ENERGY NORTHWEST

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June 8, 2009
PKWD-09-045

Ms. Kimberly D. Bose, Secretary
Office of the Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, D.C. 20426

Dear Ms. Bose:

Subject: **PACKWOOD LAKE HYDROELECTRIC PROJECT**
FERC DOCKET NO. P-2244
LAKE CREEK RAMPING RATE PLAN FOR REACH 5 BELOW THE DROP STRUCTURE JUNE 2009, REVISION 1

Reference: Letter dated June 4, 2009; Energy Northwest to the Federal Energy Regulatory Commission; Lake Creek Ramping Rate Plan for Reach 5 Below the Drop Structure

Enclosed is the Lake Creek Ramping Rate Plan For Reach 5 Below The Drop Structure June 2009, Revision 1. This Plan supersedes the submittal referenced above.

The revisions apply as follows:

- Correction to the bypass flows for May, June, and July in Table 2-1 and accordingly, the text of the first bulleted item following the table.
- Editorial change to the header label for Tables 3-1, 3-2.1, and 3-2.2 to include "Stage" associated with the -1 inch, -2 inch and -4 inch data.
- Insertion of "(effective December 1)" in Section 3.2 as it relates to the 7 cfs to 4 cfs flow information at all 11 transects.
- Insertion of Table 3-3.1 and text associated with the table. The other tables in Section 3.3 have been subsequently renumbered.

If you have any questions or require additional information, contact me at 509.377.8581.

Respectfully,

Dan Ross
Packwood Project Manager

Enclosure: Lake Creek Ramping Rate Plan For Reach 5 Below The Drop Structure June 2009, Revision 1

Lake Creek Ramping Rate Plan For Reach 5 Below The Drop Structure

for

Energy Northwest's
Packwood Lake Hydroelectric Project
FERC No. 2244
Lewis County, Washington

Submitted to:

P.O. Box 968
Richland, Washington 99352-0968

Submitted by:

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June 2009
Revision 1

Lake Creek Ramping Rate Plan for Reach 5 Below The Drop Structure

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Lake Creek Ramping Rate Plan For Reach 5 Below The Drop Structure

1.0 INTRODUCTION

Energy Northwest (EN) is in the process of relicensing its Packwood Lake Hydroelectric Project (FERC No. 2244) and has submitted a Final License Application (FLA) to the Federal Energy Regulatory Commission (FERC). At the FERC-mandated 10(j) meeting held in Olympia, Washington on April 27, 2009, FERC requested that EN examine the effect of flow reductions associated with the changing instream flows on the habitat in Reach 5, directly downstream of the drop structure.

EN produced an analysis at the meeting to show the changes in stage associated with changes in the instream flow as agreed to by EN and the natural resource agencies and tribes. FERC requested that EN submit this analysis to the FERC. This plan is submitted to satisfy FERC's request.

2.0 METHODS

2.1 Proposed Instream Flows for the Packwood Lake Hydroelectric Project

In the FLA, EN with agency and tribal concurrence, proposed the instream flows shown in Table 2-1.

Table 2-1 Proposed instream (bypass) flows in cubic feet per second (cfs) for Lake Creek, as measured at the drop structure

Month	Bypass Flows (cfs)
January	4
February	4
March	4
April	7
May	15
June	10
July	15
August 1 – 15	15
August 16 – September 15	20
September 16 – 30	15
October	10
November	7
December	4

Reductions in stage would occur in Lake Creek during the following periods:

- June 1, when instream flow decreases from 15 cfs to 10 cfs
- September 16, when instream flow decreases from 20 cfs to 15 cfs
- October 1, when instream flow decreases from 15 cfs to 10 cfs
- November 1, when instream flow decreases from 10 cfs to 7 cfs
- December 1, when instream flow decreases from 7 cfs to 4 cfs

2.2 Washington Department of Fish and Wildlife Interim Ramping Rates

FERC requested that EN analyze the appropriate changes in flow that correspond with Washington Department of Fish and Wildlife (WDFW) interim ramping rates (Hunter 1992). WDFW has established interim ramping rates for fish based on season and time of day. These interim ramping rates apply both to anadromous and resident fish, and would be applicable for lower Lake Creek (below Packwood Lake) (personal communications; John Blum, EES Consulting with Hal Beecher, WDFW; November 4, 2005). These interim rates are found in Table 2-2.

Table 2-2 Interim ramping rates (Hunter 1992)

Season	Daylight Rates*	Night Rates
February 16 – June 15 (salmon fry)	No ramping	2 inches/hour
June 16 – October 31 (steelhead and trout fry)	1 inch/hour	1 inch/hour
November 1 – February 15	2 inches/hour	2 inches/hour
* Daylight is defined as 1 hour before sunrise to 1 hour after sunset		

As proposed, a change in flow from 15 cfs to 10 cfs (June 1) occurs when no ramping is allowed during daylight hours; while 2 inches/hour is allowed at night. Changes in flow from 20 cfs to 15 cfs (September 16) and 15 cfs to 10 cfs (October 1) occur during the June 16 – October 31 period, when changes in stage are limited to 1 inch/hour during both daylight hours and at night. Decreases in flow from 10 cfs to 7 cfs and from 7 cfs to 4 cfs occur in November and December, when ramping rates of 2 inches/hour are acceptable during all hours of the day and night.

2.3 Lake Creek Elevations and Discharge

EES Consulting (EESC) examined all 11 transects used for the instream flow study at Study Site 4, which represented habitat found within Reach 5, immediately below the drop structure at the intake (Table 2-3). EESC used the River Habitat Simulation System (RHABSIM), a computer model developed by Thomas R. Payne and Associates, to calculate the stage/discharge relationship for each transect. The calculations used the stage and associated discharge measurements determined during the calibration flows for the lower Lake Creek Instream Flow Study in Reach 5. Equations for each transect were developed

within the HYDSIM sub-module of RHABSIM that calculate flow, based upon changes in stage, and stage, based upon changes in flow.

Table 2-3 Transect Descriptions at Study Site 4, Reach 5 (below drop structure)

Transect	Transect Description
1	Wide Run
2	Plunge Pool
3	Narrow Run (boulder and cobble)
4	Pool (bedrock on sides; cobble/gravel on margins)
5	Split Channel Glide (boulder/cobble)
6	Run (below plunge pool)
7	Split Channel Run w/lateral pool
8	Wide Glide
9	Pool Tailout
10	Wide Pool
11	Riffle (gravel and cobble)

3.0 RESULTS AND DISCUSSION

3.1 Changes in flow and stage at 1 inch and 2 inch increments, Lake Creek Study Site 4 for flows between 10 cfs and 20 cfs

Table 3-1 summarizes stage changes of 1 inch (0.083 ft) and 2 inches/hour (0.1667 ft) for flows ranging from 20 cfs to 10 cfs at all 11 transects.

Table 3-1 Changes in flow and stage at 1 inch and 2 inch increments, Lake Creek Study Site 4 (below the drop structure; Reach 5)

Transect	Flow (cfs)	- 1 inch (cfs) (1 hour)	- 2 inch (cfs) (2 hours)	Stage	Stage - 1 inch	Stage - 2 inch
1	20	15.92	13.53	94.30	94.22	94.13
	15	11.70	9.78	94.15	94.06	93.98
	10			93.95		
2	20	16.55	13.60	96.05	95.96	95.88
	15	12.25	9.94	95.92	95.84	95.75
	10			95.75		
3	20	16.09	12.79	98.65	98.56	98.48
	15	11.88	9.29	98.54	98.45	98.37
	10			98.39		
4	20	16.71	13.86	98.83	98.74	98.66
	15	12.38	10.12	98.69	98.61	98.53
	10			98.52		
5	20	16.82	14.03	98.84	98.76	98.67
	15	12.44	10.22	98.70	98.62	98.54
	10			98.53		
6	20	17.55	15.24	95.81	95.73	95.65

Transect	Flow (cfs)	- 1 inch (cfs) (1 hour)	- 2 inch (cfs) (2 hours)	Stage	Stage - 1 inch	Stage - 2 inch
	15	12.84	10.83	95.64	95.56	95.47
	10	-	-	95.44	-	-
7	20	15.65	12.13	97.39	97.31	97.23
	15	11.56	8.80	97.29	97.21	97.13
	10	-	-	97.17	-	-
8	20	16.51	13.51	98.05	97.97	97.88
	15	12.22	9.84	97.93	97.84	97.76
	10	-	-	97.77	-	-
9	20	17.03	14.44	98.23	98.14	98.06
	15	12.68	10.67	98.08	98.00	97.91
	10	-	-	97.88	-	-
10	20	17.19	14.70	98.22	98.13	98.05
	15	12.77	10.81	98.06	97.98	97.90
	10	-	-	97.86	-	-
11	20	15.43	11.69	97.82	97.74	97.65
	15	11.33	8.37	97.73	97.65	97.56
	10	-	-	97.61	-	-

3.2 Changes in flow and stage at 2 inch increments, Lake Creek Study Site 4 for flows between 7 cfs and 4 cfs

Table 3-2.1 summarizes stage changes of 2 inches/hour (0.1667 ft) for decreases in flow ranging from 10 cfs to 7 cfs (effective on November 1). Table 3-2.2 summarizes stage changes of 2 inches/hour (0.1667 ft) for flows ranging from 7 cfs to 4 cfs at all 11 transects (effective December 1). A 2 inch change in stage is allowed for the November – December period, when these flow decreases would occur.

Table 3-2.1 Changes in flow (from 10 cfs) and stage at 2 inch increments (1 hour), Lake Creek Study Site 4 (below the drop structure; Reach 5)

Transect	Flow (cfs)	- 2 inch (cfs) (1 hour)	Stage	Stage - 2 inch
1	10	6.79	93.99	93.82
2	10	5.23	95.69	95.52
3	10	6.30	98.41	98.25
4	10	6.47	98.52	98.36
5	10	6.50	98.53	98.36
6	10	6.54	95.44	95.27
7	10	5.59	97.17	97.00
8	10	6.28	97.77	97.60
9	10	6.95	97.88	97.72
10	10	6.99	97.86	97.69
11	10	5.19	97.61	97.44

Table 3-2.2 Changes in flow (from 7 cfs) and stage at 2 inch and 4 inch increments (1 and 2 hours, respectively), Lake Creek Study Site 4 (below the drop structure; Reach 5)

Transect	Flow (cfs)	- 2 inch (cfs) (1 hour)	- 4 inch (cfs) (2 hours)	Stage	Stage - 2 inch	Stage - 4 inch
1	7	4.54	2.77	93.84	93.67	93.50
2	7	3.48	1.96	95.55	95.39	95.22
3	7	4.08	2.11	98.29	98.12	97.96
4	7	4.35	2.55	98.38	98.22	98.05
5	7	4.35	2.54	98.39	98.22	98.05
6	7	4.09	1.86	95.29	95.13	94.96
7	7	3.73	1.81	97.06	96.89	96.73
8	7	4.21	2.36	97.64	97.47	97.30
9	7	4.77	3.17	97.72	97.55	97.39
10	7	4.76	3.12	97.69	97.52	97.36
11	7	3.39	1.38	97.52	97.35	97.18

3.3 Recommended Ramping Rates

Table 3-3.1 summarizes the maximum, minimum, and mean change in flows permitted at the 11 transects in Reach 5, with a 2 inch change in stage/hour as flows drop from 15 cfs to 10 cfs on June 1; there would no daylight hour ramping. However, during the night, when a 2 inch change in stage could be affected, it would take approximately an hour to reduce flows.

Table 3-3.2 indicates that a reduction in stage from 20 cfs to 15 cfs would take approximately 2 hours. With the exception of Transect 6 (a run), all transects would meet criteria after 2 hours; Transect 11 is least sensitive to changes in stage with reductions in flow.

A similar trend is shown while reducing flows from 15 cfs to 10 cfs. Transect 11 is least sensitive to changes in flow, while Transect 6 is the most sensitive. Mean flow that could accommodate a 1 inch change in stage per hour at all transects is 12.2 cfs and 9.88 cfs over a 2 hour period. This rate would apply from the change in flow on September 16.

Table 3-3.3 shows changes in flow corresponding to a 2 inch/hour stage change, effective November 1, when instream flows decrease from 10 cfs to 7 cfs. This flow change falls within the 2 inch/hour change in stage criteria for all transects.

Table 3-3.4 presents changes in flow corresponding to a 2 inch/hour change in stage for the November 30 – December 1 period, when instream flow decreases from 7 cfs to 4 cfs. Flows could be dropped to 4.77 cfs from 7 cfs during the first hour and meet the ramping rate criteria for all transects; during the second hour, flows could be dropped to 4 cfs.

Table 3-3.1 Changes in flow corresponding to a 2 inch change in stage per hour (15 cfs to 10 cfs on June 1 – night only)

	Flow	2 inch stage change (1 hour)
Maximum	15 – 10 cfs	10.83
Minimum	15 – 10 cfs	8.37
Mean	15 – 10 cfs	9.88

Table 3-3.2 Changes in flow corresponding to a 1 inch change in stage per hour (20 cfs to 15 cfs and 15 cfs to 10 cfs)

	Flow	1 inch stage change (1 hour)	2 inch stage change (2 hours)
Maximum	20 - 15 cfs	17.55	15.24
	15 - 10 cfs	12.84	10.83
Minimum	20 - 15 cfs	15.43	11.69
	15 - 10 cfs	11.33	8.37
Mean	20 - 15 cfs	16.50	13.59
	15 - 10 cfs	12.19	9.88

Table 3-3.3 Changes inflow corresponding to a 2 inch change in stage per hour (from 10 cfs to 7 cfs)

	Flow	2 inch stage change (1 hour)
Maximum	10 – 7 cfs	6.99
Mean	10 – 7 cfs	6.26
Minimum	10 – 7 cfs	5.19

Table 3-3.4 Changes in flow corresponding to a 2 inch change in stage per hour (7 cfs to 4 cfs)

	Flow	2 inch stage change (1 hour)	4 inch stage change (2 hours)
Maximum	7 - 4 cfs	4.77	3.17
Mean	7 - 4 cfs	4.16	2.33
Minimum	7 - 4 cfs	3.39	1.38

4.0 PROPOSAL

In order to comply with the WDFW seasonal down ramping rates referenced in Table 2-2, EN will limit all instream (bypass) flow reductions identified in Table 2-1 to a maximum of 2.5 cfs per hour, with the exception of the June 1 reduction in flow, which could be completed in one hour.