4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Baker River Project's use of the Baker River for hydropower purposes to see what effect various environmental measures would have on the project's costs and power benefits. Consistent with the Commission's approach to economic analysis, the power benefit of the project is determined by estimating the cost of obtaining the same amount of energy and capacity using the likely alternative generating resources available in the region. In keeping with Commission policy as described in Mead, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.[43]

Our analysis includes: (1) an estimate of the net power benefit of the project for each of the licensing alternatives, and (2) an estimate of the cost of individual measures considered in the final EIS for the protection, mitigation and enhancement of environmental resources affected by the project. To determine the net power benefit for each of the licensing alternatives, we compare project costs to the value of the power output as represented by the cost of the alternative source of power. For any alternative, a positive net annual power benefit indicates that the project power costs less than the current cost of alternative generation resources and a negative net annual benefit indicates that project power costs more than the current cost of alternative generation resources. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Table 4-1 summarizes the assumptions and economic information we use in our analysis. This information was provided by Puget in its license application. We find that the values provided by Puget are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; net investment (the total investment in power plant facilities remaining to be depreciated); estimated future capital investment required to maintain and extend the life of plant equipment and facilities; relicensing costs; normal operation and maintenance cost; and Commission fees.

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[43] See Mead Corporation, Publishing Paper Division, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 4-1. Parameters for economic analysis of the Baker River Project. (Source: Puget)

Base Year	2006	
Period of Analysis (years)	30	
Taxes and Insurance (%)		
Federal income tax rate	35	
Levy rate	66	
Assessment rate	1.48	
Insurance	0.07	
Net Investment, $[a]	$0	
Future major capital cost, $[b]	$23,634,300	
Relicensing cost, $[c]	$27,741,800	
Operation and maintenance, $/yr[d]	$3,079,000	
Commission fees, $/yr[e]	$689,000	
Energy Value ($/MWh)	**Peak**	**Off-Peak**
January	39.16	34.96
February	37.31	33.91
March	33.61	30.85
April	33.41	30.61
May	29.89	25.35
June	27.98	25.39
July	39.00	33.66
August	47.92	39.13
September	52.64	44.24
October	46.92	42.95
November	47.83	43.21
December	50.93	44.24
Capacity Value ($/MW-year)[f]	63,500	
Interest rate[g]	6.10	
Discount rate[h]	6.10	

[a] Net investment is the depreciated project investment allocated to power purposes.
[b] Future major capital costs include major plant rehabilitation to maintain present-day capability scheduled between 2006 and 2035 and are expressed as a present value.
[c] Relicensing costs include the administrative, legal/study, and other expenses to date.
[d] Existing plant operation and maintenance includes operation and maintenance related to environmental measures associated with the current license.
[e] Commission fees are based on statements of annual charges received from the Commission for federal lands and administrative charges based on authorized capacity.
[f] Source: Application for New License, exhibit D, table D-6.
[g] Based on Puget's weighted average cost of capital.
[h] Assumed by staff to be same as interest rate.

As currently operated, the 170.03-MW Baker River Project generates an average of 723,320 MWh[44] annually and has a dependable capacity of 166.61 MW. Table 4-1 includes monthly values for generation under high-load period (peak) and low-load period (off-peak) conditions. These values represent Puget's marginal cost of generation as determined by system load and generation resource simulation. They reflect the cost of a mixture of generation resources available to Puget. We use monthly variable peak and off-peak energy values for our analysis in order to estimate the cost (in lost energy value) of minimum flow and reservoir operating measures that are seasonal and/or constrain the hourly operation of the project for peaking.

The capacity value of $63,500/MW-year (table 4-1) is based on the amortization and fixed operation and maintenance cost for a simple-cycle combustion turbine. Some of the measures that would require operational changes reduce the dependable capacity rating of the project. We discuss the effects of proposed operational changes on power benefits in section 4.2.1.

4.1.1 Economics of the No-Action Alternative

The existing project represents the No-Action Alternative. Under this alternative there would be no change in project facilities or operations (beyond life extension of structures and equipment), and no enhancement measures would be provided. Under these conditions, the project generates an average of 723,320 MWh annually, valued at $39,366,300 ($54.42/MWh). The annual cost of producing this energy is $8,985,900 ($12.42/MWh). Therefore, the project provides a net annual power benefit of

[44] Owing to recent powerhouse upgrades and water management improvements, this modeled value of average annual generation differs from the Project's historical generation of 708,000 MWh (as reported in section 2.2, Need for Power).

$30,380,400 ($42.00/MWh). In other words, the project produces energy at a cost that is less than that of currently available alternative generation by $42.00/MWh.

4.1.2 Economics of the Proposed Project

Under the Settlement Agreement, the project would generate an annual average of 722,019 MWh, valued at $37,440,400 ($51.86/MWh). The cost of producing this energy would be $20,734,900 annually ($28.72/MWh). Therefore, the proposed project would provide a net annual power benefit of $16,705,500 ($23.14/MWh). In other words, the proposed project would produce energy at a cost that is less than that of currently available alternative generation by $23.14/MWh.

4.1.3 Economics of the Staff Recommended Alternative

Under staff's recommended alternative, the project would generate an annual average of 722,019 MWh, valued at $37,440,400 ($51.86/MWh). The cost of producing this energy would be $20,235,200 annually ($28.03/MWh). Therefore, the proposed project would provide a net annual power benefit of $17,205,200 ($23.83/MWh).

4.2 COST OF ENVIRONMENTAL MEASURES

In this section, we estimate the annual costs of the various environmental measures evaluated in the final EIS. Section 4.2.1 discusses the impact of operations-related enhancement measures on power benefits in terms of energy and capacity replacement costs. Section 4.2.2 summarizes the estimated cost of all of the measures proposed in the Settlement Agreement.

4.2.1 Cost Impacts of Operational Changes

Currently, Puget generally operates the Baker River Project in coordination with their other power supply resources to meet the power needs of their customers. On a weekly basis, the demand for electricity is generally higher Monday through Saturday than on Sunday, and, on a daily basis, the demand for power peaks during the morning (6 a.m. to 10 a.m.) and early evening (5 p.m. to 9 p.m.). Typically, the project generates power on weekdays and often on Saturday between 6 a.m. and 10 p.m., which corresponds to heavy load (on-peak) hours. Depending on lake levels, inflows, weather forecasts, and system demand, the project may not generate weeknights and on weekends, particularly Sunday. During periods of high inflow, however, the project may generate continuously for several days or weeks.

Puget provides a continuous minimum release of 80 cfs at the Lower Baker Development for the operation of the adult fish trap-and-haul facility located 0.3 mile downstream of the powerhouse. Additionally, in a voluntary program to reduce the

potential for fish stranding, Puget seeks to limit the average downramping rate in the Baker River downstream of the Lower Baker powerhouse to 2,000 cfs per hour whenever the Skagit River flow falls below 18,000 cfs, as measured at the Skagit River near Concrete gage.

Operational changes, if implemented, would affect both energy generation and dependable capacity. Estimates of energy impacts were provided by Puget based on system simulation using the HYDROPS model, a hydropower operations computer optimization model. The effects of project operational changes on dependable capacity were also provided by Puget and are based on the project capacity during a critical hydrologic period. The Pacific Northwest Region adopted September 1936 through April 1937 as the critical period (Corps, 1999). The most recent period similar to the critical period reflecting current Skagit River operations is September 2000 through April 2001 at the Skagit River Project operated by Seattle City Light. Puget used this period for determining dependable capacity effects from operational changes.

The proposed operation includes a modified reservoir management regime, new minimum flows (1,000 cfs from August 1 through October 20 and 1,200 cfs from October 21 through July 31), new ramping rates, and reservoir drawdown limits (Proposed Article 106). To implement this release regime, specifically the ramping limits, and to generate power with the minimum flow releases, Puget would install two new 750-cfs turbine-generators units at the Lower Baker Development.

The effect of the proposed operation, in conjunction with the new turbine-generators, would be a decrease in on-peak energy, an increase in off-peak energy, and a substantial decrease in dependable capacity relative to the No-Action Alternative. Under the Proposed Action, the project would provide average annual generation of 722,019 MWh (compared to 723,320 MWh for the No-Action Alternative) and a dependable capacity of 129.83 MW (compared to 166.61 MW under the No-Action Alternative).

The dependable capacity decreases under the Proposed Action because of two factors. First, the minimum instream flow increases from 80 cfs under Current Operations to 1,000/1,200 cfs under the Proposed Action. Furthermore, the Proposed Action includes new ramping rates which require Puget to use more water when downramping at the Lower Baker Development. Both of these factors result in less water available for generation during the high demand hours of the critical period.

In combination, the reduced annual average generation and dependable capacity of the Proposed Action result in a $1.93-million decrease in annual power benefits compared with the No-Action Alternative.

4.2.2 Cost of Environmental Enhancement Measures

Table 4-2 summarizes the effects on project economics of the proposed measures as included in the Settlement Agreement.

The staff alternative includes environmental measures as proposed in the Settlement Agreement but with certain changes. We exclude in the staff alternative measures contained in the following proposed articles: 304, 318, 505, 602, and 603. Further, we make substantial modifications to measures contained in the following additional articles: 101, 107, 109, 201, 301-303, 305-308, 311, 316, 317, 401, 501-504, 507-510, and 515-517. We discuss our proposed changes to the measures contained in the Settlement Agreement in section 5.1, Comprehensive Development and Recommended Alternative.

4.2.3 Cost of Agency Recommendations

On March 16, and March 21, 2005, respectively, NMFS and WDFW filed two recommendations for fish protection measures not contained in the Settlement Agreement: (1) provide a flow continuation valve, and (2) schedule annual operation inspections; permit agencies and tribes other reasonable inspections; maintain and make available project operational records; and notify resource agencies of unusual operational incidents.

To achieve flow continuation, we estimate that it may be necessary to equip two of the four abandoned, 8-foot-diameter penstocks at the site of the proposed new auxiliary powerhouse with regulating valves.

We estimate a levelized annual cost of $101,000 to install any flow continuation valves. Costs associated with the agencies' recommendations for access, records, and notification procedures would be minimal, so there is no incremental cost associated with these measures.

Table 4-2. Summary of costs of environmental protection and mitigation measures as proposed in the Settlement Agreement (2006 $). (Source: Puget)[45]

Measure	Capital Cost	Levelized O&M Cost	Total Levelized Annual Cost[a]
101 Fish Propagation	9,687,800	303,300	974,000
102 Aquatics Reporting	--	13,400	13,400
103 Upstream Fish Passage	7,658,800	93,100	623,300
104 Fish Connectivity between Reservoirs	1,024,200	34,600	105,500
105 Downstream Fish Passage	41,926,400	585,900	3,488,600
106 Flow Implementation[b]	32,176,100	195,600	2,423,200
107 Flood Regulation[c]	--	--	--
108 Gravel Augmentation	20,000	9,600	11,000
109 Large Woody Debris	50,000	20,000	23,500
110 Shoreline Erosion	266,800	10,200	28,600
201 Programmatic Agreement	--	217,700	217,700
301 Recreation Management Report[d]	--	--	--
302 Aesthetics Management	--	19,200	19,200
303 Baker Lake Resort Redevelopment Plan	--	45,000	45,000
304 Baker Reservoir Recreation Water Safety	--	19,200	19,200
305 Lower Baker Developed Recreation	--	67,300	67,300

[45] Costs of measures as recommended by staff are identified in sections 5.1.1-5.1.3.

Measure		Capital Cost	Levelized O&M Cost	Total Levelized Annual Cost[a]
306	Upper Baker Visitor Information Services	--	27,500	27,500
307	Upper Baker Visitor Interpretive Services	--	29,400	29,400
308	Dispersed Recreation Management	--	39,000	39,000
309	Bayview Campground Rehabilitation	--	71,300	71,300
310	Upper Baker Trail and Trailhead Construction	--	37,100	37,100
311	Lower Baker Trails	--	7,500	7,500
312	Developed Recreation Monitoring	--	21,300	21,300
313	Upper Baker Developed Recreation Maintenance	--	57,300	57,300
314	Upper Baker Trail and Trailhead Maintenance	--	77,400	77,400
315	Lower Baker Trail Maintenance[e]	--	--	--
316	Forest Service Forest Road Maintenance	--	41,500	41,500
317	Access to Baker Lake[c]	--	--	--
318	Law Enforcement	--	100,000	100,000
401	Water Quality	397,100	9,000	36,500
501	Terrestrial Resource Management Plan	--	6,700	6,700
502	Deciduous Forest Habitat	355,800	1,300	25,900
503	Elk Habitat	3,436,200	50,000	287,900
504	Wetland Habitat	284,600	10,200	29,900
505	Aquatic Riparian Habitat Protection, Restoration, and Enhancement Plan	5,093,100	17,000	369,600
506	Osprey Nest Structures	16,000	1,000	2,100

Measure	Capital Cost	Levelized O&M Cost	Total Levelized Annual Cost[a]
507 Loon Floating Nest Platforms	34,900	2,600	5,000
508 Noxious Weeds	--	22,700	22,700
509 Special Status Plants	--	17,500	17,500
510 *Carax Flava* (Yellow Sedge)	--	15,000	15,000
511 Decaying and Legacy Wood	--	13,400	13,400
512 Bald Eagle Night Roost	--	2,300	2,300
513 Bald Eagle Management	--	700	700
514 Habitat Evaluation Procedures	--	8,600	8,600
515 Late Seral Forest	71,300	--	4,900
516 Mountain Goats	62,200	--	4,300
517 Grizzly Bears	100,000	--	6,900
601 Baker River Coordinating Committee	--	50,000	50,000
602 Required Resource Funding	--	96,100	96,100
603 Adaptive Management	--	3,500	3,500

[a] Includes the cost of two new turbine-generators units in a new auxiliary powerhouse at the Lower Baker dam.

[b] The annual cost is that levelized annual amount that is equivalent to the present value of planning, design, implementation, construction, operation, and maintenance costs over the 30-year period of analysis. These numbers are derived directly from the economics provided in the Settlement Agreement.

[c] Under the flood storage agreement between Corps and Puget, compensation for flood storage is provided to Puget. Therefore, there are no costs associated with this measure.

[d] No incremental cost associated with this measure.

[e] Costs are reflected in the measure for Upper Baker Trail and Trailhead maintenance (Proposed Article 314).

4.3 COMPARISON OF ALTERNATIVES

Table 4-3 summarizes the benefits, costs, and annual net power benefits of the alternatives.

Table 4-3. Summary of developmental costs, benefits, and annual net power benefits for the Baker River Project Alternatives. (Source: Puget and Commission staff)

		No-Action Alternative	**Applicant's proposal**	**Commission staff's Alternative**
Annual generation	(MWh)	723,320	722,019	722,019
Annual power benefit	($)	39,366,300	37,440,400	37,440,400
	($/MWh)	54.42	51.86	51.86
Annual cost	($)	8,985,900	20,734,900	20,235,200
	($/MWh)	12.42	28.72	28.03
Annual net power benefit	($)	30,380,400	16,705,500	17,205,200
	($/MWh)	42.00	23.14	23.83