BAKER RIVER PROJECT RELICENSE

Technical Scenario Teamlet Conference Call

May 5, 2003

10:00 a.m. – 12:00 a.m.
Dial in: (866) 280-6429
Guest #: 144995
OBC-14N Conference Room

AGENDA

1) Review Notes	10:00 – 10:10
2) Review Action Items a) Review Recent Conditions Edits b) Review Dependable Capacity Modeling Requirements c) Update on Stage-Volume issues	10:10 – 10:40
3) HYDROPS Status Report	10:40 – 11:00
4) Report from Instream Flows Technical Working Group	11:00 – 11:10
5) Report from Economics Working Group	11:10 – 11:20
6) Review Revised Draft Request Form	11:20 – 11:30
7) Initial Discussion of Global Assumptions	11:30 – 11:50
8) Set Agenda for May 9 teleconference	11:50 – 11:55
9) Set times for future meetings	11:55 - 12:00

April 25, 2003

BAKER RIVER PROJECT RELICENSE

Technical Scenario Teamlet

May 5, 2003
10:00 to noon
PSE Office (One Bellevue Center)
Bellevue, WA

MEETING NOTES

Teamlet Leader: Paul Wetherbee, 425-462-3746, paul.wetherbee@pse.com

PRESENT: Paul Wetherbee, Tony Fuchs, Bob Barnes, Stan Walsh on phone (Skagit System Cooperative), Margaret Beilharz and Scott Lentz on phone (USFS), Mark Killgore (The Louis Berger Group), Ruth Mathews on phone (The Nature Conservancy), Chuck Howard on phone (Consultant), Gary Sprague on phone (WDFW), Stuart Beck on phone (R2).

FUTURE REGULAR WORKING GROUP DATES/LOCATIONS
May 9 from 10:00 – 12:00 pm at PSE Office in Bellevue *(later cancelled)*, May 21 from 1:00 – 3:00 pm at PSE Office in Bellevue, May 30 from 10:00-noon at PSE Office in Bellevue, June 6, 10:00 – 12:00 at PSE Office in Bellevue. These meetings will mostly be by conference call: Dial 1-866-280-6429. Enter participant code 144995#. For those planning to attend in person, the meetings will be in the conference room of OBC (One Bellevue Center) on the 14th floor.

DRAFT AGENDA FOR MAY 5, 2003
10:00 – noon at PSE Office in Bellevue (14th floor conference room)

1. Review Notes
2. Review Action Items
    - Review Recent Conditions Edits
    - Review Dependable Capacity Modeling Requirements
    - Update on Stage-Volume Issues
3. HYDROPS Status Report
4. Report from Instream Flows Technical Working Group

5. Report from Economics Working Group
6. Review Revised Draft Request Form
7. Initial Discussion of Global Assumptions
8. Set agenda for May 9 teleconference
9. Set times for future meetings

NEW ACTION ITEMS

- Paul: Send out sample scenarios (proposed base-case) run and results.
- Paul: Send out list of all HYDROPS technical background information available on the website.
- Paul: Check back with Powel to see when they can update and distribute HYDROPs demonstration PowerPoint slides.
- Stuart: Coordinate R2 and Bob Barnes effort to resolve the geographic datum issue and report back to group at next meeting.
- Stuart/Bob: Develop updated area-volume curves for both reservoirs.
- Stuart and/or Sue and Ruth: Continue discussion of IHA post-processing and report back to group on progress in next meeting.
- Paul: Distribute meeting notes from the 5/2/03 meeting of the Instream Flow Technical Teamlet.to the TST
- Paul: Investigate HYDROPS ability to model reserve capacity and report to group at next meeting.
- Paul: Analyze sensitivity of spawning/incubation flow calculation method, prepare short brief and present to TST at next meeting.
- Paul: Complete example model run request form using Margaret's changes, distribute to group, and discuss at next meeting.
- Paul/Lloyd: Distribute white paper or other supporting information on the energy prices used in the model.
- Paul: Distribute brief on what has been done to define representative hydroclimatic sequences in the Econ/Ops and Aquatic Resources working groups.

REPORT ON OLD ACTION ITEMS

- All: Margaret provided input for changes to the first sheet of the scenario request form.
- Paul: Incorporated changes to April 17 meeting minutes and distributed to group.
- Mark: Arrange for notetaker for May 5 meeting. Unfortunately she called in sick and was not able to attend.
- Bob: Resolving datum issues with help from Stuart and R2. Anticipate resolving issue at May 21 meeting.
- Lloyd: Update HYDROPS references and compile list of available titles on the web site. Action Item transferred to Paul.
- Ruth & Sue: Discussing IHA post-processing and planned R2 analyses. Task on-going and will be discussed at next meeting.
- Mark: Distributed and discussed white paper on dependable capacity analysis.

REVIEW RECENT CONDITIONS EDITS

Paul distributed the Recent Conditions Summary containing the most recent edits. The group agreed the elements represented the recent conditions.

REVIEW DEPENDABLE CAPACITY MODELING REQUIREMENTS

Mark discussed his white paper on modeling dependable capacity. The brief establishes the significance of the dependable capacity analysis and identifies a method to use HYDROPS to perform the analysis. Chuck pointed out that environmental or flood control restrictions potential impact dependable capacity via head loss. Group asked several questions regarding sensitivity to peak and off peak pricing values. Several in group still digesting proposed approach (Paul, Ruth). Mark's experience is that this issue *has* potentially the largest economic *impacts on project benefits*.

UPDATE ON STAGE-VOLUME ISSUES

Bob and Stuart described the status of the vertical datum resolution issue with respect to the new data from the Walker survey. Current understanding is that the new data does not significantly vary from the existing data once the data are on a consistent datum [BOB AND STUART CHECK ME ON THIS]

HYDROPS STATUS REPORT

Paul reported that he has been testing the beta version without the multi-year run capability. Paul anticipates receiving beta version with multi-year run capability this week. He will begin testing next beta version as soon as he receives it.

REPORT FROM INSTREAM FLOW TECHNICAL TEAMLET

Paul, Stan, and Gary attended this meeting from this teamlet. Paul reported that he briefed the Instream flow Teamlet on the status of HYDROPS and the developments of the TST. He reported that the Instream Flow meeting discussed the downstream habitat models being developed by R2 in considerable detail for the majority of the meeting. The instream flow group did not delineate specific output requirements with respect to the HYDROPS modeling.

REPORT FROM ECONOMICS WORKING GROUP

Paul could not remember why this was on the agenda and no one had anything to add.

REVIEW REVISED DRAFT REQUEST FORM

Margaret discussed the revisions she made to page one of the HYDROPS model request run. Major changes include boxes to define the time periods of the requested analysis and more detailed information on the hard and soft constraints. Paul is tasked with working with the form and using it to work up an example from Stan's requests.

INITIAL DISCUSSION OF GLOBAL ASSUMPTIONS

Paul discussed the idea of global assumptions or variables. Things we could discuss once and then not re-open because they would be held constant in the comparative analysis. Energy prices are element that is input to the model that fits this description. Mark suggested inflow hydrology is another, assuming the user maintains the ability to select sub-sets from the hydrologic record. We will address energy prices in next TST meetings. Gary suggested that critical flow for ramping restrictions maybe another one global variable that can be set once and then not

adjusted. Stan questioned whether definition of critical flow would be accomplished soon enough to benefit the first wave of modeling. Gary thought it could be.

TO: Baker River Relicensing Economics and Operations Work Group and Technical Scenario Teamlet

FROM: Mark Killgore, P.E., Louis Berger Group, Inc.
(425) 881-9083; mkkillgore@louisberger.com

SUBJECT: Draft Working Paper on dependable capacity for the Baker Project (P- 2150)

The purpose of this paper is to provide the Economic and Operations Work Group and Technical Scenario Teamlet with information on the concept and computation of dependable capacity as used in FERC Relicensing. Please feel free to comment on this draft and I will be glad to incorporate suggestions in subsequent drafts.

DATE: May 5, 2003

INTRODUCTION

This working paper lays out the concept and basis for dependable capacity as an element of the developmental analysis to be performed for the Applicant Prepared Environmental Assessment (APEA) for the Baker Hydroelectric Project. It documents the relationship of critical period flows with power planning at a regional level and explains Puget's role and contribution to dependable capacity in the Northwest.

I. BACKGROUND ON FERC BASIS FOR DEPENDABLE CAPACITY

The Code of Federal Regulations (CFR) provides the basis for computing dependable capacity as part of Exhibit B

of the License Application. The regulations are stated below with appropriate phrases highlighted:

1. [Code of Federal Regulations]
[Title 18, Volume 1]
[Revised as of April 1, 2002]
From the U.S. Government Printing Office via GPO Access
[**CITE**: **18CFR4.51**]

[Page 110-117]

TITLE 18--CONSERVATION OF POWER AND WATER RESOURCES

CHAPTER I--FEDERAL ENERGY REGULATORY COMMISSION, DEPARTMENT OF ENERGY

PART 4--LICENSES, PERMITS, EXEMPTIONS, AND DETERMINATION OF PROJECT COSTS--Table of Contents

Subpart F--Application for License for Major Project--Existing Dam

Sec. 4.51 Contents of application.

(c) Exhibit B is a statement of project operation and resource utilization. If the project includes more than one dam with associated facilities, the information must be provided separately for each such discrete development. The exhibit must contain:

(1) A statement whether operation of the powerplant will be manual or automatic, an estimate of the annual plant factor, and a statement of how the project will be operated during adverse, mean, and high water years;

(2) ***An estimate of the dependable capacity*** and average annual energy production in kilowatt-hours (or a mechanical equivalent), supported by the following data:

(i) The minimum, mean, and maximum recorded flows in cubic feet per second of the stream or other body of water at the powerplant intake or point of diversion, with a specification of any adjustments made for evaporation, leakage, minimum flow releases (including duration of releases), or other reductions in available flow; a flow duration curve

indicating the period of record and the gauging stations used in deriving the curve; ***and a specification of the period of critical streamflow used to determine the dependable capacity***;

II. BACKGROUND ON REGIONAL DEFINITION OF DEPENDABLE CAPACITY AND CRITICAL PERIOD

The critical period was defined in a recent report (NORTHWEST REGIONAL FORECAST OF POWER LOADS AND RESOURCES For AUGUST 2001 - JULY 2006; Compiled by PACIFIC NORTHWEST UTILITIES CONFERENCE COMMITTEE, Portland, Oregon; June 1, 2001). The report can be downloaded from the Internet at:

http://www.pnucc.org/2001%20NRF/Complete%202001%20Web%20NRF.pdf

The definition for critical period states:

> "That portion of the historical streamflow record during which recorded streamflows, combined with all available reservoir storage, produced the least amount of hydroelectric energy. For this report, the critical period is the 8-month period starting September 1936 and ending April 1937."

III. BACKGROUND ON REGIONAL COORDINATION FOR DEPENDABLE CAPACITY

Puget is a member of the the Northwest Power Pool and a signatory to the Pacific Northwest Coordination Agreement (PNCA). According to the Power Pool website "the Northwest Power Pool is an association of utilities serving the Northwestern United States, British Columbia and Alberta. The association dates to 1942, when the United States government directed utilities to coordinate operations in support of wartime production. Three standing committees of the Power Pool address: 1) coordination of power operations, 2) transmission planning issues and 3) administration of the Pacific Northwest Coordination Agreement."

A description of the PNCA is beyond the scope of this paper, however a free publication explains the agreement in detail. The document entitled *POWER SYSTEM COORDINATION: A Guide to the Pacific Northwest Coordination Agreement* was published in October 1993. This Document was published for the Columbia River System Operation Review, a joint project of the U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, and Bonneville Power Administration. To request a copy of this document, call: 1-800-622-4520.

The fact the Puget is a party to this regional agreement justifies the approach of using a regional critical period in the development of project dependable capacity.

IV. BACKGROUND ON IMPACT OF FLOOD CONTROL ON DEPENDABLE CAPACITY

There is a direct connection between the operational impacts of flood control at Upper Baker and the amount of dependable capacity the Baker Project can produce. Flood control constraints affect dependable capacity in two aspects. Firstly the additional drawdown of the project reduces the gross head (change in elevation between the headwater (i.e. reservoir surface elevation) and tailwater. Secondly, the volume of water that can be carried into the more critical winter months is reduced since less water can be stored under drawndown condtions.

Keith Brooks of the Federal Energy Regulatory Commission issued a "Working Paper on Flood Storage at the Baker River Project" on February 19, 2003 wherein he referred to House Document No. 95-149. Some of that material related to power compensation is reproduced below:

House Document No. 95-149
Upper Baker Project, Skagit River Basin Washington
Communication from the Acting Assistant Secretary of the Army
May 9, 1977 – Referred to the Committee on Public Works and Transportation and ordered to be printed

A Corps of Engineers Report pursuant to Section 209 of the Flood Control Act of 1962

2. The District and Division Engineers recommend that the Upper Baker Project be operated to provide additional flood control storage space, and that Puget Sound Power and Light Company be compensated by the Federal Government with power, in kind, for resulting power losses.

3. The Board of Engineers for Rivers and Harbors concurs generally in the findings of the reporting officers and recommends change in operation of the Upper Baker Project with Federal compensation for power losses in accordance with the plan of the District Engineer, subject to certain requirements of local cooperation.

13. Accordingly, the Board recommends authorization of changes in operation of the Upper Baker Project to provide additional flood control storage space and compensation of Puget Sound Power and Light Company with power, in kind, for resulting hydroelectric power losses, generally in accordance with the plan of the District Engineer.

Page 58. Division of Plan Responsibilities

However, Congressional authorization is required to allow federal compensation of Puget Power from power losses that would result from the additional flood control. The Corps of Engineers and Bonneville Power Administration would share in the responsibility for carrying out the plan. Puget Power would be required to operate the project in accordance with the agreement reached with the U.S. Army Corps of Engineers, and to compute associated power losses for use by the Corps of Engineers and Bonneville Power in providing replacement power.

Based on the above information, it appears appropriate to include the effects of the Corp-BPA Upper Baker additional flood control compensation agreement as part of recent historical conditions. This agreement provides for up to 1750 MWh per month from November through February in amount not to exceed 7 MW per hour.

V. EFFECT OF THE CRITICAL PERIOD ON BAKER HYDROLOGY

The September 1936 through April 1937 regional critical period is coincidentally the most severe critical period for those months in the Baker River Basin as shown in figures 1 and 2. The total period of record analyzed encompassed 1926-27 through 2001-02 or 76 years. We begin our cumulative inflow analysis on August 1, since the Baker Project reservoirs would likely be at full pool by that date and most of the snowpack runoff would have finished. Additionally it not likely that Puget would cease generating altogether in the month of August or just pass inflow. Finally, by 2012, Puget would require additional electric resources in the month of August per the *2002-2003 Draft Least Cost Plan* dated December 2002.

Cumulative inflows for the August 1936 through April 1937 critical period totaled 367,228 sfd at Lower Baker and 277,422 sfd at Upper Baker (an sfd is one cfs for a period of 1 day and is a measure of volume). Eleven other dry years are plotted on figures 1 and 2 for comparison purposes.

Figure 1. Cumulative inflow at Lower Baker from August 1 through end of April.

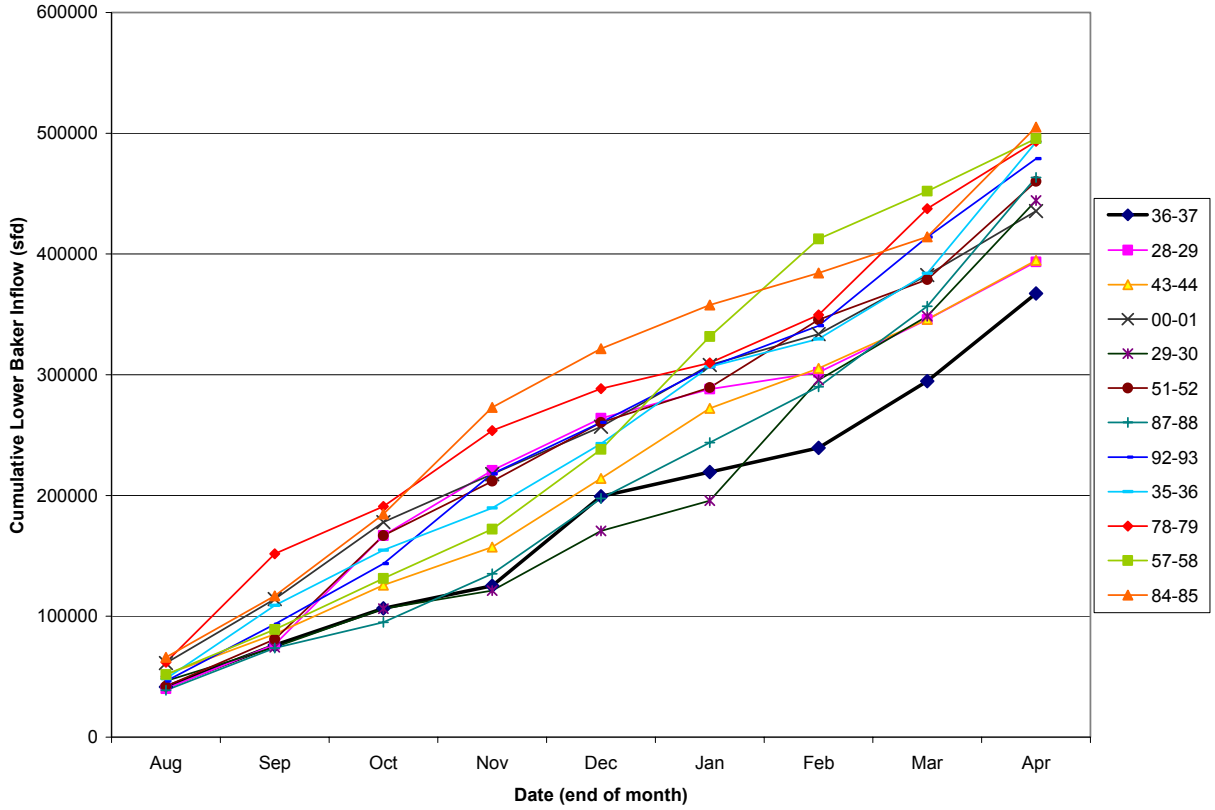
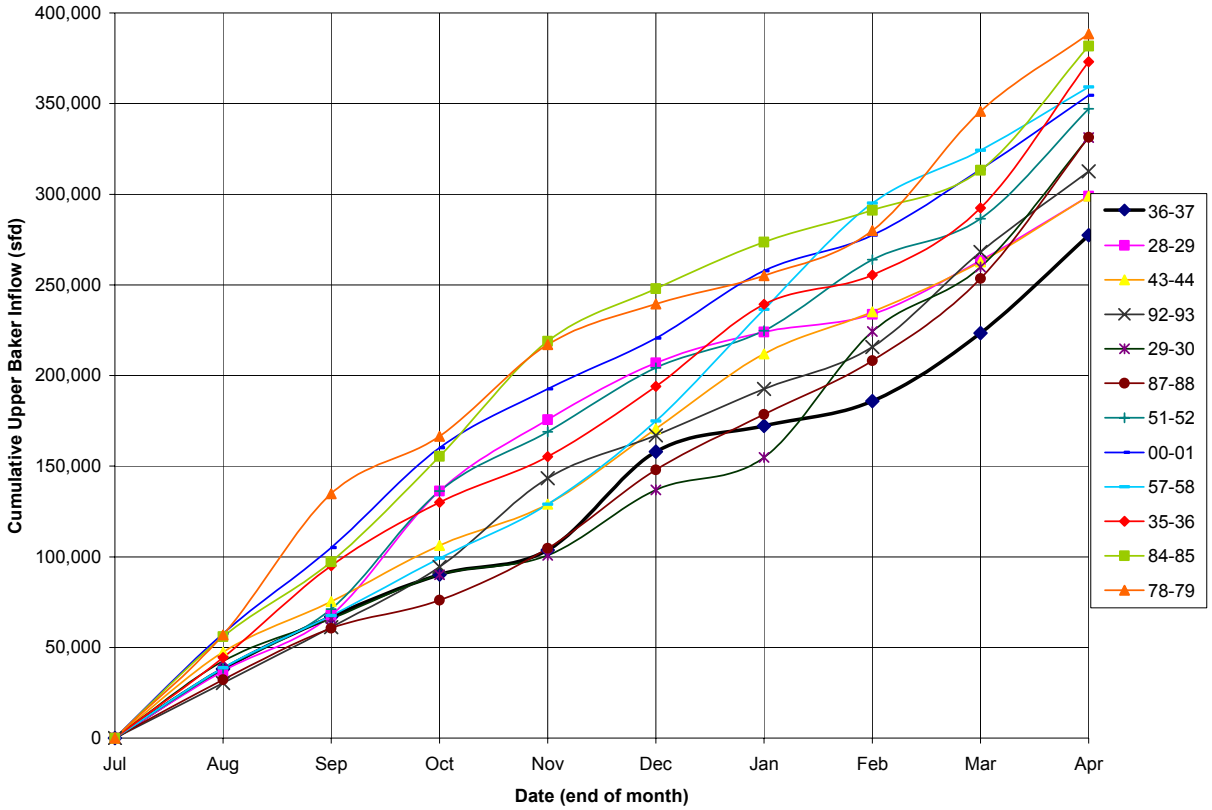


Figure 2. Cumulative inflow at Upper Baker from August 1 through end of April.



VI. PUGET'S NEED FOR DEPENDABLE CAPACITY DURING A CRITICAL PERIOD

We described the most important load requirements in the Initial Consultation Document as occuring:

- 6 AM till 10 AM

- 5 PM till 9 PM

These higher load requirements generally occur on Monday through Friday excluding holidays. The Baker Project provides power to meet this load and Puget's obligations under the PNCA. Provision of this power is most important during dry hydrologic periods, particularly the 1936-37 critical period.

VII. PROPOSED APPROACH TO HDYROPS MODELING AND INCORPORTATION OF DEPENDABLE CAPACITY IN APEA

We are required to evaluate the economic impact of operational measures in the APEA. Typically we compare alternatives presented in the APEA against recent project operations as a basis for determining economic impacts. New environmental constraints would likely affect Puget's ability to ramp the project. Additionally, more stringent ramp rate requirements would likely result in a shift of peak energy to off-peak periods.

The 1936 – 1937 critical period significantly predates current operations since only the Lower Baker Development was operating on the Baker River and only Gorge and Diablo Developments were operating on the Skagit River. The most recent dry period was 2000 – 2001 (4^{th} driest at Lower Baker) and we propose to simulate dependable capacity operations at the Baker Project during this period as a surrogate for 1936-37 conditions. We would begin the critical period with partially drawdown reservoirs at Baker Lake and and possibly Lake Shannon under this approach to adjust for lower water supply in 1937. The following steps must be taken to use this approach.

- The first step is to run HYDROPS using the August 1, 1936 through April 30, 1937 hydrology with both Lake Shannon and Baker Lake at normal maximum pool on August 1. Environmental and flood control constraints should reflect recent historic conditions. The pricing signals should be such that power has no value outside the 6 AM till 10 AM and 5 PM till 9 PM weekday periods (non-holiday). For this reason I have suggested we define a third category of energy with the HYDROPS model called superpeak energy (alternatively we could insert a middle category called shoulder peak energy). Table 1 (at the end of this report) identifies the days during which dependable capacity is required. By using August 1, 2004 through

April 30, 2005 we block out 39 weeks compatible with the Hydrops Model. A total of 1,520 hours of dependable capacity is needed over this period. The dependable capacity target should be 7 MW lower from November through February at Upper Baker (assuming we include Corp-BPA Upper Baker additional flood control compensation agreement as part of recent historical conditions). The capacity should be distributed over the nine months as evenly as possible. This will likely be an iterative process and may require either appropriate price signals or minimum monthly releases that increase, compensating for reduced gross head. The ending pool level on April 30 should be the minimum normal pool at both reservoirs unless there is insufficient water to operate both projects at full gate during the hours the dependable capacity is needed.

- The second step is to repeat step 1 using August 1, 2000 through April 30, 2001 hydrology. Begin with Baker Lake drawndown by 77,175 sfd (153,074 AF) and Lake Shannon at normal maximum pool. The difference in inflow (1936-37 versus 2000-01) at Lake Shannon is 68,393 sfd (135,655 AF) so it is more than taken into account by the drawdown at Baker Lake. This run will likely produce less energy (and hence dependable capacity) than the first run due to both the inflow differential at Lower Baker and lower operating pool level.

- The third step is to reduce the drawdown at Baker Lake such that the dependable capacity in step one is matched. This will likely require a series of iterations until the values converge on the results from step 1. It may be necessary to adjust Lake Shannon starting pool elevation as well.

Once we define a preferred settlement alternative, we'll need to make a similar run using the 2000-01 hydrology and the same starting levels in Lake Shannon and Baker Lake that resulted from step 3 above.

Table 1. Computation of hours requiring dependable capacity.
Sample 2004-2005 Period

	Sun	Mon	Tues	Wed	Thu	Fri	Sat	Business Days per Week	Capacity Hours Req'd	Hours per Month
Aug	1	2	3	4	5	6	7	5	40	
	8	9	10	11	12	13	14	5	40	
	15	16	17	18	19	20	21	5	40	
	22	23	24	25	26	27	28	5	40	
	29	30	31					2	16	176
Sep				1	2	3	4	3	24	
	5	***6***	7	8	9	10	11	4	32	
	12	13	14	15	16	17	18	5	40	
	19	20	21	22	23	24	25	5	40	
	26	27	28	29	30			4	32	168
Oct						1	2	1	8	
	3	4	5	6	7	8	9	5	40	
	10	11	12	13	14	15	16	5	40	
	17	18	19	20	21	22	23	5	40	
	24	25	26	27	28	29	30	5	40	
	31							0	0	168
Nov		1	2	3	4	5	6	5	40	
	7	8	9	10	11	12	13	5	40	
	14	15	16	17	18	19	20	5	40	
	21	22	23	24	25	***26***	27	4	32	
	28	29	30					2	16	168
Dec				1	2	3	4	3	24	
	5	6	7	8	9	10	11	5	40	
	12	13	14	15	16	17	18	5	40	
	19	20	21	22	23	***24***	25	4	32	
	26	27	28	29	30	31		5	40	176

Jan*							1		0	
	2	***3***	4	5	6	7	8	4	32	
	9	10	11	12	13	14	15	5	40	
	16	17	18	19	20	21	22	5	40	
	23	24	25	26	27	28	29	5	40	160
	30	31						1	8	
Feb**			1	2	3	4	5	4	32	
	6	7	8	9	10	11	12	5	40	
	13	14	15	16	17	18	19	5	40	
	20	***21***	22	23	24	25	26	4	32	152
	27	28						1	8	
Mar			1	2	3	4	5	4	32	
	6	7	8	9	10	11	12	5	40	
	13	14	15	16	17	18	19	5	40	
	20	21	22	23	24	25	26	5	40	
	27	28	29	30	31			4	32	184
Apr						1	2	1	8	
	3	4	5	6	7	8	9	5	40	
	10	11	12	13	14	15	16	5	40	
	17	18	19	20	21	22	23	5	40	
	24	25	26	27	28	29	30	5	40	168

Total hours requiring dependable capacity	1520	1520
Total days requiring dependable capacity	190	190

* Although January 1 falls on a Saturday, we assign the holiday in January since most years it falls in the month of January

** We have ignored the effect of any leap years in this analysis.

Highlighted days do not require dependable capacity and holidays are shown in bold italic.

DISCUSSION RECENT CONDITIONS (PRE INTERIM PROTECTION PLAN)

Revised based on 4/25 teamlet discussion.

For analysis purposes, specifically the NEPA analysis, the following elements (engineering and environmental constraints) of the Baker River Project comprise the recent condition for the HYDROPs model configuration.

Powerhouse Capacity: Existing LB and UB combined turbine capacities. Note: this is a hard constraint.

Flood Control: Existing Corps flood control at Upper Baker. UB WSEL 720.7' by 1-Nov, 707.8 from 15-Nov through 28-Feb. These will be updated going forward. No flood control at Lower Baker. Note: this is a soft constraint.

Recreational Reservoir Levels:

Upper Baker: WSEL 715' 4-Jul through 3-Sep (nominal Labor Day weekend).
Lower Baker: WSEL 401' 15-Apr through 3-Sep (nominal Labor Day weekend).
Note: these are soft constraints.

Ramping: 1978 Ramping Restrictions: 2000 cfs/hr downramping restriction at the Baker River USGS gage when Skagit River near Concrete flows are ≤ 18,000 cfs. Note: these are soft constraints.

Minimum Instream Flow (MIF): 80 cfs (mean daily flow) at the Baker River USGS gage independent of Skagit River streamflow. Note: this is a soft constraint.

Rough draft Hydrops runs from Stan Walsh

Definitions

Minimum flow period for egg incubation and fry emergence: September 1 to May 1 for salmon and March 15 to August 15 for steelhead.

Spawning periods: September 1 to January 15 for salmon and March 15 to June 15 for steelhead.

Daily spawning flow: average of the highest eight hours of release.

Run 1

Minimum flows during the incubation period that are 2/3 the daily spawning flow of the 10 highest days during the spawning period.

Constraints: current flood control rule curve and meet state downramp guidelines.

Outputs: spawning flows that will allow for incubation flows under the 2/3 scenario without running out of water at 90 percent exceedance for the Baker Basin.

Run 2

Change output using exceedance values of 95 percent instead of 90 percent.

Runs 3 and 4

Change minimum flows from 2/3 to 50 percent of spawning flows and rerun Runs 1 and 2.

Runs 5-7

Eliminate flood control as a constraint and rerun Runs 1-4.

Possible Refinements

Spawning periods are approximate and can be refined with R2 studies. Spawning and incubation periods for salmon may be segregated by species with some overlap.