurrences in the Project Vicinity

A query of the Washington Department of Fish and Wildlife Priority Habitats and Species data base and the Department of Natural Resources National Heritige Sites data base indicated that there have been 5 historical site centers detected within 2 miles of Baker Lake from 1988 to 1990. No current info exists on these 5 centers and no new detections have been made. There are no site centers closer to Baker Lake than 1.5 miles but thier range extends to the lake shore. Suitable nesting, roosting and foraging habitat exists near the project area

9.0 MARBLED MURRELET

9.1 Life History and Habitat Requirements

The marbled murrelet is a small seabird that spends most of its life cycle on marine waters, but is the only North American Alcid that nests in trees (Nelson and Hamer 1995). It is documented nesting in trees up to 39 miles inland in Washington (USFWS 1995a), although detections indicating stand occupancy (i.e., nesting) have been documented up to 52 miles inland (Ralph et al. 1994). Suitable nesting habitat is old-growth coniferous forest or mature coniferous forest with an old-growth component (Marshall 1988; Hamer and Cummins 1990; Interagency Interim Guidelines Committee 1991; Hamer 1995; Ralph et al. 1995). Murrelets typically require large coniferous trees greater than 32 inches in dbh, with large-diameter moss-covered limbs for nest sites (Singer et al. 1991; Ralph et al. 1994).

9.2 Population Status

The marbled murrelet was listed as threatened in Washington, Oregon and California in 1991 under the federal ESA. A variety of factors were presented as contributing to its decline, including over-fishing (of its prey), entanglement in fishing nets, oil spills and loss of nesting habitat (Marshall 1988; Ewins et al. 1993; Ralph et al. 1995; Carter and Kuletz 1995). The State of Washington also lists the marbled murrelet as threatened. Recent population estimates include 5,500 murrelets in Washington and a total population of about 300,000 birds in North America (Ralph et al. 1995). Modeling for the Pacific Northwest population indicates an annual decline of 2 to 12 percent in the at-sea population of marbled murrelets (Beissinger 1995).

9.3 Known Occurrence In Project Vicinity

A query of the Washington Department of Fish and Wildlife Priority Habitats and Species data base and the Department of Natural Resources National Heritage Sites data base indicated that there were 4 detections of marbled murrelets within one mile of Baker Lake. This detection may have been determined by sight or sound. In addition suitable nesting habitat exists near the project area.

10.0 GRIZZLY BEAR

10.1 Life History and Habitat Requirements

The grizzly bear is able to utilize a wide variety of habitat conditions, from open dry prairie to wet montane forest. Whitaker (1980) describes a general habitat condition of semi-open country, usually in mountainous areas. Population size and distribution have been limited by human intrusion (USFWS 1997b). Grizzly bears will avoid areas of human use, including areas containing roads and signs of timber cutting (USFWS 1997b).

The grizzly bear is a free-ranging animal that requires a large home range, with males having larger home ranges (200 to 500 square miles) than females (50 to 300 square miles) (USFWS 1995b). It is an opportunistic omnivore; however, 80 to 90 percent of the grizzly bears diet is green vegetation, wild fruits and berries, nuts, and bulbs or roots. The majority of the meat in its diet comes from carrion (USFWS 1995b). Grizzly bears may travel extensively to find suitable den locations, which are generally located on remote mountain slopes where snow will last until late spring. They usually move down to lower elevations after emerging from their dens in the spring.

10.2 Population Status

The grizzly bear is federally listed as threatened and state listed as endangered in Washington. The USFWS established six recovery zones within the conterminous 48 states, including the North Cascades Recovery Zone (north of Interstate Highway 90) (USFWS 1993). The grizzly bear population in the North Cascades ecosystem is estimated to number at least 10 to 20 bears (Johnson and Cassidy 1997).

10.3 Known Occurrence In Project Vicinity

A query of the Washington Department of Fish and Wildlife Priority Habitats and Species data base and the Department of Natural Resources National Heritage Sites data base indicated that grizzly bears have the potential to occur in the Baker Lake area, although no priority 1 detections have been made since 1992.

11.0 GRAY WOLF

11.1 Life History and Habitat Requirements

Gray wolves are habitat generalists. The availability of prey may be the primary factor in determining habitat suitability (Stevens and Lofts 1988). Whitaker (1980) lists gray wolf habitat in North America as open tundra and forest. Human disturbance plays a roll in determining gray wolf distribution. In Alaska, Thurber et al. (1994) found that wolves avoided areas of human activity, including roads. In studying historic population changes of wolves in Wisconsin, Thiel (1985) found that wolf populations decreased when road densities exceeded 0.93 mile per square mile. Gray wolves often maintain very large home ranges; 40 to 47 square miles on Vancouver Island and 93 to 248 square miles in northern British Columbia (Scott 1979). Den sites are most commonly burrows in sandy soils, but can be located in a variety of settings, from downed logs and hollow trees to rock caves. Rendezvous sites tend to be near sources of open water in small meadows with limited visibility.

11.2 Population Status

The gray wolf is listed as endangered at both the federal and state levels in Washington. Gray wolves had apparently disappeared from Washington by 1920 (Ingles 1965). Although, between 1992 and 1997, two reliable sightings of wolves feeding pups were recorded in the North Cascades, the occurrence of the gray wolf in Washington remains questionable (Johnson and Cassidy 1997).

11.3 Known Occurrence In Project Vicinity

A query of the Washington Department of Fish and Wildlife Priority Habitats and Species data base and the Department of Natural Resources National Heritage Sites data base indicated that gray wolves have the potential to occur near Baker Lake.

12.0 CANADIAN LYNX

12.1 Life History and Habitat Requirements

In Washington, lynx are known to occur above 4,000 feet in elevation (McKelvey et al. 1999; WDFW 1993). The Canadian lynx requires a matrix of two important habitat types. For thermal and security cover and for denning it uses mature, closed-canopy, boreal forest that contains a high density of large logs and stumps and is near hunting habitat. For hunting, it uses early successional forest with high densities of snowshoe hare *(Lepus americanus)*. Additionally, lynx avoid large open spaces and tend not to cross openings greater than 330 feet (Koehler and Aubry 1994). The abundance of Canadian lynx is correlated with the population cycle of its primary prey the snowshoe hare (Ingles 1965; Koehler and Aubry 1994; Johnson and Cassidy 1997).

12.2 Population Status

In Washington, where its population is estimated to be between 91 and 196 individuals, the Canadian lynx is listed by the state as threatened (WDFW 1993). It has been proposed for federal listing as threatened throughout the lower 48 states (63 FR 36994). The listing proposal states that, "...the Canadian lynx is threatened by human alteration of forests, low numbers as a result of past over-exploitation, expansion of the range of competitors (bobcats; *Felis rufus*) and coyotes (*Canis latrans*), and elevated levels of human access into lynx habitat," (63 FR 36994). The current projected range of the lynx in Washington does not extend west of the Cascade crest (WDFW 1993).

12.3 Known Occurrence In Project Vicinity

A query of the Washington Department of Fish and Wildlife Priority Habitats and Species data base and the Department of Natural Resources National Heritage Sites data base indicated that the Canadian lynx has the potential to occur near Baker Lake. No priority 1 detections have been made since or ever.

13.0 Direct and Indirect Effects

13.1 Aquatic Resources

13.11 Reservoir Drawdown

Chinook Salmon

After spawning, Chinook salmon offspring generally emerge from the spawning gravel within two months (Wydoski 1979). With chinook spawning occurring from July through October, emergence is generally complete by 31 January. The reservoir drawdown in occurs in November creating a potential dewatered impact to chinook spawning in August, September, and October in shallow areas such as the nearshore margins and at the mouths of larger streams. To this point, no dewatering of chinook redds has been documented. Although there have not been any chinook spawning surveys conducted, there have been sockeye spawning surveys conducted in Baker Lake which have not found chinook spawning within the drawdown zone (Stan Walsh, Personal Communication, Skagit System Cooperative, June 2000). It is not believed that chinook spawned inside the drawdown zone due, in part, from their preference to spawn in larger rivers and in the main channel of these rivers.

Barriers to upward adult fish movement can result from the reservoir drawdown as waters recede from the mouth of tributaries. A low gradient stream carrying sediment to its mouth can create deltas which can become a barrier to fish movement when the elevation of Baker Lake is lowered. In addition, it is possible that the mouths of some creeks along Baker Lake could become inaccessible as water flow at their mouths reduces over the summer. At Baker Lake, biologists familiar with the Baker River system have indicated only Sandy Creek and the Upper Baker River were known to create significant delta deposits. The Upper Baker River Delta has had extensive sockeye spawning surveys conducted but, no chinook were found spawning in this area. In addition, the Upper Baker River mouth remains open year round and maintains a well-established channel. Sandy Creek also has a delta at the mouth of the Creek but past spawning surveys and recent observations have found no evidence to suggest that the delta formations have created any barriers to anadromous migration. In conclusion, the drawdown of the reservoir as prescribed by the Corps flood control agreement has not been identified as creating barriers to fish movement.

Bull Trout

The reservoir drawdown will have no measurable effects on Bull trout spawning. Bull trout spawning typically occurs in the smaller, steeper tributaries within headwater streams primarily due to their need for cold, clean water and low tolerance of elevated sediment levels for spawning. Bull trout are currently known to spawn in Bald Eagle Creek, Pass Creek, and Crystal Creek which flow into the Upper Baker River at least 4 miles above the reservoir (Reed Glesney, Personal Communication., National Parks Service, June 2000). With the spawning of Bull trout taking place a considerable distance upstream of the reservoir, effects to spawning caused by the drawdown of the reservoir are not anticipated.

Reservoir drawdown is not anticipated to create a migrational barrier to Bull trout. All tributaries of the lake are considered passable by chinook, indicating the smaller, swifter bull trout should encounter no difficulties because of reservoir drawdown.

13.12 Downstream Effects

Reservoir evacuation because of the flood control agreement requires that Upper Baker Dam release water through the turbines. The releases move directly into Lake Shannon where Lower Baker Dam reacts to the increased flow by releasing a corresponding amount of water through its turbines. The releases then travel down the Baker River for 1 mile where it enters the Skagit River.

After evacuation, the flood control agreement may require Upper Baker Dam to store water during flood events for a short period therefore shifting the peak discharges to the Skagit River. This effectively, creates a slightly longer but smaller peak flow within the Skagit River and a reduction in potential flood damages. During flood operations, releases from the Baker River system average 17% of Skagit River flows but range between 1% and 26% (Figure 3). To the extent that the releases alter stage elevations or affect flood duration within the Lower Baker River or Skagit River, it can cause some environmental affects.

Chinook Salmon

Chinook salmon spawning can occur between the months of April and September within both the lower Baker River and the Skagit River. Although limited within and below the Baker River, fish that do spawn below the project have the potential to be affected by flood control operations. Artificially high and prolonged water elevations can cause salmonids to construct redds in areas that can become dewatered when waters recede. Similarly, extremely high flows can cause adult and juvenile stranding in side channels or flooded fields. The affect of side channel stranding is not likely given the channelized nature of the lower Baker and Skagit Rivers but the releases do help alleviate the potential for levee failure, a common source of adult mortality during flood events. Stage increases, because of flood operations is not likely to cause significant affects to chinook salmon. High water levels within the Baker River during flood events are of short duration, usually lasting less than 5 days and coupled with a likely reduction in spawning activity. Together these factors reduce the potential for chinook spawning during high flows and subsequent losses of redds.

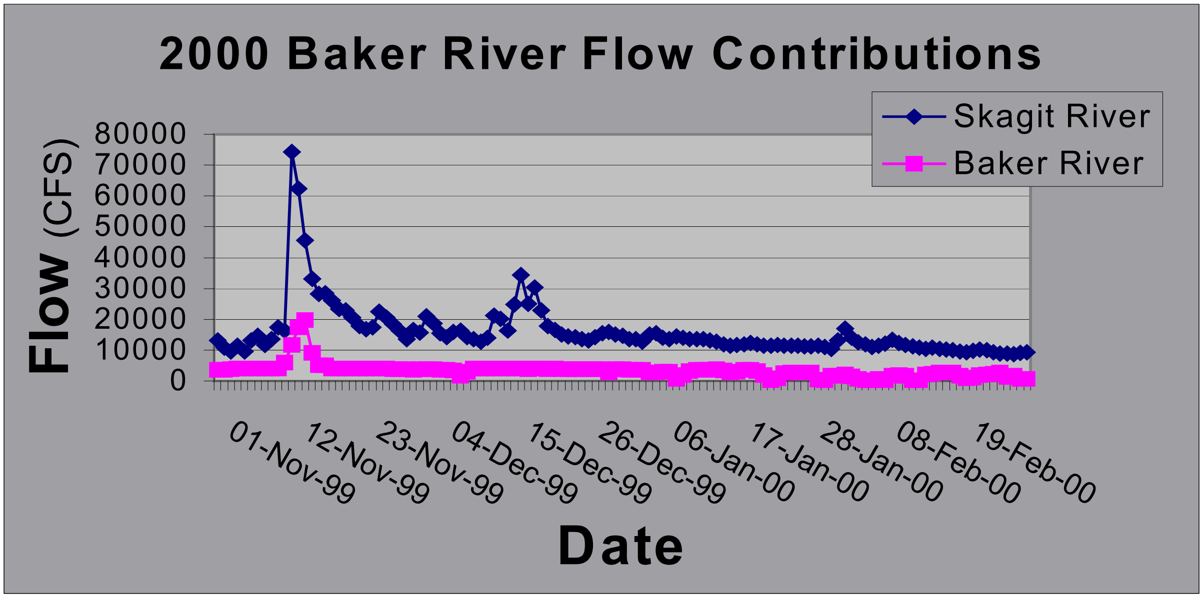


Figure 3. Baker River System Flow Contributions to the Skagit River. Year 2000

Bull Trout
Bull trout use of the project area is minimal and they are not generally believed to spawn in the 1-mile stretch of river below Lower Baker Dam or in the mainstem Skagit River below its confluence with the Lower Baker River. Juvenile bull trout are not likely to be found in the project area during flood control months as it ends prior to any outmigration period. Stranding opportunities within the lower Baker River and Skagit River are infrequent. As such, flow modifications and small-scale stage alterations because of Baker Lake flood operations should not cause any measurable affects to adult or juvenile bull trout.

13.2 Critical Habitat

Chinook Salmon
Another potential effect on chinook due to reservoir drawdown could be the loss of shoreline habitat. When the pool is evacuated, shoreline margins recede, resulting in a desiccation of aquatic and emergent plants. Reservoir drawdown can also cause the loss of available cover to fish resources provided by overhanging terrestrial plants which juvenile chinook use for cover. Furthermore, shoreline vegetation can be vital to the production of aquatic insects, snails and crustaceans sometimes utilized as food by juvenile salmonids.

Chinook salmon do utilize shoreline vegetation for cover and to seek food organisms, however, during the period of reservoir drawdown, juvenile chinook would still be residing in Baker River and the larger streams found around the reservoir. Chinook use of the reservoir is generally limited to those periods immediately before outmigration when the juveniles descend from the tributaries and stage in the reservoir for while they prepare for their downstream migration in the spring and early summer; outside the period of reservoir drawdown. Resident chinook and any overwintering juveniles in the reservoir would not be dependent on shoreline vegetation as a food source and terrestrial insect production is anticipated to be low during those months when drawdown occurs. This project will have no affect on tributary habitats or habitats downstream of Upper Baker Dam. Affects to juvenile and adult chinook will be discountable.

Bull trout
The reduction of shoreline flora because of the flood agreement is not expected to have an impact on the Bull trout population. Juvenile and adult bull trout are generally bottom oriented showing a preference for the deep pools of cold water rivers, lakes and reservoirs which reduces the probability of being effected by any reduction in shoreline vegetation (Moyle 1976).   In addition, Bull trout feeding preferences are weighted towards piscivory, further reducing their dependence on terrestrial food sources. This project will have no affect on tributary habitats or habitats downstream of Upper Baker Dam. Affects to bull trout will be discountable.

15.3 Terrestrial Resources

Birds
The flood control agreement is not expected to have any impact on the spotted owl or the marbled murrelet.. Both species will not be effected by the drawdown of the reservoir, due to the fact that they do not forage on Baker Lake. In addition no perching, nesting, or roosting habitat is disturbed by the operations of the dam as prescribed by the flood control agreement The bald eagle is not expected to suffer any significant adverse effects due to the flood control agreement as no perching, nesting, or roosting habitat is disturbed. The minimal increase in distance to the lake from trees that the eagle may inhabit caused by the drawdown is clearly insignificant. The drawdown of the reservoir is not expected to effect the abundance of prey items that the bald eagle feeds on, in fact it may increase the concentration of fish in the area reducing the energy expenditure required by the eagle to feed. In addition it would be useful to point out that the existing operations at Baker Lake have been in place since 1980, and the Corps is not proposing any changes.

Mammals
The flood control agreement is not expected to have any significant effect on the grizzly bear, Canadian lynx, or the Gray wolf. First, it is extremely rare to find any of these species in the project area due primarily to the low population numbers and the increasing public use of the Baker Lake area. It is highly unlikely that the grizzly bear, Canadian lynx, and gray wolf would utilize the project area due to the numerous recreational activities and the constant presence of people that occur in the project area. The only potential effect to any of the listed mammals in the area would be to the grizzly bear and its potential foraging of fish. This effect could result from drawing down the reservoir possibly resulting in some sockeye carcasses being removed from the Upper Baker River delta. This scenario is highly unlikely given the other constraints for grizzlies to not be present in the project area.

14.0 Interdependent and Interrelated Effects

The Federal Flood Control Agreement is an operational procedure that requires no structural components which could be concluded as causing interrelated or interdependent effects to bull trout, chinook salmon, or to any listed birds or mammals. However, Puget Sound Energy during the course of executing the agreement may conduct operational changes which could affect to some degree, chinook salmon and bull trout of the lower Baker River or the Skagit River. In general, the nature of these operational changes is to reduce high water discharges having the effect of reducing adult stranding potential and redd scour.

The Corps of Engineers flood control agreement ends March 1 with a reservoir elevation approximately 707.8. The Federal flood control agreement does not affect refill operations of the reservoir for power generation which is under the full control of PSE. Any impacts to bull trout and chinook salmon because of these refill operations are unknown.

15.0 Cumulative Affects

The encouragement of development in the floodplain by local entities in association with any flood control structure is sometimes considered a cumulative affect as the reduction in flooding may encourage development in areas that otherwise would have remained undeveloped. While the Skagit Valley has seen significant growth in the years since the project was completed, the purpose of the project was to become a portion of a comprehensive flood control program within the Skagit Basin designed to protect infrastructure at the time of its construction. Regional growth and floodplain management occurring since the federal flood control agreement is the responsibility of local and state agencies and outside the scope of the U.S. Army Corps of Engineers.

16.0 Conservation Measures

None anticipated.

17.0 Determinations

17.1 Aquatic resources

Based on existing fisheries data, and the existing history of the current flood control agreement, it is believed that the extension of the existing agreement will have discountable affects to chinook salmon and bull trout. It is our belief that the Corps of Engineers flood control agreement does not constitute a measurable adverse effect to chinook salmon or bull trout spawning for the following reasons: first, no chinook or Bull trout are known to spawn in the drawdown zone, secondly, the winter drawdown will have little impact on shoreline vegetation and potential food availability for chinook and bull trout, thirdly, significant long term use of the reservoir by juvenile chinook during the period of flood control is restricted as juvenile chinook are most likely to reside in Upper Baker River, Swift Creek or Park Creek and the chinook present in the lake are migrating through on their way to Puget Sound. Affects to bull trout and chinook spawning will be discountable given the short duration and minimal stage changes within the Lower Baker River and Skagit River from this agreement. It is also believed that the drawdown of the reservoir does not create any barriers to fish movement. The extension of the Upper Baker Flood Control Agreement is determined as a May affect, Not Likely to Adversely Affect for both bull trout and chinook salmon.

17.2 Terrestrial Resources

Based on the existing history of the current flood control agreement, it is believed that the extension of the existing agreement will have No Affects to the marbled murrelet, and the northern spotted owl, gray wolf, and the Canadian lynx. The flood control agreement May Affect, But Not Likely to Adversely Affect the bald eagle and the grizzly bear based on reasons mentioned before. It is our belief that in review of the previous 20 years this agreement was in effect, no effects were documented as contributing to the degradation of the listed terrestrial species.

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Biological Assessment Supplement

Upper Baker Reservoir Flood Control Agreement with Puget Sound Energy

July 30, 2001

Backgound

In the summer of 2000 the Seattle District, U.S. Army Corps of Engineers (Corps) attempted to renew and extend the flood control agreement (Contract Number DE-MS79-80BP90011) with Upper Baker Dam to June 2006. This flood control agreement was implemented on October 10, 1980 and expired September 30, 2000. The agreement modified dam operations to provide an additional 58,000 acre-feet of water storage for flood control. To abide by this agreement, the pool elevation is required to be 720.75 feet by November 1 and 707.8 feet (a drop of 12.95 ft.) by November 15. The 707.8 feet pool elevation is to be maintained from November 15 until March 1 thus providing the additional 58,000 acre-feet and a total of 74,000 acre-feet of reservoir storage.

On October 27, 2000 the Corps signed a flood control agreement (00PB23686) with the Bonneville Power Administration (BPA), and Puget Sound Energy (PSE) that is valid through the 2003 flood season. This agreement is identical to the previous agreement in all respects with the exception of monetary compensation and duration.

On October 19, 2000 the U.S. Fish and Wildlife Service (USFWS) concurred with the Corps effect determination that the Upper Baker Reservoir Flood Control Agreement with Puget Sound Energy is not likely to affect the bull trout, bald eagle, and grizzly bear. This concurrence was only for one year, from fall 2000, to summer 2001. This concurrence was granted for one year as a result of Upper Baker Dam operations that avoided any potential impacts to bull trout spawning. In addition, the Corps agreed to obtain more information in an attempt to determine the risk to bull trout as a result of the flood control agreement. The tasks agreed upon to obtain this information are as follows:

Task 1
While the reservoir is at the flood control elevation (707.8 feet), the Corps and Service will determine if any of the fish bearing tributaries are obstructed to either upstream or downstream passage for adult adfluvial bull trout. If passage is obstructed, then the Corps will provide a plan to the Service describing the measures the Corps would take to remove the blockage.

Task 2
The Corps will conduct a potential bull trout spawning habitat assessment on the upper Baker River delta. The methods used in the assessment will include bathymetry of the delta area, measurements of the average width, water depth, water velocity and water temperature of the main channels flowing through the delta and some velocity measurements of the delta in the

vicinity of the main channels. This information would be collected for at least three pool elevations: high (720 feet), intermediate (715feet), and low (708 feet).

Task 3
The Corps will conduct a reconnaissance level survey for bull trout presence on the upper Baker River delta. The survey would be conducted in October and November 2000. Known bull trout holding areas in the upper Baker River would also be surveyed at the same time to confirm that prespawning or spawning fish are present in the system.

Summary of Task Results

Task 1
The results of the reconnaissance survey to determine if any tributaries are obstructed to either upstream or downstream passage for adult adfluvial bull trout showed that there are no obvious passage problems with any fish bearing streams. This task was conducted by approaching each tributary via boat and walking the stream from the mouth to the full pool elevation while observing the stream channel characteristics. The features of the stream that were examined were water depth, water velocity and slope of the channel.

At the time that the agreement was made between the Corps and the U.S. Fish and Wildlife Service to conduct the tributary survey, the elevation at Baker Lake had already been drafted to an elevation below 707.8 so preliminary reconnaissance was conducted at pool elevation 700 ft. In October of 2000, the Corps accompanied PSE, and the Skagit System Cooperative on a sockeye spawning survey of all tributaries known to be utilized by sockeye for spawning. On this survey the pool elevation was 700 ft. with typical fall flows, and no obvious passage problems were detected.

The first opportunity to conduct the tributary reconnaissance survey at or near pool elevation 707.8 occurred May 17, 2001. On this date a biologist from the Corps and PSE, along with a fluvial geomorphologist from R2 Resource Consultants conducted the reconnaissance at pool elevation 705 ft. All tributaries of Baker Lake were examined for water depth, water velocity and slope from the lake edge to the full pool elevation. In addition, all tributaries were photographed for the record. This reconnaissance indicated that no obvious passage problems exist.

Task 2

The Baker River separates into two large channels as is enters the delta at the northernmost section of Baker Lake and each of these channels contains many smaller channels. In addition, a third channel is present on the delta that is a result of ground water, and several small creeks that feed into this larger channel. As pool elevations change, the effects to these three channels differ from each other so it was determined that each channel should be surveyed separately. These channels were designated Delta Right Channel, Delta Middle Channel, and Delta Left Channel, as a result of geographical parameters and established nomenclature. The Delta Right Channel is the channel to the right if looking downstream (south) from the Baker River, and Delta Left

Channel is to the left if looking downstream. Delta Middle is the channel between the two previous mentioned channels.

To estimate the amount potential spawning area in the Baker River delta at pool elevation 707.8 ft, 715 ft, and 720, channel lengths and widths were measured. For all pool elevations a hip chain was used to measure the lengths of the many channels present in the delta. The hip chain was used by securing the chain to a log that is located at the full pool lakeshore elevation. Using that as a starting point the main channel length was measured by simply walking the river to the lakeshore. To measure the lengths of the many braids of the channel, the hip chain was secured to a rock at the point the braid left the main channel and measured to the point the braid returned to the main channel. Stream widths were measured using a 100- foot/30-meter tape. Stream widths were taken approximately every 220 ft. It was determined that stream widths were more appropriate to use rather than channel widths (bankfull width) due to the dynamic nature of the delta, where channels actively migrate with moderate inflow fluctuations. Water velocity and depth measurements were also taken at each of the points stream widths were taken. Depths were taken with a staff and water velocity measurements were taken with a Swoffer Model 2000 Open stream current velocity meter.

Potential spawning habitat was estimated by averaging channel widths and multiplying these with the appropriate channel lengths to obtain area as outlined in USFWS 1983. This method ignored known bull trout redd characteristics such as, water velocity, depth, substrate, and temperature so these numbers were refined. It was determined that substrate and temperature did not limit the available spawning habitat due to the temperature range of 7.0-8.0^{o} Celsius, and the availability of suitable substrate throughout the delta. However, using minimum mean depths over redds (0.28 m), and minimum mean velocities (0.29m/sec) over redds, portions of the delta were eliminated as potential spawning habitat (Goetz 1989). Using these criteria for every depth and velocity data point the potential area available for bull trout spawning is 18,089 m^2, 8,787m^2, and 5,184 m^2 for the entire delta at pool elevations 707.8 ft, 715 ft, and 720 ft respectively (Figures 1-4). By utilizing the entire channel means for depth and velocity as presented in figure 5, the criteria does not eliminate any potential spawning habitat in Delta Right and Delta Middle channel but eliminates the entire Delta Left Channel resulting in 26,639 m^2, 12,595 m^2, and 8,114 m^2 for pool elevations 707.8 ft, 715 ft, and 720 ft respectively (Figures 1 and 5).

The Corps purchased aerial photos of the delta area and was in the initial phase of developing a model for calculating the amount of delta exposed at various pool elevations when it was discovered that R2 Resource Consultants had already developed digital terrain model (DTM) for PSE. This model produced 5-foot contour maps of the delta for pool elevations 707.8 ft, 715 ft, and full pool 724 ft. (Figures 6-8).

Task 3

In November of 2000, the Corps funded a reconnaissance level spawning survey of the Baker River immediately upstream of Baker Lake. The USFWS Western Washington Office (WWO) conducted this survey. The survey was conducted on three separate dates and the area surveyed was from the mouth of the Baker to the Baker River trailhead (~3.0 km). These surveys were prompted by concerns that bull trout may spawn in the drawdown area and that their redds may be dewatered by the Corps mandated operations of Upper Baker Dam.

Bull trout redd surveys were conducted in two forms, snorkeling and walking the bank of the river to observe fish/redds. One team worked its way downstream from the trailhead to survey the mainstem river while the other team surveyed the delta area. Redds were designated as definite, probable, or possible based on appearance of depression, and a GPS was used to mark there location. The spawning surveys were conducted on 11/01/00, 11/15/00, and 11/30/00.

The results of the study state that a total of eight bull trout and two bull trout redds (one definite and one probable) were observed during the three surveys. All bull trout fish and redd observations were located in the mainstem river below the trailhead but just above the delta area. However, the one definite redd observed on 11/15/00 was plotted on the contour map provided by R2 Resource Consultants using both NAD 83 and NAD27 and it is actually located below the 707.8 elevation (Figure 9).

The results of this survey indicate that a few bull trout were present in the areas adjacent to the drawdown zone, but there were no bull trout present in the drawdown zone. As a result of this study there is no data that suggests that bull trout are spawning in the drawdown zone therefore it in unlikely that the Corps flood control agreement is likely to significantly impact bull trout.

The results of the agreed upon tasks indicate that the reservoir drawdown does not create barriers to fish passage at any of the tributaries of Baker Lake, the maximum potential spawning area ranges from approximately 8,000 to 30,000 square meters, and bull trout were not found to be spawning in the drawdown zone.

This BA Supplement concludes that the existing and proposed action is not likely to adversely affect bull trout.

References

USFWS. 1983. Field Methods and Statistical Analyses for Monitoring Small Salmonid Streams. December 1983. U. S. Fish and Wildlife Service. 200 p.

Goetz, F. 1989. Biology of the bull trout, *Salvelinus confluentus*: a literature review: Technical Report prepared for the Willamette National Forest, Eugene, Oregon.

BAKER RIVER PROJECT RELICENSING STUDY REQUEST

The purpose of this form is to provide a uniform template for any working group member to request a study and to provide the working group(s) with information from which to evaluate and prioritize study requests. In-depth proposals will be developed after the working group(s) approve the study concept. This form is intended only to assist the working group(s) in the selection of studies, and is not intended to inhibit the working group(s) from pursuing other options that ultimately lead to a settlement agreement. The methods for approving and funding studies are described in the Baker Relicensing Process Document.

The steps involved in development of a study are:
1. Proponent completes the study request form and submits it to the working group.
2. The working group(s) or the Solution Team approves the study.
3. The technical working group(s) and/or consultant develops the study design.
4. Review and approval of the study design is conducted by the working group(s).
5. Final approval and funding will be decided based on methods described in the Process Document.

<table>
<tr><th colspan="3">BAKER RIVER PROJECT RELICENSING STUDY REQUEST</th></tr>
<tr><td>Name and Affiliation
David Brookings, Skagit County</td><td>Working Group
Economics and Operations</td><td>Date
12/2/02</td></tr>
<tr><td colspan="3">Study Title
Evaluation of Optimal Flood Control Storage in Upper Baker Reservoir (Baker Lake)</td></tr>
<tr><td colspan="3">Brief Description :
The study would evaluate the optimal flood control storage in Baker Lake by determining the optimal benefit/cost ratio for provided flood control storage. The study would evaluate incremental flood storage volumes in Baker Lake up to a maximum of 100,000 acre-feet of flood control storage as discussed under Article 32 of the 1956 FERC License.</td></tr>
<tr><td colspan="3">Purpose
To determine the optimal flood control storage in Baker Lake to be proposed for the new FERC license for the Baker River Project.</td></tr>
<tr><td colspan="3">Related Interests and Issues (bulleted list)
• Flow augmentation and downstream water rights.
• Flow augmentation for salmonids/bull trout.
• Linkage to downstream future flood control project.</td></tr>
</table>

STEP ONE - Linkage to Relicensing. Briefly answer the following questions. All proposals must address at least one of the next four questions for further consideration.

A. Does the study eliminate a critical uncertainty that is essential to address a range of alternatives and/or Project impacts? Briefly describe the uncertainty.

Yes. The 1956 FERC license authorized the Baker River Project with conditional language that allowed for the implementation of additional flood control storage (in addition to the 16,000 acre-feet to replace lost valley storage) provided that it was financially justified. The U.S. Army Corps of Engineers (USACE) and PSE evaluated optimal flood control storage in 1976 and as a result Congress authorized an additional 58,000 acre-feet of flood control storage in 1977. The 1976 study is the last time that the optimal flood control storage at the project has been evaluated and significant development along the Skagit River has occurred over the past 25 years. Skagit County, the USACE and all other downstream cities and towns need to understand the potential options for increased flood control prior to approving the submittal to FERC for the license renewal of this facility. By implementing this study now PSE will eliminate the need to perform the studies late in the environmental and public review process.

B. What information does the study provide that is needed to support protection, mitigation, and enhancement discussions?

Determination of flood control operations will have a significant impact on determining reservoir levels during the fall/winter timeframe. Having a better knowledge of how the reservoir might be operated for flood control under the new license will help provide a clearer picture of future reservoir levels which will help to direct studies that support protection, mitigation, and enhancement measures.

C. How will the results of the study help us to develop, evaluate or choose between proposed strategies and/or alternatives?

The study outcome will determine the optimal flood control storage volume in Baker Lake, which will be used to set the flood control reservoir elevation "rule curve" that will be used to limit maximum reservoir elevations during the fall/winter flood season. Identification of the reservoir elevation rule curve is a critical step in determining potential impacts of the project to the environment and is also a critical element to be considered with others in the final determination of the preferred alternative.

D. What information does the study provide that addresses one or more statutory requirements (e.g., Endangered Species Act (ESA), Clean Water Act (CWA), Northwest Forest Plan (NWFP), Federal Power Act (FPA))?

STEP TWO – Study Context. Your response to these questions will be used by the working group(s) when setting study priorities. Please provide brief answers.

A. Does the study provide information that will allow the working group to achieve multipurpose goals that may be considered during the relicensing process (e.g., recreation and wildlife)? Describe how the information would achieve these goals. Is the study related to other studies in the basin?

This study will be used to guide the selection of the optimal fall/winter flood control storage volume in Baker Lake, which will be used to define the flood control "rule curve" (i.e., the target reservoir elevations required to provide optimal flood storage space). The study will also provide results to achieve the goal of improving public health and safety and protecting the region's economy and downstream infrastructure. Definition of the flood control rule curve is a critical step that is needed before many other studies linked to reservoir operations (e.g., study of reservoir operations on fisheries and wildlife) can proceed.

B. What existing data are relevant? Why aren't these data sufficient?

Significant information is available at the USACE and Skagit County that could likely be used for this study. Skagit County initiated a Skagit River Feasibility Study (SRFS) in 1996 and has since worked very closely with the USACE in the development of a current, sophisticated river hydraulic model that can be used to simulate flood events, an updated economics-based flood damage analysis using current GIS-based floodplain development data and other environmentally-based information associated with the SRFS. Other relevant information that already exist include 1) updated stage-damage functions within the lower Skagit River valley (in progress); 2) updated peak discharge-frequency relationships for the Skagit River that reflect current flood control operations at Baker Lake; and, 3) updated peak discharge-frequency relationship for Baker Lake inflow.

C. Are there established methods for this study? Cite references.
Yes, in particular the USACE has many engineering and design guidelines that would be applicable to this study. In particular, USACE publication EM-1110-2-1619 describes standard procedures for estimating the expected benefits and costs of proposed flood damage reduction measures.

D. When are the study results needed? Will the results be available when needed in the relicensing process?
Study results are needed as soon as possible to be available in a timely fashion for use in the relicense process.

STEP THREE – Study Description. This description is not the design, rather information that can be used to complete a draft of a detailed design. This section may be completed prior to or after preliminary evaluation by the working group, but must be completed prior to final approval for study design. If necessary, the working group can designate a technical working group and/or request a consultant to assist with the completion of step 3.

A. What questions will the study answer (specific objectives, hypotheses being tested or parameters being estimated)? (bulleted list)

- Can additional flood control storage (i.e., greater than the current 74,000 acre-feet) be provided in the Upper Baker Reservoir (Baker Lake)?
- What is the incremental cost of providing this storage?
- What are the incremental benefits of the additional storage?
- At what point is the additional flood storage optimized?

B. What information needs to be obtained to meet the objectives or test the hypotheses? (bulleted list)

- Cost of implementation (design, construction, loss revenues, fisheries impacts).
- Savings associated with additional storage (reduced flood damages, reduced costs for downstream improvements, reduced flood insurance premiums, reduced public risk, ancillary benefits [i.e., fisheries, etc.]).

C. Will there be a statistical analysis in this study? If yes, what method and to what level of reliability? If no, why?
Yes, the methodology inherently incorporates statistical methods through the use of discharge-frequency relationships to describe the relationship between streamflow and probability of occurrence.

D. What are the assumptions of the study? (bulleted list)

- The project (including Baker Lake) will be operating over the period of the new license (likely 30 to 50 years).
- Growth will not decrease within the downstream floodplain.
- Flood control storage will be provided over roughly the same period (November 1 to March 1) as it is under the current license.

E. Proposed study schedule. Estimated timeframe of study before results are available to make management decisions?

This study would likely require a minimum of 6 months to complete.

F. Preliminary cost estimate or range, if available.
Not available.

G. Briefly describe the study methods and provide background literature, if available.
Stage-damage functions would be constructed based on current development within the downstream floodplain. These functions would be used to relate Skagit River stage to the associated economic impact of flooding. Stage-damage functions would likely only be used for the Sedro-Woolley/Mt. Vernon area (study area) since most of the existing infrastructure (in dollars) is located in this area. Stage-frequency curves for the study area would be developed for a range of flood storage volumes up to a maximum of 100,000 acre-feet. These stage-frequency curves would be developed by assuming various (incremental) flood storage volumes in Baker Lake and then using a reservoir model coupled with a hydraulic routing model to simulate the associated flood stage in the study area. This information would be used to compute the economic benefits of given flood control volumes, where economic benefits are defined as the flood damages prevented for a given volume of flood control space. The benefits of given flood control volumes would be coupled with the associated cost of providing the flood control volume to determine a benefit/cost ratio for each incremental flood storage volume considered in the study. The optimal flood storage space would be selected based on the flood storage volume that provides the maximum benefit/cost ratio.

There are a number of USACE publications that discuss various aspects of this type of evaluation. For instance, USACE publication EM-1110-2-1619 describes standard procedures for estimating the expected benefits and costs of proposed flood damage reduction measures.

H. How will the results be used to develop or implement protection, mitigation and enhancement measures?
Determination of flood control operations will have a significant impact on determining reservoir levels during the fall/winter timeframe. Having a better knowledge of how the reservoir might be operated for flood control under the new license will help provide a clearer picture of future reservoir levels which will help to direct studies that support protection, mitigation, and enhancement measures.

BAKER RIVER PROJECT RELICENSING STUDY REQUEST

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<table>
<tr><th colspan="3">BAKER RIVER PROJECT RELICENSING STUDY REQUEST</th></tr>
<tr><td>Name and Affiliation

Stan Walsh, Skagit System Cooperative</td><td>Working Group
Aquatics, Economic and Operations</td><td>Date
11/19/02</td></tr>
<tr><td colspan="3">Study Title

An examination of spawning and incubation flows in the Skagit River below the Baker confluence during brood year 2000.</td></tr>
<tr><td colspan="3">Brief Description

The study is an examination of flow sources that contributed to Brood Year 2000 spawning flows as well as incubation flows in the mainstem Skagit River below the Baker River confluence, these sources included Seattle City Light’s (SCL) Skagit Project, tributary inflow including the Sauk River, and Puget Sound Energy’s (PSE) Baker River Project. The unregulated flows will also be reconstructed as a baseline of dewatering risk based the persistent low flow conditions during the 2000-2001 incubation period.</td></tr>
<tr><td colspan="3">Purpose
This analysis should shed light on how generation and minimum flow from the Skagit and Baker Projects and tributary flow effected incubation through the spring of 2001. It will be helpful in considering how the Skagit and Baker Projects can be operated and potentially coordinated during low flow years.</td></tr>
<tr><td colspan="3">Related Interests and Issues (bulleted list)
• Skagit River salmonid incubation flows
• Project minimum flows
• Flow coordination
• ESA
• 401c certification
• Northwest Forest Plan Aquatic Conservation Strategy</td></tr>
</table>

STEP ONE - Linkage to Relicensing. Briefly answer the following questions. All proposals must address at least one of the next four questions for further consideration.

A. Does the study eliminate a critical uncertainty that is essential to address a range of alternatives and/or Project impacts? Briefly describe the uncertainty.
Brood Year 2000 presents an opportunity to examine a low flow year in which substantial redd dewatering was observed. While there has been much discussion about the factors that contributed to that redd dewatering there has been no in-depth analysis of those factors. This study will be helpful in developing a flow management regime for the Baker Project that will result in minimum flows that protect salmonid eggs through incubation and fry emergence.

B. What information does the study provide that is needed to support protection, mitigation, and enhancement discussions?
This study provides flow information that can be used in coordination with study A-09 in setting minimum flows for the project to avoid impacts to incubating and emerging salmonids, especially during low flow years. The information can also be used to explore opportunities for flow coordination between the Baker and Skagit Projects.

C. How will the results of the study help us to develop, evaluate or choose between proposed strategies and/or alternatives?
This study will provide a piece of information aimed at how flows could be managed in low flow years to provide protection for incubating salmonid eggs and emerging fry. While it is aimed at providing for effective minimum flows from the Baker Project it could be used to develop a flow coordination strategy between the Baker and Skagit Projects.

D. What information does the study provide that addresses one or more statutory requirements (e.g., Endangered Species Act (ESA), Clean Water Act (CWA), Northwest Forest Plan (NWFP), Federal Power Act (FPA))?

- ESA, CWA, FPA section 10, Wild and Scenic Rivers Act, Northwest Forest Plan Aquatic Conservation Strategy

STEP TWO – Study Context. Your response to these questions will be used by the working group(s) when setting study priorities. Please provide brief answers.

A. Does the study provide information that will allow the working group to achieve multipurpose goals that may be considered during the relicensing process (e.g., recreation and wildlife)? Describe how the information would achieve these goals. Is the study related to other studies in the basin?
The information from this study will tie in with study A-09.

B. What existing data are relevant? Why aren't these data sufficient?
All of the data for this study exist but have not been analyzed in the manner envisioned in this request. It is likely that all of the data is in the Hydrops model, if not it can be obtained from USGS.

C. Are there established methods for this study? Cite references.
Yes, data used is flow data collected at USGS gauging stations. Contribution to spawning and incubation flows from various sources is a matter of simple subtraction, possibly with some adjustment for lag time and attenuation. Flow management scenarios will be run through the Hydrops model.

D. When are the study results needed? Will the results be available when needed in the relicensing process?
The results will be needed for PME discussions on Skagit River flows below the Baker confluence. The results could be obtained in short order.

STEP THREE – Study Description. This description is not the design, rather information that can be used to complete a draft of a detailed design. This section may be completed prior to or after preliminary evaluation by the working group, but must be completed prior to final approval for study design. If necessary, the working group can designate a technical working group and/or request a consultant to assist with the completion of step 3.

A. What questions will the study answer (specific objectives, hypotheses being tested or parameters being estimated)? (bulleted list)

- What was the contribution to spawning and incubation flows for chinook and chum salmon in Brood Year 2000 for the Skagit Project, tributaries (including the Sauk River), and the Baker Project?
- What would the hydrograph for the Skagit Gauge at Concrete have been without the influence of hydropower?
- How could the hydropower projects in the Skagit Basin have been managed differently to avoid redd stranding during BY 2000?

B. What information needs to be obtained to meet the objectives or test the hypotheses? (bulleted list)

- USGS gauge data from August 15, 2000 to June 1, 2001 for the Skagit Gauge at Newhalem, the Skagit Gauge at Marblemount, the Sauk River Gauge at Sauk, the Baker River Gauge, the Skagit River Gauge at Concrete.
- Spawning data for the Skagit River below the Baker River confluence from WDFW and study A-09c.
- Redd monitoring data from Seattle City Light above the Sauk River confluence.
- How the Skagit River Project was operated in relation to SCL's license requirements or normal operations.
-

C. Will there be a statistical analysis in this study? If yes, what method and to what level of reliability? If no, why?
Unlikely outside of what is built into Hydrops. There may be some analysis of probability but that will likely come form USGS exceedance curves.

D. What are the assumptions of the study? (bulleted list)

- Lag time and attenuation can be accounted for or is insignificant in this analysis
- Hydrops can be coordinated with Skagit River flow in a manner that will allow for an analysis of how the project could have been operated to avoid or reduce redd stranding.

E. Proposed study schedule. Estimated timeframe of study before results are available to make management decisions?
To be determined in the study plan but it should be something that can be accomplished in less than two months.

F. Preliminary cost estimate or range, if available.

To be determined in the study plan, but this should be low cost as all information is available and may already be plugged into Hydrops.

G. Briefly describe the study methods and provide background literature, if available.
USGS gauge data will be used to assess the flow contribution of the Skagit River Project, tributaries, and the Baker River Project to spawning and incubation flows in the Skagit River below the Baker confluence. Spawning flows can be examined on a weekly or daily basis, information from spawning surveys can be used to segregate spawning and incubation segments on a weekly and biweekly basis. The Hydrops model will be used to determine how flows could have been managed to avoid or reduce stranding. The unregulated hydrograph will be used to determine the likelihood of stranding absent the hydro projects.

H. How will the results be used to develop or implement protection, mitigation and enhancement measures?
This study will be used in conjunction with study A-09 to set minimum flows that protect incubating and emerging salmonids in the Skagit River below the baker River confluence for a Settlement Agreement and 401c certification.

BAKER RIVER PROJECT RELICENSING STUDY REQUEST

Name and Affiliation	Working Group	Date
Skagit County PUD, City of Anacortes, and Town of Concrete by Jerry Louthain, Economic & Engineering Services, Inc.	Economics/Operations	12/9/02

Study Title
Additional flow releases from the Baker River Project

Brief Description
The HYDROPS Model would be used to evaluate a range of additional flow releases from the Baker River Project during low flow periods.

Purpose
The purpose of this study request is to evaluate additional flow releases during low flow periods, as a potential means of mitigation for water right holders or exempt well users, who could be subject to potential curtailment of water use due to the instream flow regulations contained in Chapter 173-503 WAC. Additional flow releases during low flow periods could also provide benefits to the fishery resource.

Related Interests and Issues (bulleted list)
- Study A09.A Skagit R. Flow and Habitat Assessment, which is to describe the mainstem middle Skagit R. habitat and flow/habitat relationships, and which is a combination of Study ID Nos. A 04, A09, and A12.
- Sufficient instream flows to satisfy existing and future water users
- Any other studies that address flow releases from Baker River Project reservoirs

STEP ONE – Linkage to Relicensing. Briefly answer the following questions. All proposals must address at least one of the next four questions for further consideration.

A. Does the study eliminate a critical uncertainty that is essential to address a range of alternatives and/or Project impacts? Briefly describe the uncertainty.
Yes. The flow releases from the Baker River Project are a key element in the licensing process, and determine the Project impacts on streamflows downstream of the Project.

B. What information does the study provide that is needed to support protection, mitigation, and enhancement discussions?
This study will provide information that will be used in evaluation of the benefits and costs associated with additional flow releases from the Project during low flow periods as mitigation for water uses in the lower Baker River and Skagit River downstream of its' confluence with the Baker River. Certain surface water and ground water users in the Skagit River, including uses for domestic supply, could be subject to curtailment of their water use during periods of low flow in the Skagit River as a result of the adoption of Chapter 173-503 WAC in April 2001. In addition, augmentation of instream flows during low flow periods could benefit the fisheries resource in the lower Baker River and in the approximately 50 mile reach of the Skagit River located downstream of the Baker River.

C. How will the results of the study help us to develop, evaluate or choose between proposed strategies and/or alternatives?
The results of this study will help to determine the flow releases from the Project during low flow periods which have the optimum benefit to cost ratio, considering a multitude of factors, including power generation, domestic and other water uses, and the fisheries resource.

D. What information does the study provide that addresses one or more statutory requirements (e.g., Endangered Species Act (ESA), Clean Water Act (CWA), Northwest Forest Plan (NWFP), Federal Power Act (FPA))?

STEP TWO – Study Context. Your response to these questions will be used by the working group(s) when setting study priorities. Please provide brief answers.

A. Does the study provide information that will allow the working group to achieve multipurpose goals that may be considered during the relicensing process (e.g., recreation and wildlife)? Describe how the information would achieve these goals. Is the study related to other studies in the basin?

The study will provide information for the multipurpose goals of the public interest for downstream water users to ensure their domestic water use is not interruptible, the fisheries resource related to increased streamflows and improved habitat, and maximizing the economic benefits of power generation. This study is most closely related to Study A09.A.

B. What existing data are relevant? Why aren't these data sufficient?

None

C. Are there established methods for this study? Cite references.

Use of the HYDROPS model

D. When are the study results needed? Will the results be available when needed in the relicensing process?

The study results are needed as soon as possible, so this information is available when it is needed in the preparation of the application for relicensing documents.

STEP THREE – Study Description. This description is not the design, rather information that can be used to complete a draft of a detailed design. This section may be completed prior to or after preliminary evaluation by the working group, but must be completed prior to final approval for study design. If necessary, the working group can designate a technical working group and/or request a consultant to assist with the completion of step 3.

A. What questions will the study answer (specific objectives, hypotheses being tested or parameters being estimated)? (bulleted list)

- Can the Project provide flow augmentation on a continuous basis during the periods of time when the Skagit River flow at Mount Vernon is below the established instream flows, in an amount equivalent to the total amount of water use subject to the instream flow requirements of Chapter 173-503 WAC?
- What are the revenue costs in power generation of providing this flow augmentation, by using a range of assumptions in amounts and timing of flow augmentation?
- What are the revenue benefits in power generation of providing this flow augmentation using the same assumptions?

B. What information needs to be obtained to meet the objectives or test the hypotheses? (bulleted list)

- Assumptions will need to be made for a range of amounts and timing of flow augmentation, based on historic stream gaging records for the Skagit River at Mount Vernon when the Skagit River flow has been below the established instream flow.
- A range will be used to estimate the amounts of water use that would be subject to the instream flow requirements.
- Information needs to be obtained from PSE on the current operational procedures to serve as a means of comparison with the proposal in this Study Request.

C. Will there be a statistical analysis in this study? If yes, what method and to what level of reliability? If no, why?

Yes, the methodology inherently incorporates statistical methods through the use of discharge-frequency relationships to describe the relationship between streamflow and probability of occurrence.

D. What are the assumptions of the study? (bulleted list) • The Project will continue to be operated over the term of a new license expecting to be authorized for 30-50years • Assumptions will be made on the average number of days during each year that the Skagit River flows at Mount Vernon will be below the established instream flows • Assumptions will be made on the total amount of water use that might be subject to instream flow requirements.
E. Proposed study schedule. Estimated timeframe of study before results are available to make management decisions? It is estimated that this study would require less than six months to complete
F. Preliminary cost estimate or range, if available. Not available.
G. Briefly describe the study methods and provide background literature, if available. As described above in A through D. Assumptions would be made for a range of conditions and a comparison will be made of the benefits and costs in hydropower generation between the current operating scenarios and the proposal in this study request. In addition, the benefits and costs associated with maintaining a continuous domestic water supply, and the benefits and costs associated with the fisheries resources due to the flow augmentation will need to be determined.
H. How will the results be used to develop or implement protection, mitigation and enhancement measures? The results of this study will be used in conjunction with other studies related to instream flows downstream of the Project to determine what protection, mitigation, and enhancement measures will be included related to instream flow requirements downstream of the Project.