4.0 DEVELOPMENTAL ANALYSIS

4.1 INTRODUCTION

The Proposed Action includes a variety of environmental protection, mitigation, and enhancement (PM&E) measures (PGE, 2005). The measures include changes to Project operations that would decrease the annual electric power output of the Project while also increasing its operating costs. This developmental analysis estimates the Clackamas River Project's net annual economic benefits under the Proposed Action and the No Action Alternative.

The Clackamas River Project's net economic benefits are the difference between the cost of producing power, including the costs of the proposed PM&E measures and changes in operation, and the value of the electric power it would produce. The value of the power is based on the costs of obtaining the same amount of energy and firm generating capacity from a likely alternative source. For the Clackamas River Project, we use energy values based on the cost of purchasing electricity from the Bonneville Power Administration (BPA) at its new resource rate for firm power in the last two years (2005-06) of the current rate schedule. We use the average of the monthly rates for the high and low load periods. For the capacity value, we use $57/kilowatt-year ($/kw-yr), which is based on the cost of a new natural gas-fired, combined cycle combustion turbine (CCCT) plant.

Table 4.1-1 presents the significant economic assumptions used in our analysis.

4.2 PROJECT POWER BENEFITS

Staff used a HEC-5 operations model to simulate historical operations of the project for the 1971 to 2000 water years. Under current operations, which is the No Action Alternative, the Project generated on average approximately 755,591 megawatt hours (MWh) annually between 1971 and 2000. The model also estimated that on average nearly 71 percent of the Project's annual generation, or 535,768 MWh, was produced on-peak, and that 29 percent, or 219,823 MWh, was produced off-peak. The peak period is 6:00 a.m. to 10:00 p.m. and the off-peak period is 10:00 p.m. to 6:00 a.m.

Table 4.1-1. Key Economic Assumptions for the Economic Analysis of the Clackamas River Hydroelectric Project.

Parameter	Value
Period of Analysis – years	30
Terms of Financing – years	20
Short-term Interest Rate	4.3%
Long-term Interest Rate	4.6%
Discount Rate	7.80%
Power Value	
Peak Energy Value - mills/kWh	41.42
Off-Peak Energy Value - mills/kWh	29.16
Capacity Value - $/kW-year of capacity	$57
Production Costs (2006$)	
Net Investment	$70,495,197
Relicensing - Cost of PM&E Measures	See Tables 4.3-1 and 4.4-2
Operations & Maintenance ($/year)	$3,995,500
FERC Fees ($/year)	$339,500
Oregon & Land Use Fees ($/year)	$216,400

Notes: The energy values presented above are based on prices to purchase new-resource firm power during the last 2 years (2005 and 2006) of the Bonneville Power Administration's (BPA) current rate schedule. The capacity value is based on a new, 600-megawatt, natural gas fired, combined cycle combustion turbine (CCCT) generating plant with a current capital cost (2006$) of $649/kW. Finally, the interest rate assumptions in Table 4.1-1 are derived from several sources, including the January 2006 interest rates for short-term notes and 10-year and 30-year bonds, and information provided by PGE.

The Project has a total installed capacity of 173 megawatts (MW) and a dependable capacity of 67.2 MW. Dependable capacity has a current value of $57/kw-yr assuming that the alternative type of generation is a natural gas fired, combined cycle, combustion turbine (CCCT) power plant.

The bulk of the Project is essentially operated in run-of-river mode, with only the Oak Grove Development having any substantial peaking generation. As a result, the amount of peak power generated – 71 percent of total annual energy output – is only 4 percentage points higher than the number of peak hours per week – 112 out of 168 hours, or 67 percent.

Implementation of the Proposed Action would result in a total annual loss of 60,225 MWh, with 39,178 MWh of the loss coming during the peak period and 21,047 MWh of the loss occurring during the off-peak period. Under this alternative, total annual power generation would decrease by 8 percent, with a 7.3 percent decline during peak periods and a 9.6 percent decrease during off-peak periods. The annual loss in power generation would be due to the aquatic PM&E

measures that would reduce the amount of water flowing through the turbines. Compared to the No Action Alternative, the Proposed Action would lower the annual power benefit of the Project by about $2.2 million.

4.3 COST OF ENVIRONMENTAL MEASURES

The Proposed Action includes a number of environmental and recreational PM&E measures. Table 4.3-1 presents the capital and annual O&M costs of these measures by major resource type and area. Table 4.4-2 presents the detailed costs of the PM&E measures. The total increase in Project capital costs for the Proposed Action would be $120.2 million, of which approximately 63 percent would be to benefit fish and aquatic resources, especially at the North Fork and River Mill developments. Other PM&E measures would benefit terrestrial, recreational, aesthetic, cultural, and land use resources. Among these, measures with large capital costs include upgrading the water supply at Timothy Lake recreation sites, upgrading boat launch sites and docks, and improving access to Lake Harriet for fishing. Annual O&M costs would increase by $1.3 million and the total levelized annual increase in Project costs (capital plus O&M), based on the parameters presented above in Table 4.1-1, would be just under $13.4 million (Table 4.3-1).

Table 4.3-1. Annualized Costs of PM&E Measures of the Proposed Action.

	(Thousands of 2006$)		
PM&Es by Type and Area	**Capital Costs**	**O&M Costs**	**Annualized Costs**
Project wide	$ 23,490.0	$ 535.3	$2,892.3
Oak Grove Fork Recreation/Cultural/Aesthetics	$ 18,566.0	$128.3	$1,991.2
Oak Grove Fork Terrestrial	$ 1,553.0	$ 65.0	$ 220.8
Oak Grove Fork Aquatics	$ 2,881.0	$ 0.0	$ 289.1
North Fork Recreation/Cultural/Aesthetics	$ 231.0	$ 0.0	$ 23.2
North Fork Terrestrial	$ 65.0	$42.7	$ 49.3
North Fork Aquatics	$ 55,243.0	$461.3	$6,004.4
Faraday Recreation/Cultural/Aesthetics	$ 26.0	$ 0.0	$ 2.6
Faraday Aquatics	$ 106.0	$ 0.0	$ 10.6
River Mill Recreation/Cultural/Aesthetics	$ 389.0	$ 0.0	$ 39.0
River Mill Aquatics	$ 17,669.0	$76.9	$1,849.8
Total	$120,219.0	$1,309.5	$13,372.4

Source: PGE 2005b.

4.4 COMPARISON OF ALTERNATIVES

Table 4.4-1 summarizes the annualized costs, benefits, and net benefits of the Proposed Action, the No Action Alternative, and the Staff Alternative.

Table 4.4-1. Summary of Costs, Power Benefits, and Net Benefits of the Clackamas River Hydroelectric Project alternatives.

	No Action	Proposed Project	Staff Recommended[1]
Installed Capacity	173 MW	173 MW	173 MW
Annual Generation	755,591 MWh	695,366 MWh	695,366 MWh
Annual Power Value	$32,431,900 (42.92 mills/kWh)	$30,195,500 (43.42 mills/kWh)	$30,195,500 (43.42 mills/kWh)
Annual Cost	$9,358,000 (12.38 mills/kWh)	$18,856,400 (27.12 mills/kWh)	$18,674,940 (26.86/MWh)
Net Annual Benefit	$23,074,000 (30.54/MWh)	$11,339,100 (16.32/MWh)	$11,520,560 ($16.57/MWh)

[1] The cost of the Staff Alternative reflects deduction of the items not included in the Staff Alternative.

The net annual benefits under the No-Action Alternative are $23.074 million or 30.54 mills/kWh. As shown in Table 4.4-1, the Proposed Action would reduce the annual net benefit to $11.339 million, a reduction of $11.735 million. The decline in the Project's net benefit would be due primarily to the costs of the Proposed Action's PM&E measures as the annual costs of the Project would rise by 102% (i.e., slightly more than double). At the same time, the annual power output in kWh generated by the Proposed Action would decline by 8%, resulting in a 6.9% drop in the annual power value.

Table 4.4-2. Detailed Cost Estimates for the Proposed Action.

	Capital Costs	Annual O&M Costs	Annualized Cost
Project Wide PM&Es, Or PM&Es Not Associated with a Specific Development			
Project wide Mitigation Fund	$ 8,200,000		$ 822,797
Project wide Water Quality Management and Monitoring Plan (WQMMP) implementation	$ 4,613,000		$ 462,873
Project wide upstream passage evaluation (Studies)	$ 538,000		$ 53,983
Project wide downstream passage evaluation (Studies, DM3)	$ 5,151,000		$ 516,857
ODFW Hatchery	$ 2,306,000		$ 231,386
Operation of Project Recreation Areas		$ 535,333	$ 535,333
I&E Plan Development and Implementation	$ 800,000		$ 80,273
Historic Properties Management Plan (HPMP) and programmatic agreement	$ 169,000		$ 16,958
Historic Resources Working Group (HRWG) Coordination	$ 231,000		$ 23,179
Aesthetics Strategy/Plan and Recreation Resources Management Plan (RRMP)	$ 969,000		$ 97,230
Fisheries Committee (FC) implementation	$ 513,000		$ 51,475
SUB TOTAL	$ 23,490,000	$ 535,333	$ 2,892,344
Oak Grove Fork Development (Recreational/Cultural/Aesthetics Resources)			
Upgrade the Park Water System (Timothy Lake)	$ 51,000		$ 5,117
Boat Ramps and Dock Replacement	$ 359,000		$ 36,022
Shoreline enhancements	$ 41,000		$ 4,114
Timothy Lake Campground Upgrades and Amphitheater	$ 1,138,000		$ 114,188
New group area and 50-site Campground at Timothy Lake	$ 646,000		$ 64,820
Timothy Lake Trail / new loop trails	$ 108,000		$ 10,837
Dispersed Site Management Plan	$ 103,000		$ 10,335
Timothy Lake Lodge revisions	$ 10,000		$ 1,003
Construction of River Access feature, Playboat, USGS gage	$ 149,000		$ 14,951
Lake Harriet Site Plan and Improvements	$ 538,000		$ 53,983
Law Enforcement		$ 38,433	$ 38,433
USFS and USGS payments for river access, Playboat, and gage management		$ 89,867	$ 89,867
Roads	$ 15,054,000		$ 1,510,534
Dispersed site treatment and dust abatement at Lake Harriet	$ 369,000		$ 37,026
SUB TOTAL	$ 18,566,000	$ 128,300	$ 1,991,232
Oak Grove Fork Development (Terrestrial Resources)			
USFS Volunteer Wildlife Monitoring/Maintenance		$ 767	$ 767
Wetlands Mitigation/Measures	$ 1,435,000		$ 143,989
Oak Grove Pipeline Small Animal Crossing	$ 58,000		$ 5,820
Oak Grove Pipeline Large Animal Crossing	$ 29,000		$ 2,910
Cold Water Corydalis Monitoring		$ 29,900	$ 29,900
Sensitive Plant Monitoring		$ 16,367	$ 16,367
Timothy Lake Wetland/Amphibian Monitoring		$ 17,933	$ 17,933
Frog Lake Vegetative Screening Project	$ 31,000		$ 3,111
SUB TOTAL	$ 1,553,000	$ 64,967	$ 220,796
Oak Grove Fork Development (Aquatic Resources)			
Flow pipeline from buldhead for min. flows below Harriett	$ 820,000		$ 82,280
Replace outlet bar racks at Timothy Lake	$ 183,000		$ 18,362
Culvert replacements Anvil & Dinger Creek (wood structures)	$ 231,000		$ 23,179
Cutthroat Trout migration investigation	$ 51,000		$ 5,117
Fish habitat improvements to Dinger Creek (wood structures)	$ 51,000		$ 5,117
Timothy Lake fisheries measures (spawning disruption)	$ 364,000		$ 36,524
Fish habitat improvements below Timothy Lake	$ 72,000		$ 7,225
Oak Grove Habitat Measures	$ 1,109,000		$ 111,278
SUB TOTAL	$ 2,881,000		$ 289,083

Table 4.4-2 Detailed Cost Estimates for the Proposed Action (continued)

	Capital Costs	Annual O&M Costs	Annualized Cost
North Fork Development (Recreational/Cultural/Aesthetics Resources)			
Promontory Park Upgrades (recreation)	$ 231,000		$ 23,179
SUB TOTAL	$ 231,000		$ 23,179
North Fork Development (Terrestrial Resources)			
Vegetation Mgmt Plan coordination and updates	$ 33,000		$ 3,311
Bald Eagle Nest Site Mgmt Plans	$ 2,000		$ 201
North Fork fish ladder wildlife protection fencing	$ 2,000		$ 201
North Fork fish ladder wildlife crossings	$ 28,000		$ 2,810
Terrestrial Resources Working Group (TRMP) planning/coordination/meetings/reporting		$ 42,733	$ 42,733
SUB TOTAL	$ 65,000	$ 42,733	$ 49,256
North Fork Development (Aquatic Resources)			
Downstream juvenile surface collector at North Fork Dam	$ 36,941,000		$ 3,706,698
Upgrade existing Juvenile Pipeline	$ 463,000		$ 46,458
Extend juvenile pipeline to North Fork Dam	$ 6,655,000		$ 667,770
Sampling facility for the juvenile pipeline (Timber Park)	$ 1,871,000		$ 187,738
Juvenile pipeline connection to existing collection system	$ 1,236,000		$ 124,022
Replace existing screens at North Fork Dam	$ 268,000		$ 26,891
New adult sorting facility in North Fork Dam ladder	$ 3,998,000		$ 401,163
Remove adult/juvenile separator from North Fork Dam ladder	$ 124,000		$ 12,442
Install strobe lights at North Fork Dam intake	$ 195,000		$ 19,567
Install spillway exclusion net at North Fork Dam	$ 513,000		$ 51,475
Install south bank guide curtain at North Fork Dam	$ 2,050,000		$ 205,699
Large Woody Debris (LWD) storage site and operation	$ 104,000		$ 10,435
Lamprey passage evaluation program	$ 569,000		$ 57,094
Pulsed flow evaluation on upstream passage in diversion reach	$ 256,000		$ 25,687
Operate North Fork Dam aduld salmonid sorting facility during new license		$ 307,500	$ 307,500
Operate and maintain North Fork juvenile salmonid transport facilities		$ 153,767	$ 153,767
SUB TOTAL	$ 55,243,000	$ 461,267	$ 6,004,407
Faraday Development (Recreational/Cultural/Aesthetics Resources)			
Promontory Park Upgrades (recreation)	$ 26,000		$ 2,609
SUB TOTAL	$ 26,000		$ 2,609
Faraday Development (Aquatic Resources)			
Valves and Plumbing for new Diversion Reach flow release	$ 106,000		$ 10,636
SUB TOTAL	$ 106,000		$ 10,636
River Mill Development (Recreational/Cultural/Aesthetics Resources)			
Timber Park improvements (recreation)	$ 133,000		$ 13,345
River Mill boat ramp replacement	$ 256,000		$ 25,687
SUB TOTAL	$ 389,000		$ 39,033
River Mill Development (Aquatic Resources)			
Downstream migrant surface collector at River Mill	$ 10,250,000		$ 1,028,496
Operate & maintain River Mill juvenile salmonid transport facilities		$ 76,867	$ 76,867
Clackamas River gravel augmentation below River Mill Dam	$ 7,419,000		$ 744,430
SUB TOTAL	$ 17,669,000	$ 76,867	$ 1,849,793
Project Totals	**$ 120,219,000**	**$ 1,309,467**	**$ 13,372,366**

Annual O&M costs presented above in column 3 were obtained by dividing the total costs for PM&E measures that were O&M expenses over the life of the project by 30