

PUBLIC UTILITY DISTRICT NO. 1 *of* CHELAN COUNTY
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March 28, 2012

VIA ELECTRONIC MAILING

Honorable Kimberly D. Bose, Secretary, and
Nathaniel J. Davis, Sr., Deputy Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 First Street, NE
Washington, DC 20426

Re: **Lake Chelan Hydroelectric Project No. 637**
Article 405 – 2011 Annual Flow and Water Temperature Report

Dear Secretary Bose and Deputy Secretary Davis:

On February 24, 2012, the Federal Energy Regulatory Commission (Commission) issued an "Order Granting Extension of Time Pursuant to Article 405" for the Lake Chelan Hydroelectric Project (Project). Ordering Paragraph (A) granted the Public Utility District No. 1 of Chelan County, Washington (Chelan PUD) to file the report by the extended deadline of March 28, 2012.

In accordance with the above Order requirement, Chelan PUD hereby files the 2011 Annual Flow and Water Temperature Report. On February 29, 2012, a final draft of this report was provided to the resource agencies, Tribes and non-governmental organizations specified for 30-day review, which ends March 31.[1] None of the recipients provided any comments to date. If additional comments requiring changes to this report are received by March 31, Chelan PUD will file a revised report.

[1] *See* http://www.chelanpud.org/departments/licensingCompliance/LC_implementation/corres/38293.pdf

Please contact me or Steve Hays at (509) 661-4181 of my office regarding any questions or comments regarding this request.

Sincerely,

Keith Truscott for Michelle Smith

Michelle Smith
Licensing and Compliance Manager
michelle.smith@chelanpud.org
(509) 661-4180

cc: Erich Gaedeke, FERC Portland Regional Office

Enclosure: 2011 Annual Flow and Water Temperature Report

LAKE CHELAN ANNUAL FLOW AND WATER TEMPERATURE REPORT 2011

LICENSE ARTICLES 405 & 408

Final

LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637

March 28, 2012

Public Utility District No. 1 of Chelan County
Wenatchee, Washington

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EXECUTIVE SUMMARY

Chelan PUD received a new license (License) from the Federal Energy Regulatory Commission (FERC) on November 6, 2006, authorizing Chelan PUD to operate the Lake Chelan dam and powerhouse for a period of 50 years. The License conditions require that Chelan PUD provide minimum flows to the Chelan River and monitor those flows and water temperatures at various locations. The License required the construction of a Low Level Outlet at Chelan Dam, a Reach 4 habitat channel and spawning areas in the tailrace, and operations to protect aquatic life through flow ramping rates and powerhouse operations. The License also requires that Chelan PUD file an Annual Flow and Temperature Report with the FERC documenting compliance with these License requirements.

Minimum flows to the Chelan River of 80 cfs and 320 cfs were provided in accordance with the schedules described in License documents. Additional flow was provided from the Pump Station to the Reach 4 habitat channel for salmon and steelhead spawning during their respective spawning periods (October 15 – November 30 and March 15 – May 15). There were three deviations below minimum flow requirements in 2011 due to equipment failures in April and May. Corrective measures were taken to prevent further occurrences.

Chelan PUD further refined operating criteria for compliance with the two inches per hour ramping rates and managed flow releases using those operating criteria in conjunction with onsite monitoring of actual water level changes. The refined criteria performed well during the adjustments of spill flows that occurred from June – mid August and when ramping down from flows that provided whitewater boating in September.

Powerhouse operations for Chinook redd protection provided for periodic turbine operation during outages. There were a number of partial day outages from January 1 – April 30 due to various mechanical issues with the new turbines and generators and to conserve water to maintain lake levels. The powerhouse generally ran continuously with both units in operation from January 1 – April 9, with 21 periods, less than 9 hours in duration, of no turbine operation. There was a 17 hour turbine outage on April 10 and two other short (3 hour and 1 hour) outages prior to the end of April. There was water movement through the tailrace from March 15 – April 18 due to operation of the Pump Station.

During the March 15 – May 15 spawning period for steelhead, the powerhouse generally operated both turbines, with the exception of 13 shutdowns, all but one (April 10) lasting less than eight hours. Steelhead spawning was observed in the Reach 4 habitat channel in 2011, with 20 redds in the habitat channel and canal outlet pool, and one redd in flow from the habitat channel just downstream from its confluence with the tailrace.

During the Chinook spawning period in 2011, powerhouse daily average flows were maintained above 2000 cfs from October 1 – December 2, with the exception of a few hours with flows between 1000 – 2000 cfs. A total count of 413 Chinook redds were estimated to have been deposited in the Chelan River Reach 4 (173), tailrace (192), and downstream in the

Chelan/Columbia River confluence and Columbia River (48). Five coho redds were also observed in Reach 4.

A number of powerhouse outages occurred from December 3 – 31. Early December outages of 7-8 hours were scheduled for the purpose of installing oxygen monitoring equipment in Chinook redds (12/3-5) and cylindrical egg tubes with Chinook eggs for egg-emergence survival studies (12/10-12). Longer outages were scheduled starting December 20 for conservation of water to maintain lake levels in light of abnormally low mountain snow levels. These outages were scheduled with periodic powerhouse operation to maintain oxygen levels, with the duration of outages eventually extended to 23 hours, with one hour of turbine operation, by the end of December.

Water temperatures were monitored at seven locations in the Chelan River and tailrace. The water released from the Low Level Outlet into the Chelan River was slightly cooler during a few days from late August – early September than the average water temperature arriving at the Chelan Dam from the outlet of Lake Chelan. Water temperatures demonstrated small increases during transit from the upper end of Reach 1 to the end of Reach 3 during May – August, but cooling from September – December water temperatures neither increased nor decreased during transit through the Reach 4 habitat channel.

SECTION 1: INTRODUCTION

The Lake Chelan Hydroelectric Project (Project) is owned and operated by the Public Utility District No. 1 of Chelan County (Chelan PUD). The Federal Energy Regulatory Commission (FERC) license for operation of this project, issued on November 6, 2006, authorizes Chelan PUD to operate the Lake Chelan dam and powerhouse for a period of 50 years. As part of the normal operation of the Project, Chelan PUD withdraws water from Lake Chelan for power generation and discharges that water through the powerhouse into an excavated tailrace, which leads to the confluence of the Chelan River and the Columbia River. Flows released from the Chelan Dam follow the natural channel of the Chelan River, joining with the powerhouse tailrace flows and discharging to the Columbia River. As a requirement of the new License, minimum flows were established for the Chelan River and that flow was initiated on October 14, 2009.

Chelan PUD filed an Operations Compliance Monitoring Plan (OCMP), as required in License Article 405, which describes how Chelan PUD operates to meet: (1) the instream flows, ramping rates, and tailrace flows as set forth in Article 7 of the Lake Chelan Settlement Agreement and Chapter 7 of the Comprehensive Plan attached to the Settlement Agreement; (2) and the lake levels as set forth in Article 8 of the Settlement Agreement and Chapter 8 of the Comprehensive Plan. The OCMP includes the specifics of flow measurement techniques, electronic flow data posting, quarterly and annual reporting requirements, and an implementation schedule.

Chelan PUD filed a Threatened and Endangered Species Protection Plan (TESPP), as required in License Article 408, which describes: (1) how Chelan PUD implemented provisions for timely development of a system to release water at the Lake Chelan Dam or pump water from the project powerhouse tailrace to the Chelan River, and subsequent operation of that system to continuously maintain flows equal to or greater than the flows required for Chelan River Reach 4; and (2) methods and schedules for monitoring of flows in the project tailrace and in Reach 4 of the Chelan River and annual reporting of the monitoring results, as set forth in Article 7 of the Lake Chelan Settlement Agreement and Chapter 7 of the Comprehensive Plan attached to the Settlement Agreement, and (3) methods for timely determination of the need to take actions to improve water quality characteristics adversely affecting anadromous fish, and identification and implementation of appropriate actions.

The OCMP and TESPP were submitted to FERC on May 4, 2007 and FERC issued an order approving the TESPP on November 28, 2007 and an order modifying and approving the OCMP on November 30, 2007. Both the OCMP and TESPP require the recording and reporting of flows in the Chelan River, as related to meeting minimum flow requirements, protection of fish habitat and protection of salmon and steelhead eggs incubating in the tailrace. The FERC order approving the OCMP requires that Chelan PUD shall file an Annual Flow Report with the FERC by February 28 of each year. The TESPP includes annual reporting of water temperature monitoring required in the Lake Chelan Settlement Agreement. This Annual Flow and Temperature Report meets the flow and temperature reporting requirements of License Articles 405 and 408.

Chelan PUD manages the level of Lake Chelan and flow releases through the powerhouse and into the Chelan River channel at the dam for power generation and other purposes. License Article 405 requires management of lake levels with priority given to maintaining minimum flows in the Chelan River (initiated in 2009) and reducing high spillway flows into the Chelan River to protect fish habitat. The Annual Lake Level Report documents Chelan PUD's decisions regarding operation of the powerhouse for lake level management to meet these Chelan River objectives, as well as recreation and other requirements. Annual lake level reports are filed with FERC and posted to Chelan PUD's public web page at: http://www.chelanpud.org/lc-Resource-Documents.cfm.

This Annual Flow Report includes two sections that correspond to the flow reporting requirements of the FERC order: Section 2, Chelan River Instream Flows and Section 3, Powerhouse Tailrace Security Flows. Section 4 of this report contains the water temperature monitoring that was conducted in 2011.

SECTION 2: CHELAN RIVER INSTREAM FLOWS

2.1 Chelan River Instream Flows

Flow releases were provided throughout the year from the Low Level Outlet for minimum flows of at least 80 cfs in Reaches 1-3 (Figure 2-1). The runoff forecast for 2011 was in the upper 20 percent exceedance level, which is classified as a "wet year" for setting minimum flows during the annual runoff cycle. The 2011 minimum flow releases to Reaches 1-3 were at least 320 cfs from May 15 – July 15. Additional flow was provided from the Pump Station to the Reach 4 habitat channel for salmon and steelhead spawning during their respective spawning periods (Figure 2-2). The spawning flows from April 18 – May 15 were provided solely from the Low Level Outlet to assist in managing lake levels. There were three deviations below minimum flow requirements in 2011, on April 18, May 15 and May 17. These deviations were due to operating control system failures and corrective measures were taken to prevent further occurrences. The FERC determined that these deviations did not constitute a violation of the license (Appendix C).

Flows were released from the Low Level Outlet and spillway as needed for lake level control, beginning April 18 and June 1, respectively. Flows for lake level control continued until August 18. These flow releases were managed to meet lake level target elevations and to avoid high spill levels that could damage the Reach 4 habitat channel. Flow releases for lake level control peaked at 5931 cfs daily average on July 3. Flow releases from the spillway and Low Level Outlet were also managed to provide two weekend whitewater boating events on September 11 and 24-25. Whitewater boating events scheduled for July 9-10 were canceled due to high inflows that required spill levels that were too high for safe whitewater boating and events scheduled for July 23-24 and September 10 were cancelled for lack of participant registration.

Spawning flows were provided for steelhead trout from March 15 – May 14 and for Chinook salmon from October 15-November 30. The spawning flows were provided through the combination of the Low Level Outlet flows and Pump Station flows, maintaining flow levels of at least 320 cfs. At the end of the fall spawning period, flows from the Pump Station were ramped down one pump at a time to avoid fish stranding. Since "wet year" minimum flows of 320 cfs were required from May 15 – July 15, there was no ramping down of flows at the end of the steelhead spawning period. Steelhead trout adults were observed spawning in the Reach 4 habitat channel beginning on April 1. Spawning continued into May, with 20 redds counted by May 4 and one late additional redd on June 1, for a total of 21 redds. One steelhead redd was located in Reach 4 flows, but below the confluence with the tailrace. Chinook fry were present in the Reach 4 habitat channel from mid April through June. Chinook spawning began just prior to October 15 and was completed prior to November 30. There were a total of 413 redds counted in the Chelan River Reach 4, the tailrace and Columbia River at the confluence. There were 173 redds in the Reach 4 habitat channel and upstream pool, 192 in the tailrace and 48 in the Columbia River in Chelan River flows below the confluence. Five coho redds were also observed in Reach 4.

A tabulation of average daily flows from the Low Level Outlet, Pump Station, combined flows into Reaches 1-3 and Reach 4, powerhouse discharge, spill discharge and hourly lake levels and powerhouse tailwater levels are presented in Appendix A. Quarterly hourly data is available at the internet site: http://www.chelanpud.org/lc-Resource-Documents.cfm.

Figure 2-1. Flow Releases to Reaches 1-3 of the Chelan River, 2011.

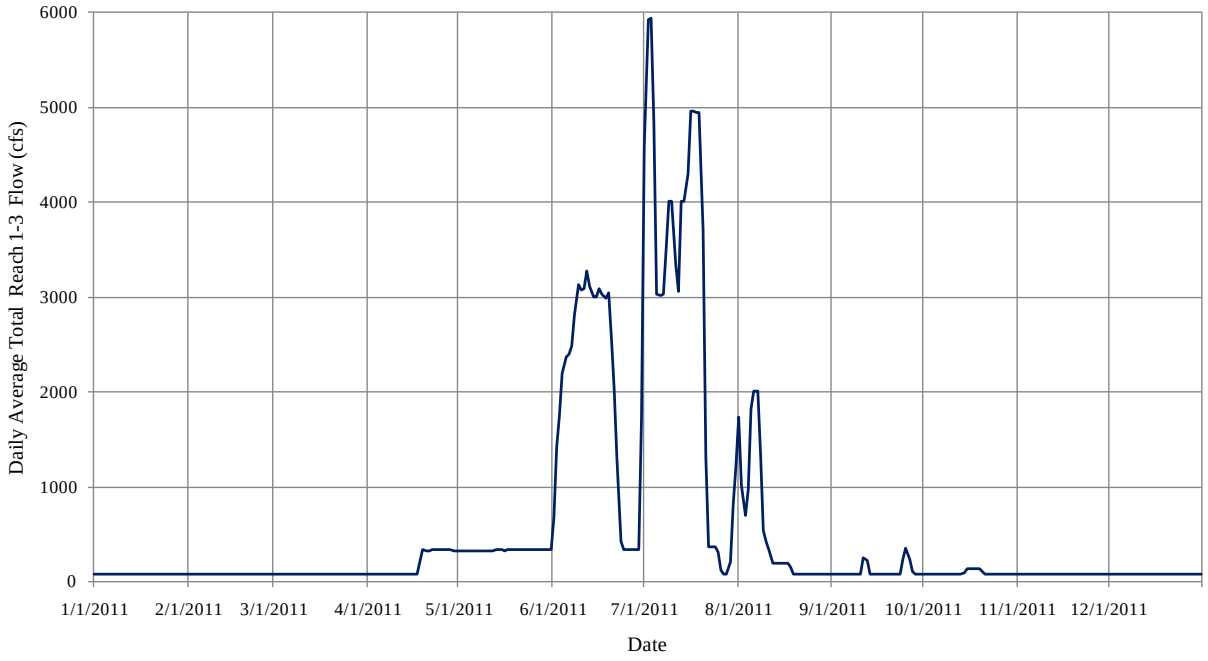
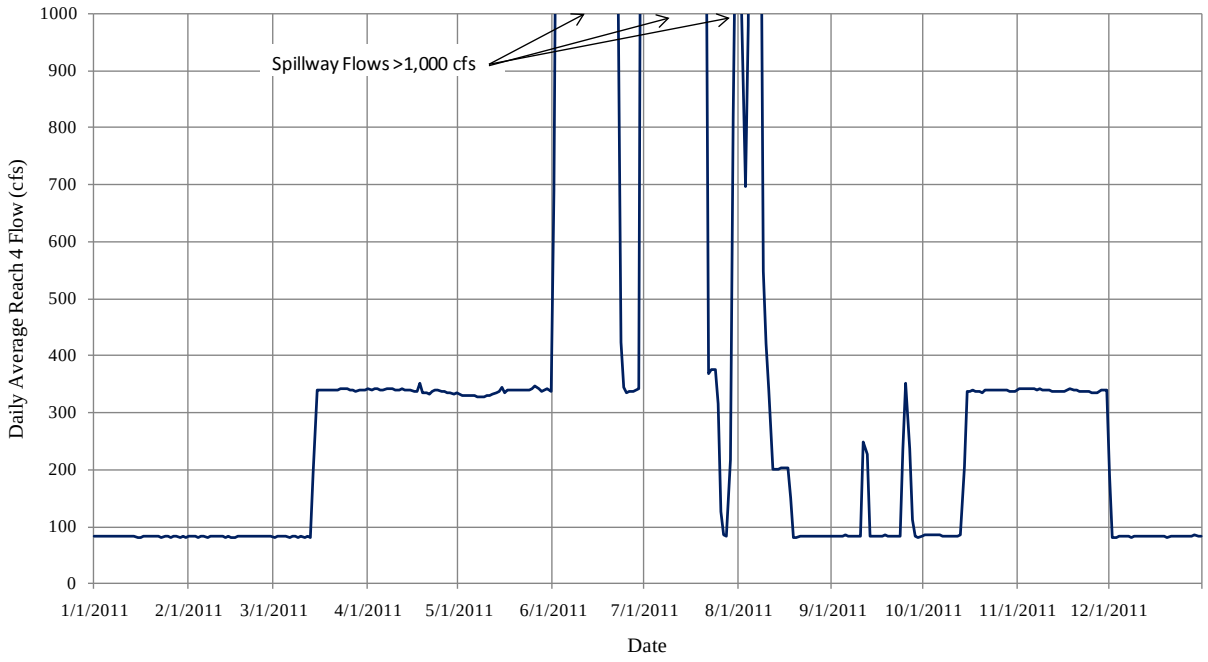


Figure 2-2. Flow Releases to Chelan River Reach 4, 2011.



2.2 Chelan River Ramping Rates

The Lake Chelan Settlement Agreement requires that ramping rates are to be established for the Chelan River to protect aquatic organisms from rapid fluctuations in water levels. The ramping rates for decreases in water levels are initially set at approximately two inches per hour during the period when juvenile salmon and steelhead fry may be present. The OCMP states that the two inches per hour ramping rates will remain in effect until biological evaluations have determined the actual ramping rates necessary to prevent stranding of fish in the Chelan River. The locations in the Chelan River where water level changes will be measured to determine operating criteria for compliance with ramping rates will be determined in consultation with the Chelan River Fishery Forum. A study will be conducted to determine the operating criteria for changes in flow from the Low Level Outlet, spillway and Pump Station. The results of this study will establish ramping procedures in terms of allowable flow reductions per hour for these sources of flow releases. Biological evaluations will determine the periods of time during the year when ramping rates will be applied to protect fry from stranding.

The year 2011 was the second full year of minimum flow operations for the Chelan River since completion of the Low Level Outlet, Reach 4 habitat channel, and Pump Station. Biological evaluations of fish populations in the Chelan River Reaches 1-3 are not scheduled to begin until 2012. However, observations during the steelhead spawning surveys (weekly March 15 – June 1), summer observations during temperature logger replacement (monthly July, August, September) and fall during Chinook spawning surveys (weekly October – November) determined that Chinook salmon fry were present in the Reach 4 habitat channel during the months of April, May and June. No Chinook or steelhead fry were observed prior to mid April and after July. However, ramping rate operations for juvenile fish were followed throughout the year since the biological evaluations have not yet occurred.

In 2011, Chelan PUD refined operating criteria for compliance with the two inches per hour ramping rates and managed flow releases using those operating criteria in conjunction with onsite monitoring of actual flow level changes. The revised operating criteria used in 2011, with the changes from 2010 in boldface and strikeout, are shown in Table 2-1. The changes from 2010 criteria were to reduce the allowable flow reduction per hour, when reducing flows from 400 cfs – 100 cfs, to only 30 cfs per hour, then to only reduce flows at 20 cfs per hour for the last stage to go from 100 cfs to the 80 cfs minimum flow. These refined criteria performed well during the adjustments of spill flows that occurred from June – mid August and when ramping down from flows provided whitewater boating in September.

Additional ramping operations were used in 2011 to transition from spawning flows in the Reach 4 habitat channel, provided by the Pump Station, to switch over to flows coming from Reaches 1-3. On April 18, steelhead spawning flows were transitioned from the Pump Station to being provided solely from the Low Level Outlet. The procedure involved increasing Low Level Outlet flows from 80 cfs to 320 cfs over a three hour period from 1000 – 1300. Then, when the increased flow began to arrive at the Reach 4 habitat channel the pumps were turned off one by one, while monitoring water levels in the pool at the canal outlet structure to wait for water levels to recover before shutting off the next pump. This procedure provided stable water levels until the last pump was turned off, which resulted in a drop in water levels over a 30 minute period.

This operation will be further refined in 2012 by providing higher flows from the Low Level Outlet to better buffer the effect of shutting off the final pump.

Table 2-1. Refined Ramping Criteria (2011).

Decreasing Spill Ramping Rate Restrictions Except for Plant Safety and System Reliability, the following are License Compliance ramping rate restrictions when reducing spill:	
Maximum Spill Reduction Ramping Rates	
	Ramp Rate
Total Spill* cfs	cfs/hr
1000 < Total Spill	250
500 < Total Spill <= 1000	100
400~~300~~ < Total Spill <= 500	50
100 ~~200~~ < Total Spill <= **400** ~~300~~	**30** ~~35~~
80 < Total Spill <= **100** ~~200~~	**20** ~~30~~
* Total Spill = Low Level Outlet + Spill Gates Note: Only reduce spill during daylight hours (to aid fish movement from potential entrapment areas).	

SECTION 3: POWERHOUSE TAILRACE SECURITY FLOWS

3.1 Powerhouse Operations

There were 234 salmon redds with eggs incubating in the tailrace from spawning that occurred in 2010. Based on the Chinook fry observed in April in the Reach 4 habitat channel, the incubation period for these eggs was probably concluded by mid April. Powerhouse operations from January 1 – April 30 included a number of outages for partial days due to various mechanical issues with the new turbines and generators and to conserve water to maintain lake levels. The powerhouse generally ran continuously with both units in operation from January 1 – April 9, with 21 periods, less than 9 hours in duration, of no turbine operation. There was a 17 hour turbine outage on April 10 and two other short (3 hour and 1 hour) outages prior to the end of April. There was water movement through the tailrace from March 15 – April 18 due to operation of the Pump Station. Daily average powerhouse flows are shown in (Figure 3-1).

During the March 15 – May 15 spawning period for steelhead, the powerhouse generally operated both turbines, with the exception of 13 shutdowns, all but one (April 10) lasting less than eight hours. Steelhead spawning was observed in the Reach 4 habitat channel in 2011, with 20 redds in the habitat channel and canal outlet pool, and one redds in flow from the habitat channel just downstream from its confluence with the tailrace.

During the Chinook spawning period in 2011, powerhouse daily average flows were maintained above 2000 cfs from October 1 –December 2, with the exception of a few hours with flows between 1000 -2000 cfs. A total count of 413 Chinook redds were estimated to have been deposited in the Chelan River Reach 4 (173), tailrace (192), and downstream in the Chelan/Columbia River confluence and Columbia River (48). Five coho redds were also observed in Reach 4. A number of powerhouse outages occurred from December 3 – 31. Early December outages of 7-8 hours were scheduled for the purpose of installing oxygen monitoring equipment in Chinook redds (12/3-5) and cylindrical egg tubes with Chinook eggs for egg-emergence survival studies (12/10-12). Longer outages were scheduled starting December 20 for conservation of water to maintain lake levels in light of abnormally low mountain snow levels. These outages were scheduled with periodic powerhouse operation to maintain oxygen levels, with the duration of outages eventually extended to 23 hours, with one hour of turbine operation, by the end of December.

Water surface elevations in the tailrace can fluctuate by several feet over the course of a day due to changes in Columbia River flows that affect the backwater curve of the Rocky Reach reservoir. The water level fluctuations in the tailrace are somewhat reduced when the Chelan Powerhouse is operating. In past years, temporary dewatering of a few Chinook redds in shallow areas has been observed when the powerhouse was not operating and Columbia River flows were low. During tailrace spawning habitat construction in 2008 these areas were graded to prevent dewatering. The water levels in the tailrace remained above 708 feet most of the time and never dropped below 707 feet from January 1 – May 31 and October 15 – December 31. No dewatering of salmon redds was observed in 2011. The daily average tailwater levels measured at the powerhouse are shown in Figure 3-2.

Figure 3-1. Chelan Powerhouse Daily Average Flows, 2011.

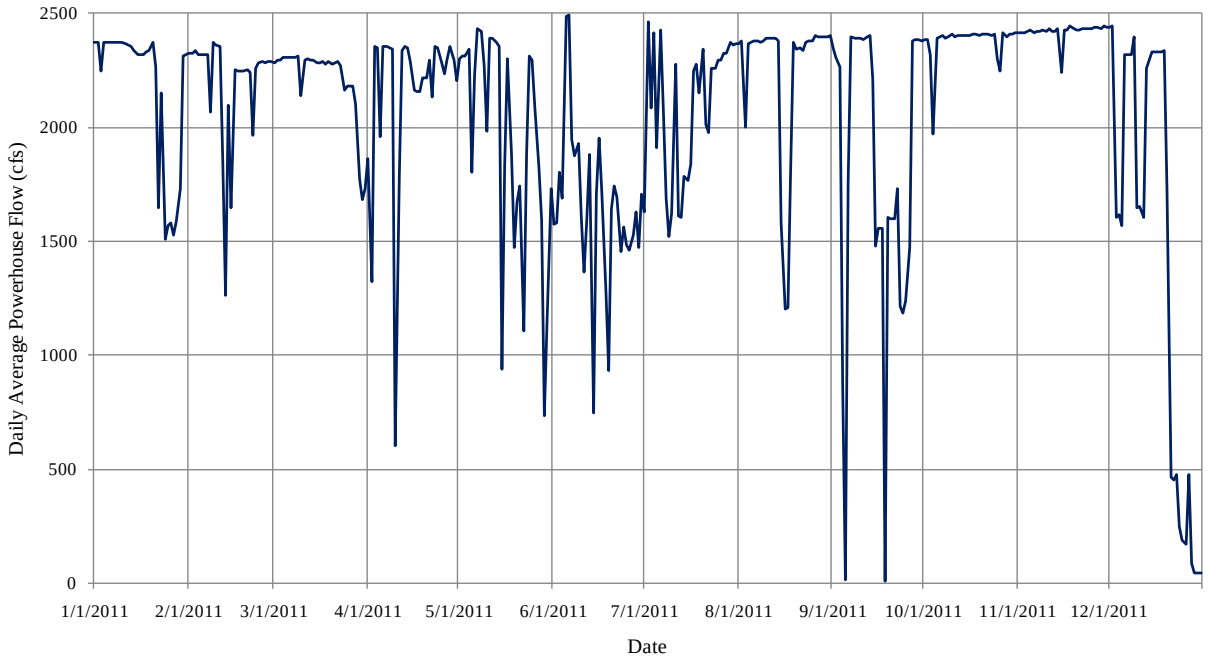
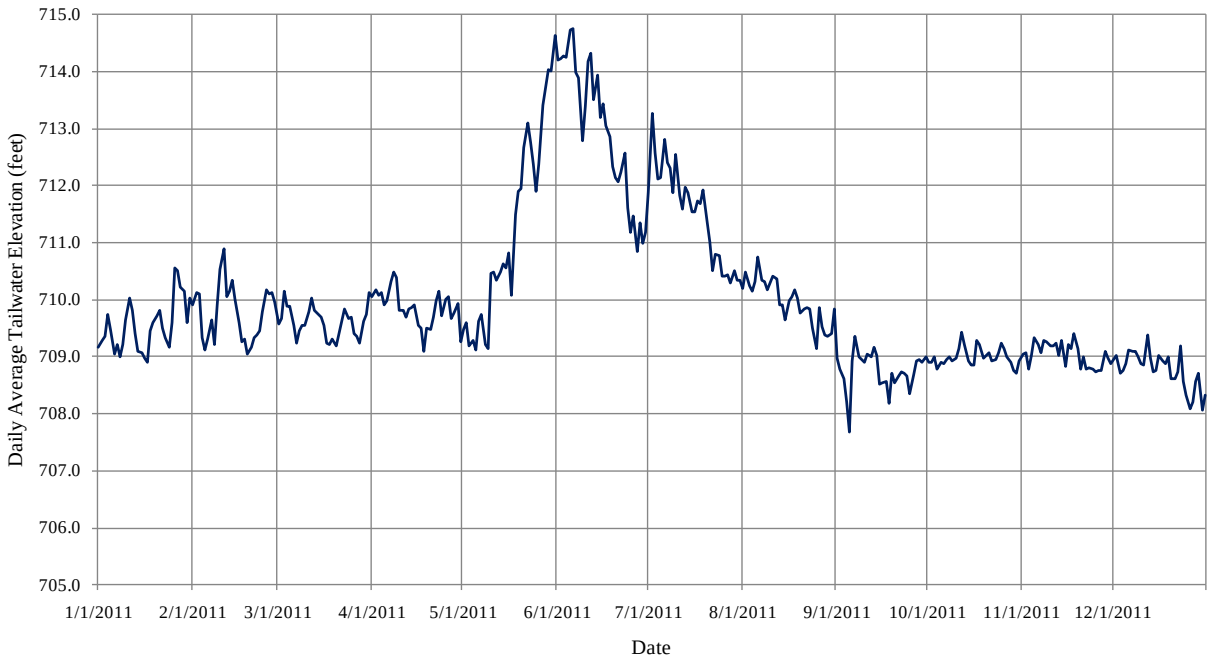


Figure 3-2. Chelan Powerhouse Daily Average Tailwater Elevations, 2011.



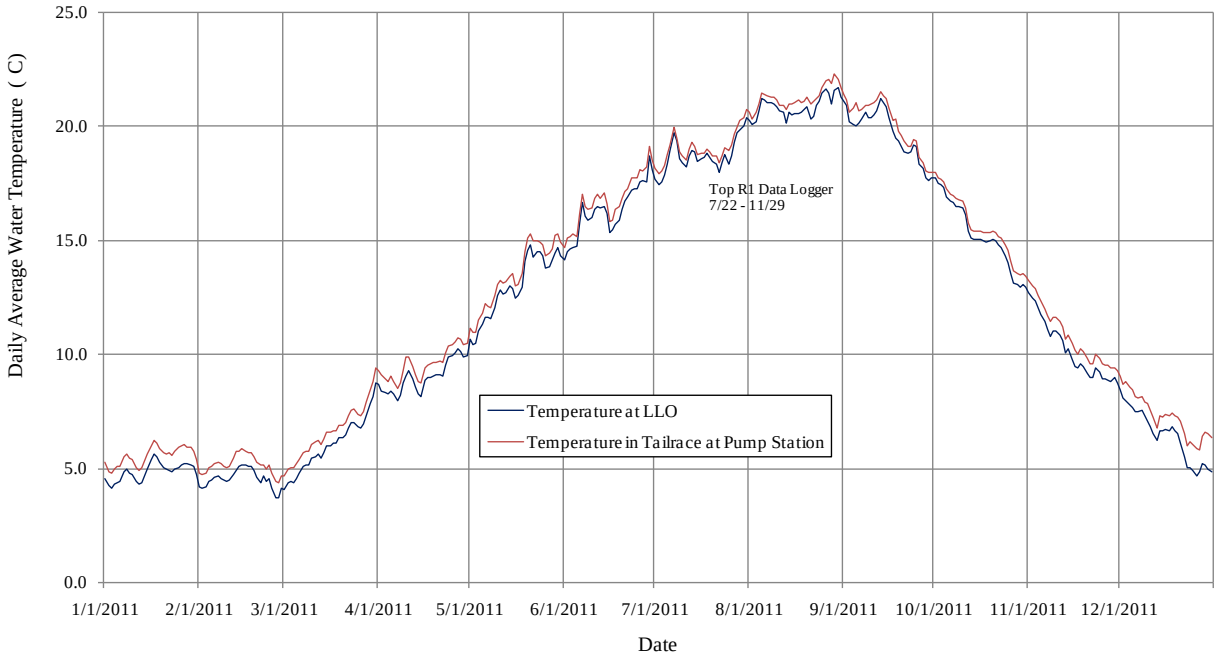
SECTION 4: WATER TEMPERATURE MONITORING

4.1 Water Temperatures Released to Chelan River and Tailrace

Automated water temperature monitoring equipment is installed at two locations, within the pipe that draws water from the base of the Chelan Dam and discharges to the Chelan River through the Low Level Outlet and in the Chelan Powerhouse Tailrace from a sensor mounted on the Pump Station intake screens. These monitoring locations measure the water temperatures that reflect the coolest water available for the Chelan River (Low Level Outlet temperature) and the average of water temperatures arriving at the face of Chelan Dam as drawn through the powerhouse intakes (Chelan Powerhouse Tailrace). Water temperatures measured in the tailrace also represent the temperature of water that is being discharged to the Reach 4 habitat channel when the Pump Station is in operation.

Water temperatures from these sources (Figure 4-1) show that generally there was little stratification in water temperatures at the face of Chelan Dam. However, the Low Level Outlet temperature sensor broke off on July 22 and a new device was not installed until November 29. Temperature data from the top of Reach 1 is shown in Figure 4-1 for this time period and was predominately measuring spillway flow until August 11. The spillway flow is drawn from the upper strata of the forebay, thus stratification would not be detectable after July 22. There were a few days from mid August through early September when water temperatures released from the Low Level Outlet appear to have been cooler than the average water temperature arriving at Chelan Dam from the outlet of Lake Chelan. Daily average water temperatures measured from the top of R1 peaked at 21.7 °C on August 26 and 30, while tailrace temperatures peaked at 22.3 °C August 29, respectively.

Figure 4-1. Low Level Outlet and Powerhouse Tailrace Water Temperatures.



4.2 Water Temperatures in Chelan River Reaches 1-3.

Water temperatures are monitored at three locations with temperature recording data loggers (Onset HOBO Water Temp Pro v2) that are set to record the water temperature at hourly intervals. These locations are at the top of Reach 1, which measures the temperature of water entering the Chelan River from the Low Level Outlet and the spillway. The location of this temperature logger is set below the mixing zone for these sources of water. The second location is at the end of Reach 1, which is the reach of the Chelan River that has the lowest gradient and least profile shading, thus the greatest potential for water temperature heating during the spring and summer. The third location is at the end of Reach 3, where the Chelan River exits the series of cascades and falls that are the upstream barrier to anadromous fish. The temperature loggers at each location are exchanged several times during the year to retrieve the data. These data are reported quarterly during most of the year, with monthly reporting for July, August and September. These data reports are available at http://www.chelanpud.org/lc-Resource-Documents-WaterQuality.cfm.

The water temperatures recorded at these locations in 2011 demonstrated small increases in water temperature during May – August, but cooling from September – December (Figure 4-2). This is not unexpected because the water exiting Lake Chelan is affected by the heat sink effect of the lake's large volume. Water in Lake Chelan is still warming from May – mid-August, but then retains this heat through the late summer and fall, thus water exiting the lake is cooler than sustainable at equilibrium with ambient solar and air temperature conditions through the summer, then tends to be warmer than sustainable through fall and early winter. The maximum daily average water temperatures recorded in 2011 were 21.7 °C, 21.4 °C and 21.6 °C, respectively from upstream to downstream locations. The highest hourly temperatures recorded were 22.1 °C, 23.2 °C, and 23.8 °C, respectively for the same locations.

4.3 Water Temperatures in Chelan River Reach 4 Habitat Channel.

Water temperatures are monitored at hourly intervals at two locations (Onset HOBO Water Temp Pro v2), at the upper and lower end of the habitat channel. The upper location records the water temperature from the pool below the end of Reach 3 and the mixed flows from that source and the Pump Station, when the pumps are in operation. The monitoring location at the end of the habitat channel is at the point where habitat channel flows enter into the tailrace, just upstream from where mixing of these flows is expected.

The daily average water temperature data from these locations did not show any evidence of heating as water passed through the habitat channel, despite the lack of any shade from vegetation under current, newly constructed, conditions (Figure 4-3). The maximum daily average temperatures recorded were 21.5 °C at the top and 21.6°C at the end of the habitat channel. The maximum hourly temperatures were 23.8 °C and 23.9 °C at the upper and lower ends of the habitat channel.

Figure 4-2. Chelan River Reaches 1-3 Daily Average Water Temperatures.

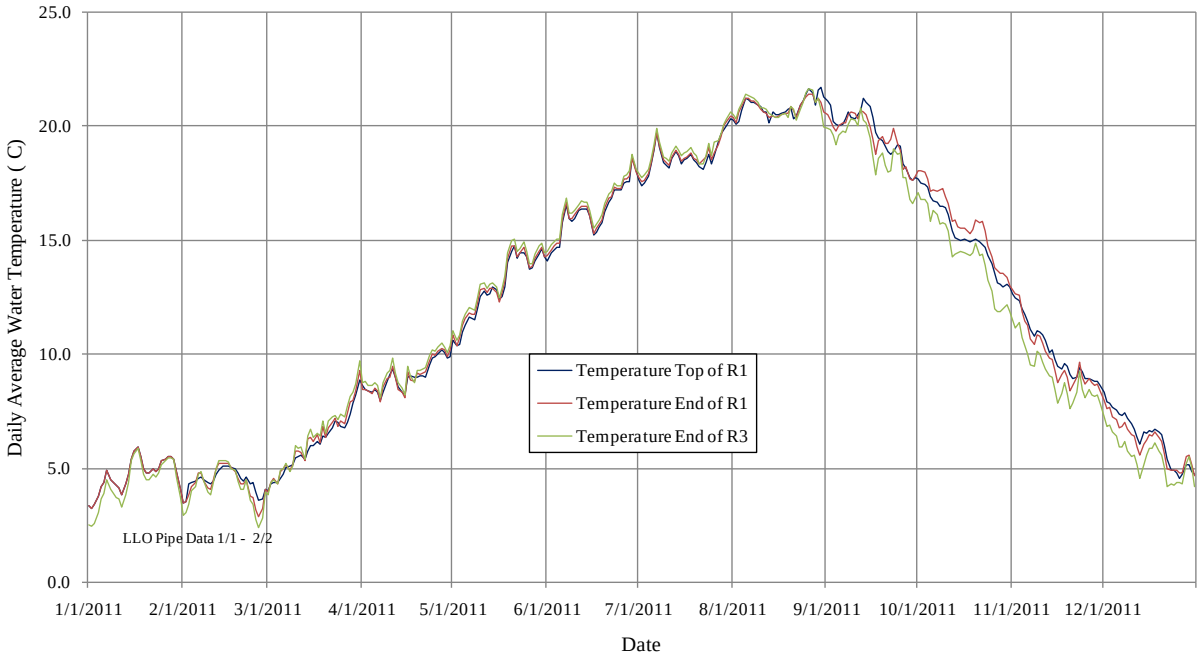
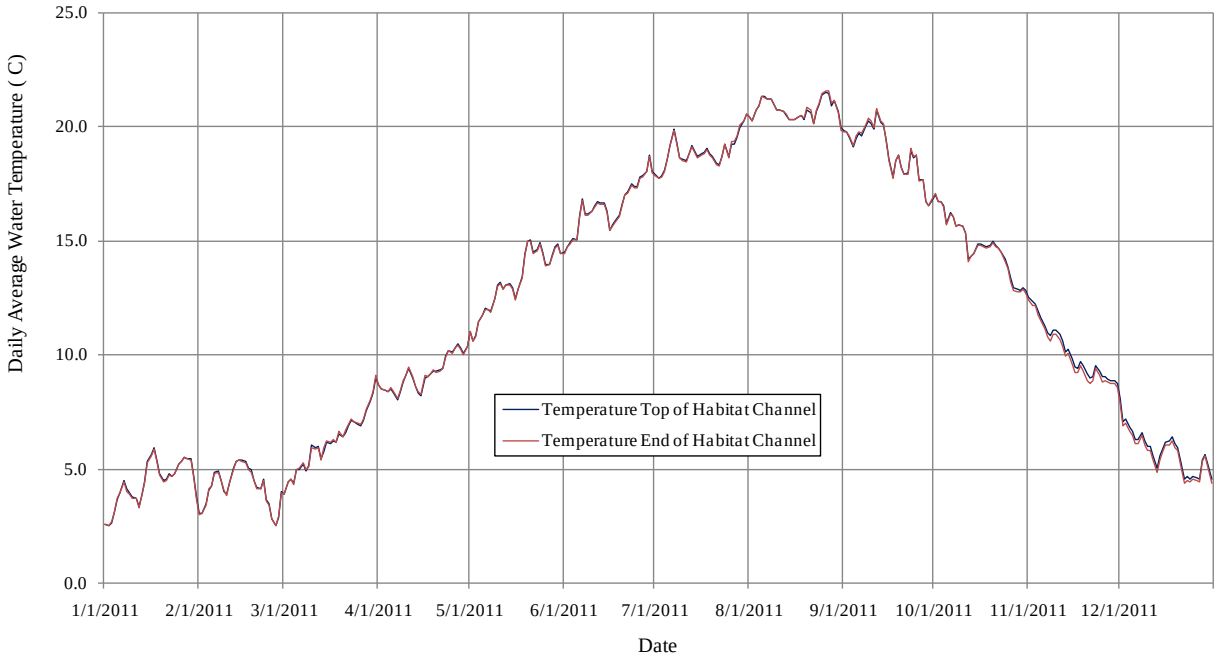


Figure 4-3. Reach 4 Habitat Channel.



SECTION 5: SUMMARY

Flow releases were provided throughout the year from the Low Level Outlet for minimum flows of at least 80 cfs in Reaches 1-3. The runoff forecast for 2011 indicated a wet water year, thus minimum flow releases to Reaches 1-3 were at least 320 cfs from May 15 – July 15. Additional flow was provided from the Pump Station to the Reach 4 habitat channel for salmon and steelhead spawning during their respective spawning periods (October 15 – November 30 and March 15 – May 15). There were three deviations below minimum flow requirements in 2011 due to equipment failures during April and May. Corrective measures were taken to prevent further occurrences.

Flows were released from the Low Level Outlet and spillway as needed for lake level control, beginning April 18 and June 1, respectively. Flows for lake level control continued until August 18. These flow releases were managed to meet lake level target elevations and to avoid high spill levels that could damage the Reach 4 habitat channel. Flow releases for lake level control peaked at 5931 cfs daily average on July 3. Flow releases from the spillway and Low Level Outlet were also managed to provide two weekend whitewater boating events on September 11 and 24-25. Whitewater boating events scheduled for July 9-10 were canceled due to high inflows that required spill levels that were too high for safe whitewater boating and events scheduled for July 23-24 and September 10 were cancelled for lack of participant registration.

Chelan PUD further refined operating criteria for compliance with the two inches per hour ramping rates and managed flow releases using those operating criteria in conjunction with onsite monitoring of actual flow level changes. The changes from 2010 criteria were to reduce the allowable flow reduction per hour, when reducing flows from 400 cfs – 100 cfs, to only 30 cfs per hour, then to only reduce flows at 20 cfs per hour for the last stage to go from 100 cfs to the 80 cfs minimum flow. These refined criteria performed well during the adjustments of spill flows that occurred from June – mid August and when ramping down from flows provided whitewater boating in September.

Powerhouse operations for Chinook redd protection provided for periodic turbine operation during outages. There were a number of partial day outages from January 1 – April 30 due to various mechanical issues with the new turbines and generators and to conserve water to maintain lake levels. The powerhouse generally ran continuously with both units in operation from January 1 – April 9, with 21 periods, less than 9 hours in duration, of no turbine operation. There was a 17 hour turbine outage on April 10 and two other short (3 hour and 1 hour) outages prior to the end of April. There was water movement through the tailrace from March 15 – April 18 due to operation of the Pump Station.

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A number of powerhouse outages occurred from December 3 – 31. Early December outages of 7-8 hours were scheduled for the purpose of installing oxygen monitoring equipment in Chinook redds (12/3-5) and cylindrical egg tubes with Chinook eggs for egg-emergence survival studies (12/10-12). Longer outages were scheduled starting December 20 for conservation of water to maintain lake levels in light of abnormally low mountain snow levels. These outages were scheduled with periodic powerhouse operation to maintain oxygen levels, with the duration of outages eventually extended to 23 hours, with one hour of turbine operation, by the end of December.

Water temperatures were monitored at seven locations in the Chelan River and tailrace. The water released from the Low Level Outlet into the Chelan River was slightly cooler during a few days from late August – early September than the average water temperature arriving at the Chelan Dam from the outlet of Lake Chelan. Water temperatures demonstrated small increases during transit from the upper end of Reach 1 to the end of Reach 3 during May – August, but cooling from September – December Water temperatures neither increased nor decreased during transit through the Reach 4 habitat channel.

APPENDIX A: DAILY AVERAGE LAKE CHELAN ELEVATIONS, POWERHOUSE FLOWS, TAILWATER ELEVATIONS AND CHELAN RIVER FLOWS FROM SPILL, LOW LEVEL OUTLET AND PUMPING STATION

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
1/1/2011	1089.1	2373	709.2	82	0	82	0	82
1/2/2011	1089.0	2373	709.3	82	0	82	0	82
1/3/2011	1088.9	2247	709.4	82	0	82	0	82
1/4/2011	1088.7	2370	709.7	82	0	82	0	82
1/5/2011	1088.6	2372	709.5	82	0	82	0	82
1/6/2011	1088.5	2372	709.1	82	0	82	0	82
1/7/2011	1088.4	2373	709.2	82	0	82	0	82
1/8/2011	1088.3	2372	709.0	82	0	82	0	82
1/9/2011	1088.2	2370	709.2	82	0	82	0	82
1/10/2011	1088.1	2370	709.6	82	0	82	0	82
1/11/2011	1087.9	2367	710.0	82	0	82	0	82
1/12/2011	1087.8	2358	709.8	82	0	82	0	82
1/13/2011	1087.8	2352	709.4	82	0	82	0	82
1/14/2011	1087.7	2335	709.1	82	0	82	0	82
1/15/2011	1087.6	2321	709.1	82	0	82	0	82
1/16/2011	1087.6	2321	709.0	82	0	82	0	82
1/17/2011	1087.8	2318	708.9	82	0	82	0	82
1/18/2011	1088.0	2328	709.5	82	0	82	0	82
1/19/2011	1088.1	2338	709.6	82	0	82	0	82
1/20/2011	1088.1	2370	709.7	82	0	82	0	82
1/21/2011	1088.1	2266	709.8	82	0	82	0	82
1/22/2011	1088.1	1648	709.5	82	0	82	0	82
1/23/2011	1088.1	2153	709.3	82	0	82	0	82
1/24/2011	1088.1	1510	709.2	82	0	82	0	82
1/25/2011	1088.1	1569	709.6	82	0	82	0	82
1/26/2011	1088.2	1584	710.6	82	0	82	0	82
1/27/2011	1088.2	1529	710.5	82	0	82	0	82
1/28/2011	1088.2	1585	710.2	82	0	82	0	82
1/29/2011	1088.2	1732	710.1	82	0	82	0	82
1/30/2011	1088.2	2315	709.6	82	0	82	0	82
1/31/2011	1088.1	2318	710.0	82	0	82	0	82
2/1/2011	1088.1	2322	709.9	82	0	82	0	82
2/2/2011	1088.0	2325	710.1	82	0	82	0	82
2/3/2011	1087.9	2333	710.1	82	0	82	0	82
2/4/2011	1087.9	2321	709.3	82	0	82	0	82
2/5/2011	1087.9	2316	709.1	82	0	82	0	82
2/6/2011	1087.8	2316	709.3	82	0	82	0	82
2/7/2011	1087.8	2320	709.6	82	0	82	0	82
2/8/2011	1087.7	2066	709.2	82	0	82	0	82
2/9/2011	1087.7	2370	709.9	82	0	82	0	82
2/10/2011	1087.6	2358	710.5	82	0	82	0	82
2/11/2011	1087.5	2354	710.9	82	0	82	0	82
2/12/2011	1087.5	1852	710.1	82	0	82	0	82
2/13/2011	1087.5	1262	710.2	82	0	82	0	82
2/14/2011	1087.5	2097	710.3	82	0	82	0	82
2/15/2011	1087.4	1645	710.0	82	0	82	0	82
2/16/2011	1087.4	2250	709.6	82	0	82	0	82
2/17/2011	1087.4	2247	709.3	82	0	82	0	82
2/18/2011	1087.3	2245	709.3	82	0	82	0	82
2/19/2011	1087.2	2245	709.0	82	0	82	0	82

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
2/20/2011	1087.1	2252	709.2	82	0	82	0	82
2/21/2011	1087.0	2241	709.3	83	0	83	0	83
2/22/2011	1087.0	1966	709.4	82	0	82	0	82
2/23/2011	1086.9	2256	709.4	82	0	82	0	82
2/24/2011	1086.8	2280	709.8	82	0	82	0	82
2/25/2011	1086.7	2288	710.2	82	0	82	0	82
2/26/2011	1086.6	2281	710.1	82	0	82	0	82
2/27/2011	1086.5	2287	710.1	82	0	82	0	82
2/28/2011	1086.5	2289	710.0	82	0	82	0	82
3/1/2011	1086.4	2282	709.6	82	0	82	0	82
3/2/2011	1086.3	2293	709.7	82	0	82	0	82
3/3/2011	1086.3	2297	710.2	82	0	82	0	82
3/4/2011	1086.2	2308	709.9	82	0	82	0	82
3/5/2011	1086.1	2304	709.9	82	0	82	0	82
3/6/2011	1086.0	2307	709.5	82	0	82	0	82
3/7/2011	1085.9	2305	709.2	82	0	82	1	83
3/8/2011	1085.8	2306	709.5	82	0	82	0	82
3/9/2011	1085.7	2310	709.5	82	0	82	0	82
3/10/2011	1085.6	2136	709.6	82	0	82	2	84
3/11/2011	1085.6	2293	709.8	82	0	82	0	82
3/12/2011	1085.5	2301	710.0	82	0	82	0	82
3/13/2011	1085.4	2295	709.8	82	0	82	0	82
3/14/2011	1085.3	2297	709.8	82	0	82	110	192
3/15/2011	1085.2	2285	709.7	82	0	82	258	340
3/16/2011	1085.2	2281	709.5	82	0	82	257	339
3/17/2011	1085.1	2290	709.2	82	0	82	257	339
3/18/2011	1085.0	2276	709.2	82	0	82	258	340
3/19/2011	1085.0	2289	709.3	82	0	82	257	339
3/20/2011	1084.9	2276	709.2	82	0	82	258	340
3/21/2011	1084.9	2285	709.4	82	0	82	258	340
3/22/2011	1084.8	2288	709.6	82	0	82	258	340
3/23/2011	1084.7	2272	709.8	82	0	82	259	342
3/24/2011	1084.6	2163	709.7	82	0	82	259	341
3/25/2011	1084.5	2183	709.7	82	0	82	259	341
3/26/2011	1084.5	2180	709.4	82	0	82	258	340
3/27/2011	1084.4	2180	709.4	82	0	82	257	339
3/28/2011	1084.4	2105	709.2	82	0	82	256	338
3/29/2011	1084.3	1774	709.6	82	0	82	258	340
3/30/2011	1084.3	1686	709.7	82	0	82	257	339
3/31/2011	1084.4	1730	710.1	82	0	82	258	340
4/1/2011	1084.5	1860	710.0	82	0	82	260	342
4/2/2011	1084.6	1326	710.2	82	0	82	259	341
4/3/2011	1084.6	2353	710.1	82	0	82	259	341
4/4/2011	1084.7	2350	710.1	82	0	82	259	341
4/5/2011	1084.7	1957	709.9	82	0	82	258	340
4/6/2011	1084.7	2355	710.0	82	0	82	258	340
4/7/2011	1084.6	2354	710.3	82	0	82	260	342
4/8/2011	1084.6	2350	710.5	82	0	82	260	342
4/9/2011	1084.6	2343	710.4	82	0	82	260	342
4/10/2011	1084.5	605	709.8	82	0	82	258	340

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
4/11/2011	1084.6	1786	709.8	82	0	82	257	339
4/12/2011	1084.5	2336	709.7	84	0	84	258	342
4/13/2011	1084.5	2354	709.8	82	0	82	258	340
4/14/2011	1084.4	2349	709.9	82	0	82	258	340
4/15/2011	1084.4	2288	709.9	82	0	82	258	340
4/16/2011	1084.3	2160	709.6	82	0	82	256	338
4/17/2011	1084.3	2158	709.5	82	0	82	256	338
4/18/2011	1084.2	2158	709.1	212	0	212	141	353
4/19/2011	1084.1	2214	709.5	335	0	335	0	335
4/20/2011	1084.0	2218	709.5	334	0	334	0	334
4/21/2011	1084.0	2292	709.7	334	0	334	0	334
4/22/2011	1083.9	2130	710.0	337	0	337	0	337
4/23/2011	1083.8	2351	710.1	341	0	341	0	341
4/24/2011	1083.7	2351	709.7	340	0	340	0	340
4/25/2011	1083.6	2285	710.0	338	0	338	0	338
4/26/2011	1083.6	2236	710.1	338	0	338	0	338
4/27/2011	1083.5	2303	709.7	336	0	336	0	336
4/28/2011	1083.4	2353	709.8	335	0	335	0	335
4/29/2011	1083.4	2296	709.9	333	0	333	0	333
4/30/2011	1083.3	2203	709.3	334	0	334	0	334
5/1/2011	1083.2	2298	709.5	332	0	332	0	332
5/2/2011	1083.1	2310	709.6	330	0	330	0	330
5/3/2011	1083.1	2313	709.2	331	0	331	0	331
5/4/2011	1083.0	2341	709.3	329	0	329	0	329
5/5/2011	1083.0	1803	709.1	331	0	331	0	331
5/6/2011	1083.0	2226	709.6	329	0	329	0	329
5/7/2011	1083.0	2433	709.7	328	0	328	0	328
5/8/2011	1083.0	2423	709.2	327	0	327	0	327
5/9/2011	1083.0	2270	709.2	329	0	329	0	329
5/10/2011	1083.0	1980	710.5	331	0	331	0	331
5/11/2011	1083.1	2389	710.5	331	0	331	0	331
5/12/2011	1083.2	2389	710.3	333	0	333	0	333
5/13/2011	1083.3	2370	710.5	335	0	335	0	335
5/14/2011	1083.5	2357	710.6	337	0	337	0	337
5/15/2011	1083.9	942	710.6	342	0	342	2	344
5/16/2011	1084.4	1831	710.8	334	0	334	0	334
5/17/2011	1084.8	2300	710.1	339	0	339	0	339
5/18/2011	1085.1	1880	711.5	340	0	340	0	340
5/19/2011	1085.3	1475	711.9	340	0	340	0	340
5/20/2011	1085.6	1673	712.0	340	0	340	0	340
5/21/2011	1085.9	1744	712.7	340	0	340	0	340
5/22/2011	1086.3	1110	713.1	340	0	340	0	340
5/23/2011	1086.7	1882	712.8	340	0	340	0	340
5/24/2011	1087.0	2313	712.4	339	0	339	0	339
5/25/2011	1087.3	2293	711.9	342	0	342	0	342
5/26/2011	1087.7	2090	712.4	347	0	347	0	347
5/27/2011	1088.0	1826	713.4	341	0	341	0	341
5/28/2011	1088.2	1596	713.7	338	0	338	0	338
5/29/2011	1088.5	737	714.0	341	0	341	0	341
5/30/2011	1088.7	1158	714.0	343	0	343	0	343

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
5/31/2011	1089.0	1730	714.6	337	0	337	0	337
6/1/2011	1089.3	1577	714.2	333	356	689	0	689
6/2/2011	1089.6	1579	714.2	334	1086	1420	0	1420
6/3/2011	1089.8	1802	714.3	335	1420	1755	0	1755
6/4/2011	1090.0	1692	714.2	337	1860	2197	0	2197
6/5/2011	1090.2	2485	714.7	338	2038	2376	0	2376
6/6/2011	1090.5	2495	714.8	339	2066	2405	0	2405
6/7/2011	1090.9	1944	714.0	343	2137	2480	0	2480
6/8/2011	1091.4	1877	713.9	347	2470	2818	0	2818
6/9/2011	1091.7	1927	712.8	350	2776	3126	0	3126
6/10/2011	1092.0	1607	713.4	341	2739	3080	0	3080
6/11/2011	1092.4	1367	714.2	326	2757	3083	0	3083
6/12/2011	1092.7	1591	714.3	328	2942	3271	0	3271
6/13/2011	1093.0	1881	713.5	331	2790	3120	0	3120
6/14/2011	1093.3	745	713.9	334	2666	3001	0	3001
6/15/2011	1093.7	1706	713.2	336	2660	2996	0	2996
6/16/2011	1093.9	1955	713.4	337	2746	3084	0	3084
6/17/2011	1094.0	1715	713.0	339	2696	3034	0	3034
6/18/2011	1094.2	1282	712.9	340	2644	2984	0	2984
6/19/2011	1094.4	936	712.3	342	2703	3045	0	3045
6/20/2011	1094.6	1642	712.1	343	2224	2567	0	2567
6/21/2011	1094.8	1742	712.1	345	1690	2035	0	2035
6/22/2011	1095.2	1694	712.2	347	964	1312	0	1312
6/23/2011	1095.6	1454	712.6	350	75	425	0	425
6/24/2011	1096.0	1561	711.6	344	0	344	0	344
6/25/2011	1096.3	1485	711.2	335	0	335	0	335
6/26/2011	1096.6	1464	711.5	337	0	337	0	337
6/27/2011	1096.8	1525	710.8	338	0	338	0	338
6/28/2011	1097.1	1626	711.4	340	0	340	0	340
6/29/2011	1097.5	1472	711.0	342	0	342	0	342
6/30/2011	1098.0	1708	711.2	344	1397	1740	0	1740
7/1/2011	1098.1	1628	711.9	345	4240	4585	0	4585
7/2/2011	1098.1	2464	713.3	344	5581	5925	0	5925
7/3/2011	1098.1	2084	712.6	344	5587	5931	0	5931
7/4/2011	1098.1	2417	712.1	344	4516	4860	0	4860
7/5/2011	1098.3	1909	712.1	344	2680	3024	0	3024
7/6/2011	1098.4	2424	712.8	345	2678	3022	0	3022
7/7/2011	1098.6	2066	712.4	140	2890	3031	0	3031
7/8/2011	1098.9	1686	712.3	0	3499	3499	0	3499
7/9/2011	1098.9	1522	711.9	0	4006	4006	0	4006
7/10/2011	1098.9	1622	712.6	0	4005	4005	0	4005
7/11/2011	1098.9	2275	711.8	0	3350	3350	0	3350
7/12/2011	1099.0	1609	711.6	41	3023	3064	0	3064
7/13/2011	1099.0	1606	712.0	81	3926	4007	0	4007
7/14/2011	1099.0	1787	711.9	81	3928	4009	0	4009
7/15/2011	1099.0	1766	711.5	81	4212	4292	0	4292
7/16/2011	1099.0	1840	711.5	80	4885	4965	0	4965
7/17/2011	1098.9	2247	711.7	79	4886	4965	0	4965
7/18/2011	1098.8	2275	711.7	78	4868	4946	0	4946
7/19/2011	1098.8	2148	711.9	78	4861	4939	0	4939

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
7/20/2011	1098.7	2345	711.4	77	3637	3714	0	3714
7/21/2011	1098.8	2015	711.0	77	1245	1321	0	1321
7/22/2011	1098.9	1980	710.5	253	116	368	0	368
7/23/2011	1099.0	2260	710.8	376	0	376	0	376
7/24/2011	1099.1	2257	710.8	376	0	376	0	376
7/25/2011	1099.3	2296	710.4	225	90	315	0	315
7/26/2011	1099.4	2292	710.4	84	42	126	0	126
7/27/2011	1099.6	2323	710.4	84	0	85	0	85
7/28/2011	1099.7	2322	710.3	84	0	84	0	84
7/29/2011	1099.8	2373	710.5	85	133	217	0	217
7/30/2011	1099.9	2363	710.3	85	737	822	0	822
7/31/2011	1099.9	2365	710.3	85	1140	1225	0	1225
8/1/2011	1099.9	2367	710.2	85	1649	1734	0	1734
8/2/2011	1099.9	2376	710.5	85	932	1017	0	1017
8/3/2011	1099.9	2002	710.2	85	613	698	0	698
8/4/2011	1100.0	2368	710.1	85	894	979	0	979
8/5/2011	1100.0	2374	710.3	85	1733	1818	0	1818
8/6/2011	1099.9	2378	710.7	85	1932	2017	0	2017
8/7/2011	1099.9	2377	710.3	85	1927	2012	0	2012
8/8/2011	1099.8	2372	710.3	86	1268	1354	0	1354
8/9/2011	1099.8	2380	710.2	148	400	548	0	548
8/10/2011	1099.9	2390	710.3	200	222	422	0	422
8/11/2011	1099.8	2390	710.4	202	139	340	0	340
8/12/2011	1099.8	2388	710.4	202	0	202	0	202
8/13/2011	1099.8	2389	709.9	202	0	202	0	202
8/14/2011	1099.8	2377	709.9	202	0	202	0	202
8/15/2011	1099.8	1580	709.7	203	0	203	0	203
8/16/2011	1099.8	1206	710.0	203	0	203	0	203
8/17/2011	1099.8	1208	710.1	203	0	203	0	203
8/18/2011	1099.8	1822	710.2	150	0	150	0	150
8/19/2011	1099.7	2371	710.0	82	0	82	0	82
8/20/2011	1099.7	2342	709.8	82	0	82	0	82
8/21/2011	1099.6	2346	709.8	82	0	82	0	82
8/22/2011	1099.6	2337	709.9	83	0	83	0	83
8/23/2011	1099.6	2372	709.8	82	0	82	0	82
8/24/2011	1099.6	2380	709.5	82	0	82	0	82
8/25/2011	1099.6	2380	709.1	82	0	82	0	82
8/26/2011	1099.6	2404	709.9	82	0	82	0	82
8/27/2011	1099.5	2394	709.5	82	0	82	0	82
8/28/2011	1099.5	2397	709.4	83	0	83	0	83
8/29/2011	1099.4	2394	709.4	83	0	83	0	83
8/30/2011	1099.4	2395	709.4	83	0	83	0	83
8/31/2011	1099.3	2405	709.8	84	0	84	0	84
9/1/2011	1099.2	2349	709.0	84	0	84	0	84
9/2/2011	1099.1	2304	708.8	84	0	84	0	84
9/3/2011	1099.0	2264	708.6	84	0	84	0	84
9/4/2011	1099.0	867	708.2	84	0	84	0	84
9/5/2011	1099.0	20	707.7	85	0	85	0	85
9/6/2011	1099.0	1763	708.9	84	0	84	0	84
9/7/2011	1098.9	2397	709.4	84	0	84	0	84

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
9/8/2011	1098.9	2393	709.0	83	0	83	0	83
9/9/2011	1098.8	2393	709.0	83	0	83	0	83
9/10/2011	1098.7	2390	708.9	83	0	83	0	83
9/11/2011	1098.6	2387	709.0	250	0	250	0	250
9/12/2011	1098.5	2395	709.0	226	0	226	0	226
9/13/2011	1098.5	2400	709.2	84	0	84	0	84
9/14/2011	1098.4	2208	709.0	84	0	84	0	84
9/15/2011	1098.4	1477	708.5	84	0	84	0	84
9/16/2011	1098.3	1557	708.5	84	0	84	0	84
9/17/2011	1098.2	1560	708.6	84	0	84	0	84
9/18/2011	1098.2	10	708.2	85	0	85	0	85
9/19/2011	1098.2	1603	708.7	84	0	84	0	84
9/20/2011	1098.1	1598	708.6	84	0	84	0	84
9/21/2011	1098.0	1597	708.7	84	0	84	0	84
9/22/2011	1098.0	1729	708.7	84	0	84	0	84
9/23/2011	1097.9	1217	708.7	83	0	83	0	83
9/24/2011	1097.9	1184	708.7	237	0	237	0	237
9/25/2011	1097.9	1240	708.3	352	0	352	0	352
9/26/2011	1097.9	1473	708.7	236	0	236	0	236
9/27/2011	1097.8	2375	708.9	112	0	112	0	112
9/28/2011	1097.8	2382	708.9	82	0	82	0	82
9/29/2011	1097.6	2386	708.9	82	0	82	0	82
9/30/2011	1097.6	2380	709.0	83	0	83	0	83
10/1/2011	1097.5	2385	708.9	85	0	85	0	85
10/2/2011	1097.4	2382	708.9	85	0	85	0	85
10/3/2011	1097.3	2318	709.0	85	0	85	0	85
10/4/2011	1097.2	1973	708.8	85	0	85	0	85
10/5/2011	1097.1	2393	708.9	85	0	85	0	85
10/6/2011	1097.1	2394	708.9	85	0	85	0	85
10/7/2011	1097.0	2400	708.9	85	0	85	0	85
10/8/2011	1096.8	2392	709.0	84	0	84	0	84
10/9/2011	1096.7	2397	708.9	84	0	84	0	84
10/10/2011	1096.6	2405	709.0	84	0	84	0	84
10/11/2011	1096.5	2397	709.1	83	0	83	0	83
10/12/2011	1096.4	2401	709.4	83	0	83	0	83
10/13/2011	1096.3	2403	709.2	83	0	83	2	85
10/14/2011	1096.2	2401	708.9	102	0	102	103	205
10/15/2011	1096.1	2403	708.9	136	0	136	201	338
10/16/2011	1096.0	2405	708.9	136	0	136	201	337
10/17/2011	1095.9	2405	709.3	136	0	136	203	339
10/18/2011	1095.7	2408	709.2	135	0	135	202	337
10/19/2011	1095.6	2403	709.0	135	0	135	201	336
10/20/2011	1095.5	2410	709.0	110	0	110	225	334
10/21/2011	1095.4	2406	709.1	84	0	84	257	340
10/22/2011	1095.3	2409	708.9	83	0	83	257	340
10/23/2011	1095.2	2403	708.9	83	0	83	257	340
10/24/2011	1095.1	2408	709.1	83	0	83	256	339
10/25/2011	1095.0	2298	709.2	82	0	82	258	340
10/26/2011	1094.9	2245	709.2	82	0	82	257	340
10/27/2011	1094.8	2415	709.0	82	0	82	257	339

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
10/28/2011	1094.7	2395	708.9	82	0	82	256	339
10/29/2011	1094.6	2410	708.8	82	0	82	256	338
10/30/2011	1094.5	2408	708.7	82	0	82	256	338
10/31/2011	1094.4	2413	708.9	83	0	83	255	338
11/1/2011	1094.3	2414	709.0	86	0	86	256	342
11/2/2011	1094.2	2413	709.1	85	0	85	257	342
11/3/2011	1094.1	2415	708.8	85	0	85	256	341
11/4/2011	1094.0	2418	709.0	85	0	85	256	341
11/5/2011	1093.8	2423	709.3	85	0	85	257	342
11/6/2011	1093.7	2416	709.2	84	0	84	257	342
11/7/2011	1093.5	2419	709.1	84	0	84	257	341
11/8/2011	1093.4	2419	709.3	84	0	84	258	341
11/9/2011	1093.3	2426	709.3	84	0	84	257	341
11/10/2011	1093.2	2420	709.2	83	0	83	257	340
11/11/2011	1093.1	2433	709.2	83	0	83	256	339
11/12/2011	1093.0	2418	709.2	83	0	83	256	338
11/13/2011	1092.8	2420	709.0	82	0	82	255	337
11/14/2011	1092.7	2430	709.3	81	0	81	256	337
11/15/2011	1092.5	2242	708.8	81	0	81	255	336
11/16/2011	1092.4	2429	709.2	81	0	81	257	338
11/17/2011	1092.3	2426	709.2	83	0	83	256	339
11/18/2011	1092.2	2444	709.4	84	0	84	257	341
11/19/2011	1092.1	2435	709.1	83	0	83	256	340
11/20/2011	1092.0	2424	708.8	83	0	83	256	339
11/21/2011	1091.8	2428	709.0	83	0	83	255	338
11/22/2011	1091.8	2433	708.8	82	0	82	255	337
11/23/2011	1091.7	2432	708.8	82	0	82	254	337
11/24/2011	1091.6	2433	708.8	82	0	82	255	337
11/25/2011	1091.5	2430	708.7	82	0	82	254	335
11/26/2011	1091.4	2436	708.8	81	0	81	255	336
11/27/2011	1091.2	2438	708.8	81	0	81	255	336
11/28/2011	1091.1	2433	709.1	83	0	83	256	339
11/29/2011	1091.0	2441	709.0	84	0	84	256	340
11/30/2011	1090.9	2438	708.9	84	0	84	255	340
12/1/2011	1090.8	2440	709.0	84	0	84	107	191
12/2/2011	1090.6	2444	709.0	82	0	82	0	82
12/3/2011	1090.5	1604	708.7	82	0	82	0	82
12/4/2011	1090.4	1615	708.8	83	0	83	0	83
12/5/2011	1090.4	1572	708.9	83	0	83	0	83
12/6/2011	1090.3	2319	709.1	82	0	82	0	82
12/7/2011	1090.1	2315	709.1	82	0	82	0	82
12/8/2011	1090.0	2318	709.1	82	0	82	0	82
12/9/2011	1089.9	2399	709.0	82	0	82	0	82
12/10/2011	1089.8	1648	708.9	83	0	83	0	83
12/11/2011	1089.7	1653	708.9	83	0	83	0	83
12/12/2011	1089.6	1606	709.4	83	0	83	0	83
12/13/2011	1089.5	2260	709.0	82	0	82	0	82
12/14/2011	1089.4	2296	708.7	83	0	83	0	83
12/15/2011	1089.2	2331	708.8	84	0	84	0	84
12/16/2011	1089.1	2333	709.0	84	0	84	0	84

Date	Lake Chelan Elevation (ft)	Powerhouse Tailrace Flow (cfs)	Powerhouse Tailwater Elevation (ft)	Low Level Outlet Flow (cfs)	Spill Flow (cfs)	Chelan River Flow Reaches 1-3 (cfs)	Pump Station Flow (cfs)	Chelan River Flow Reach 4 (cfs)
12/17/2011	1089.0	2330	708.9	83	0	83	0	83
12/18/2011	1088.9	2331	708.9	83	0	83	0	83
12/19/2011	1088.7	2337	709.0	82	0	82	0	82
12/20/2011	1088.6	1728	708.6	82	0	82	0	82
12/21/2011	1088.5	469	708.6	83	0	83	0	83
12/22/2011	1088.5	457	708.7	83	0	83	0	83
12/23/2011	1088.5	481	709.2	83	0	83	0	83
12/24/2011	1088.5	254	708.6	83	0	83	0	83
12/25/2011	1088.5	193	708.3	83	0	83	0	83
12/26/2011	1088.5	171	708.1	83	0	83	0	83
12/27/2011	1088.5	480	708.2	83	0	83	0	83
12/28/2011	1088.6	87	708.6	83	0	83	0	83
12/29/2011	1088.6	49	708.7	86	0	86	0	86
12/30/2011	1088.7	46	708.1	84	0	84	0	84
12/31/2011	1088.8	46	708.3	84	0	84	0	84

APPENDIX B: DAILY AVERAGE WATER TEMPERATURES

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
1/1/2011	4.5	N/A	3.4	2.5	2.6	2.6	5.3	4.7
1/2/2011	4.2	N/A	3.3	2.4	2.5	2.5	4.9	4.4
1/3/2011	4.1	N/A	3.4	2.6	2.7	2.7	4.8	4.2
1/4/2011	4.3	N/A	3.8	3.1	3.1	3.1	5.0	4.4
1/5/2011	4.4	N/A	4.2	3.6	3.7	3.7	5.1	4.5
1/6/2011	4.4	N/A	4.4	3.9	4.0	3.9	5.1	4.5
1/7/2011	4.9	N/A	4.9	4.5	4.5	4.4	5.5	5.0
1/8/2011	5.0	N/A	4.5	4.1	4.1	4.0	5.6	5.1
1/9/2011	4.8	N/A	4.4	3.9	3.9	3.9	5.4	4.9
1/10/2011	4.7	N/A	4.3	3.7	3.8	3.7	5.4	4.8
1/11/2011	4.4	N/A	4.2	3.7	3.7	3.7	5.0	4.5
1/12/2011	4.3	N/A	3.8	3.3	3.4	3.3	4.9	4.4
1/13/2011	4.4	N/A	4.3	3.8	3.9	3.8	5.0	4.5
1/14/2011	4.7	N/A	4.8	4.4	4.4	4.4	5.3	4.7
1/15/2011	5.0	N/A	5.4	5.3	5.3	5.3	5.6	5.0
1/16/2011	5.4	N/A	5.8	5.7	5.7	5.6	6.0	5.5
1/17/2011	5.6	N/A	5.9	5.9	5.9	5.9	6.2	5.7
1/18/2011	5.5	N/A	5.5	5.4	5.4	5.3	6.1	5.5
1/19/2011	5.3	N/A	5.0	4.7	4.8	4.7	5.9	5.3
1/20/2011	5.0	N/A	4.8	4.5	4.5	4.4	5.7	5.1
1/21/2011	5.0	N/A	4.8	4.5	4.5	4.5	5.6	5.0
1/22/2011	4.9	N/A	5.0	4.8	4.8	4.7	5.7	5.0
1/23/2011	4.9	N/A	4.9	4.7	4.7	4.7	5.6	5.0
1/24/2011	5.0	N/A	5.0	4.8	4.8	4.8	5.8	5.0
1/25/2011	5.1	N/A	5.3	5.2	5.2	5.2	5.9	5.2
1/26/2011	5.2	N/A	5.4	5.3	5.4	5.4	6.0	5.3
1/27/2011	5.2	N/A	5.5	5.5	5.5	5.5	6.0	5.3
1/28/2011	5.2	N/A	5.5	5.5	5.5	5.5	5.9	5.3
1/29/2011	5.2	N/A	5.4	5.4	5.4	5.4	6.0	5.3
1/30/2011	5.1	N/A	4.9	4.7	4.7	4.6	5.8	5.2
1/31/2011	4.8	N/A	4.1	3.8	3.8	3.7	5.4	4.8
2/1/2011	4.2	N/A	3.5	3.0	3.0	3.0	4.8	4.3
2/2/2011	4.1	N/A	3.6	3.0	3.1	3.1	4.8	4.2
2/3/2011	4.2	4.3	3.9	3.4	3.5	3.4	4.8	4.3
2/4/2011	4.5	4.4	4.2	4.0	4.1	4.1	5.0	4.5
2/5/2011	4.5	4.4	4.4	4.2	4.3	4.2	5.1	4.5
2/6/2011	4.6	4.6	4.8	4.8	4.8	4.8	5.2	4.7
2/7/2011	4.7	4.7	4.8	4.9	4.9	4.8	5.3	4.8
2/8/2011	4.6	4.5	4.5	4.4	4.5	4.5	5.2	4.6
2/9/2011	4.5	4.4	4.1	4.0	4.0	4.1	5.1	4.6
2/10/2011	4.4	4.3	4.1	3.8	3.9	3.9	5.0	4.5
2/11/2011	4.5	4.5	4.5	4.4	4.4	4.4	5.1	4.6
2/12/2011	4.8	4.7	5.0	5.0	5.0	5.0	5.5	4.8
2/13/2011	4.9	4.9	5.2	5.3	5.4	5.4	5.8	5.0
2/14/2011	5.1	5.1	5.2	5.4	5.4	5.4	5.8	5.2
2/15/2011	5.1	5.1	5.3	5.3	5.4	5.3	5.9	5.2
2/16/2011	5.2	5.1	5.2	5.3	5.3	5.3	5.7	5.2
2/17/2011	5.1	5.0	5.0	5.0	5.1	5.0	5.7	5.1
2/18/2011	5.1	5.0	4.9	4.9	5.0	4.8	5.7	5.1
2/19/2011	4.9	4.8	4.6	4.5	4.5	4.5	5.5	4.9

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
2/20/2011	4.6	4.5	4.3	4.1	4.2	4.1	5.3	4.6
2/21/2011	4.4	4.4	4.3	4.1	4.2	4.1	5.2	4.5
2/22/2011	4.7	4.6	4.5	4.5	4.5	4.5	5.2	4.7
2/23/2011	4.4	4.3	3.8	3.6	3.7	3.6	5.0	4.4
2/24/2011	4.5	4.4	3.7	3.4	3.5	3.4	5.1	4.5
2/25/2011	4.1	4.0	3.2	2.7	2.8	2.8	4.8	4.1
2/26/2011	3.7	3.6	2.9	2.4	2.5	2.5	4.4	3.7
2/27/2011	3.7	3.6	3.2	2.8	2.9	2.9	4.4	3.7
2/28/2011	4.1	4.1	4.1	4.0	4.0	4.0	4.7	4.1
3/1/2011	4.1	4.0	4.0	3.9	3.9	3.9	4.7	4.1
3/2/2011	4.4	4.3	4.4	4.4	4.4	4.4	5.0	4.4
3/3/2011	4.4	4.4	4.6	4.5	4.6	4.6	5.1	4.4
3/4/2011	4.4	4.4	4.3	4.3	4.4	4.3	5.0	4.4
3/5/2011	4.6	4.6	4.9	4.9	5.0	5.0	5.2	4.6
3/6/2011	4.8	4.8	5.0	5.0	5.0	5.0	5.4	4.8
3/7/2011	5.1	5.1	5.2	5.2	5.2	5.3	5.7	5.1
3/8/2011	5.1	5.1	4.9	4.9	4.9	5.0	5.7	5.1
3/9/2011	5.2	5.2	5.2	5.1	5.2	5.1	5.7	5.1
3/10/2011	5.4	5.5	5.8	6.0	6.0	6.0	6.1	5.4
3/11/2011	5.5	5.5	5.8	5.9	5.9	5.9	6.1	5.5
3/12/2011	5.6	5.6	5.7	6.0	6.0	6.0	6.2	5.6
3/13/2011	5.5	5.4	5.3	5.4	5.5	5.4	6.1	5.4
3/14/2011	5.7	5.8	6.3	6.5	5.8	5.9	6.3	5.7
3/15/2011	6.0	6.0	6.4	6.7	6.2	6.2	6.6	6.0
3/16/2011	6.0	6.0	6.2	6.4	6.1	6.1	6.6	6.0
3/17/2011	6.1	6.2	6.5	6.6	6.2	6.3	6.7	6.1
3/18/2011	6.1	6.1	6.2	6.4	6.2	6.2	6.7	6.1
3/19/2011	6.4	6.4	6.8	7.1	6.6	6.6	6.9	6.4
3/20/2011	6.4	6.4	6.3	6.5	6.4	6.4	6.9	6.3
3/21/2011	6.5	6.5	6.8	7.1	6.6	6.7	7.0	6.5
3/22/2011	6.8	6.8	7.0	7.3	6.9	7.0	7.3	6.8
3/23/2011	7.0	7.1	7.2	7.3	7.1	7.2	7.6	7.0
3/24/2011	7.0	7.0	6.8	7.1	7.1	7.1	7.6	7.0
3/25/2011	6.8	6.8	7.1	7.4	7.0	7.0	7.4	6.8
3/26/2011	6.8	6.8	7.0	7.2	6.9	6.9	7.3	6.8
3/27/2011	7.0	7.0	7.4	7.7	7.1	7.2	7.5	6.9
3/28/2011	7.3	7.4	7.9	8.2	7.5	7.6	7.9	7.3
3/29/2011	7.8	7.9	8.0	8.4	8.0	8.0	8.5	7.8
3/30/2011	8.2	8.2	8.4	8.7	8.3	8.4	8.8	8.1
3/31/2011	8.8	8.9	9.3	9.7	9.0	9.1	9.4	8.8
4/1/2011	8.7	8.6	8.4	8.8	8.7	8.7	9.3	8.6
4/2/2011	8.4	8.5	8.4	8.8	8.5	8.5	9.1	8.4
4/3/2011	8.4	8.4	8.4	8.6	8.4	8.5	8.9	8.3
4/4/2011	8.3	8.3	8.3	8.7	8.4	8.4	8.8	8.3
4/5/2011	8.4	8.5	8.5	8.8	8.5	8.6	9.0	8.4
4/6/2011	8.3	8.3	8.4	8.7	8.4	8.4	8.8	8.2
4/7/2011	8.0	8.0	7.9	8.1	8.0	8.1	8.5	8.0
4/8/2011	8.2	8.3	8.6	8.8	8.4	8.4	8.8	8.2
4/9/2011	8.7	8.8	9.0	9.2	8.8	8.9	9.3	8.7
4/10/2011	9.1	9.1	9.0	9.3	9.1	9.1	9.9	9.0

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
4/11/2011	9.3	9.4	9.5	9.8	9.4	9.5	9.9	9.2
4/12/2011	8.9	9.0	9.0	9.2	9.0	9.0	9.5	8.9
4/13/2011	8.6	8.6	8.5	8.8	8.6	8.6	9.1	8.5
4/14/2011	8.3	8.3	8.4	8.5	8.3	8.4	8.8	8.3
4/15/2011	8.2	8.2	8.1	8.2	8.2	8.3	8.8	8.2
4/16/2011	8.9	9.0	9.3	9.5	9.0	9.1	9.4	8.9
4/17/2011	9.0	9.1	8.9	9.0	9.0	9.1	9.5	9.0
4/18/2011	9.0	9.0	8.8	8.8	9.2	9.2	9.6	9.0
4/19/2011	9.0	9.0	9.2	9.3	9.3	9.3	9.6	9.1
4/20/2011	9.1	9.1	9.1	9.3	9.3	9.2	9.7	9.1
4/21/2011	9.1	9.1	9.2	9.4	9.4	9.3	9.7	9.2
4/22/2011	9.0	9.0	9.3	9.4	9.4	9.4	9.6	9.0
4/23/2011	9.6	9.5	9.7	9.9	9.9	9.9	10.1	9.6
4/24/2011	9.9	9.8	10.0	10.2	10.2	10.2	10.4	9.9
4/25/2011	9.9	9.9	10.0	10.2	10.1	10.1	10.4	10.0
4/26/2011	10.0	10.0	10.1	10.3	10.3	10.3	10.6	10.1
4/27/2011	10.2	10.2	10.3	10.5	10.5	10.4	10.7	10.3
4/28/2011	10.1	10.1	10.2	10.3	10.3	10.3	10.7	10.2
4/29/2011	9.9	9.8	9.9	10.1	10.1	10.0	10.4	9.9
4/30/2011	9.9	9.9	10.2	10.4	10.4	10.3	10.5	10.0
5/1/2011	10.7	10.6	10.9	11.0	11.0	11.0	11.1	10.7
5/2/2011	10.4	10.4	10.4	10.6	10.6	10.6	11.0	10.5
5/3/2011	10.5	10.5	10.7	10.9	10.9	10.8	11.0	10.5
5/4/2011	11.0	11.0	11.3	11.5	11.5	11.4	11.5	11.1
5/5/2011	11.3	11.3	11.6	11.8	11.8	11.7	11.8	11.3
5/6/2011	11.6	11.6	11.8	12.1	12.0	12.0	12.2	11.7
5/7/2011	11.6	11.6	11.8	12.0	12.0	12.0	12.1	11.7
5/8/2011	11.6	11.5	11.7	11.9	11.9	11.9	12.1	11.6
5/9/2011	12.0	12.0	12.3	12.5	12.5	12.4	12.6	12.1
5/10/2011	12.6	12.6	12.8	13.1	13.0	13.0	13.1	12.6
5/11/2011	12.8	12.8	12.9	13.2	13.2	13.1	13.3	12.8
5/12/2011	12.6	12.6	12.7	12.9	12.9	12.9	13.1	12.7
5/13/2011	12.7	12.7	12.9	13.1	13.1	13.1	13.2	12.7
5/14/2011	13.0	12.9	12.9	13.1	13.1	13.1	13.5	13.0
5/15/2011	12.9	12.8	12.7	13.0	13.0	12.9	13.6	12.9
5/16/2011	12.5	12.4	12.3	12.5	12.5	12.4	13.0	12.5
5/17/2011	12.6	12.6	12.7	12.9	12.9	12.9	13.1	12.6
5/18/2011	13.0	12.9	13.2	13.4	13.4	13.4	13.5	13.0
5/19/2011	14.1	14.1	14.2	14.4	14.4	14.4	14.5	14.1
5/20/2011	14.6	14.5	14.8	15.0	15.0	15.0	15.1	14.6
5/21/2011	14.8	14.7	14.8	15.0	15.0	15.0	15.3	14.8
5/22/2011	14.2	14.2	14.3	14.5	14.5	14.4	15.0	14.4
5/23/2011	14.5	14.5	14.5	14.6	14.6	14.6	15.0	14.5
5/24/2011	14.5	14.5	14.7	14.9	14.9	14.9	14.9	14.5
5/25/2011	14.3	14.3	14.3	14.5	14.5	14.4	14.8	14.4
5/26/2011	13.8	13.7	13.8	14.0	14.0	13.9	14.3	13.8
5/27/2011	13.9	13.8	13.8	14.0	14.0	13.9	14.4	13.9
5/28/2011	14.1	14.1	14.2	14.4	14.4	14.3	14.6	14.1
5/29/2011	14.5	14.4	14.5	14.7	14.7	14.7	15.2	14.5
5/30/2011	14.7	14.6	14.7	14.9	14.9	14.8	15.3	14.7

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
5/31/2011	14.3	14.3	14.3	14.5	14.5	14.4	14.9	14.3
6/1/2011	14.1	14.1	14.3	14.5	14.5	14.5	14.7	14.2
6/2/2011	14.5	14.4	14.6	14.8	14.8	14.7	15.1	14.5
6/3/2011	14.6	14.6	14.8	14.9	14.9	14.9	15.2	14.7
6/4/2011	14.7	14.7	14.9	15.1	15.1	15.0	15.3	14.8
6/5/2011	14.7	14.7	14.9	15.1	15.1	15.0	15.2	14.8
6/6/2011	15.8	15.8	15.9	16.1	16.1	16.1	16.2	15.8
6/7/2011	16.6	16.6	16.7	16.9	16.9	16.8	17.0	16.6
6/8/2011	16.0	15.9	16.0	16.2	16.2	16.1	16.5	16.0
6/9/2011	15.9	15.8	16.0	16.2	16.2	16.1	16.3	15.9
6/10/2011	16.0	16.0	16.1	16.3	16.3	16.3	16.4	16.0
6/11/2011	16.4	16.3	16.4	16.6	16.6	16.5	16.8	16.4
6/12/2011	16.5	16.4	16.5	16.7	16.7	16.7	17.0	16.5
6/13/2011	16.4	16.4	16.5	16.7	16.7	16.6	16.9	16.4
6/14/2011	16.5	16.4	16.5	16.7	16.7	16.6	17.1	16.5
6/15/2011	16.2	16.0	16.1	16.3	16.3	16.2	16.6	16.2
6/16/2011	15.3	15.2	15.3	15.5	15.5	15.4	15.8	15.3
6/17/2011	15.4	15.4	15.5	15.7	15.7	15.6	15.9	15.5
6/18/2011	15.7	15.6	15.7	15.9	15.9	15.8	16.4	15.8
6/19/2011	15.9	15.8	15.9	16.1	16.1	16.1	16.5	15.9
6/20/2011	16.4	16.3	16.4	16.6	16.6	16.6	16.8	16.4
6/21/2011	16.7	16.7	16.8	17.0	17.0	17.0	17.1	16.7
6/22/2011	16.9	16.9	16.9	17.1	17.1	17.1	17.3	16.8
6/23/2011	17.2	17.2	17.3	17.5	17.5	17.4	17.7	17.2
6/24/2011	17.2	17.2	17.3	17.4	17.4	17.3	17.7	17.2
6/25/2011	17.3	17.2	17.3	17.4	17.4	17.3	17.7	17.2
6/26/2011	17.6	17.5	17.7	17.8	17.8	17.8	18.1	17.6
6/27/2011	17.6	17.6	17.7	17.9	17.9	17.8	18.1	17.6
6/28/2011	17.6	17.6	17.8	18.1	18.0	18.0	18.2	17.8
6/29/2011	18.7	18.6	18.6	18.8	18.8	18.7	19.1	18.6
6/30/2011	18.1	18.0	18.0	18.1	18.1	18.0	18.5	18.0
7/1/2011	17.7	17.6	17.7	17.9	17.9	17.9	18.1	17.7
7/2/2011	17.4	17.4	17.6	17.8	17.8	17.7	17.9	17.5
7/3/2011	17.5	17.5	17.7	17.8	17.8	17.8	18.1	17.6
7/4/2011	17.9	17.8	17.9	18.1	18.1	18.1	18.3	17.9
7/5/2011	18.4	18.3	18.4	18.6	18.6	18.6	18.7	18.4
7/6/2011	19.0	18.9	19.0	19.2	19.2	19.2	19.2	19.0
7/7/2011	19.7	19.7	19.7	19.9	19.9	19.9	19.9	19.8
7/8/2011	19.3	19.1	19.1	19.3	19.3	19.2	19.5	19.2
7/9/2011	18.6	18.4	18.5	18.7	18.7	18.6	18.9	18.5
7/10/2011	18.4	18.3	18.4	18.6	18.6	18.5	18.7	18.4
7/11/2011	18.2	18.2	18.3	18.5	18.5	18.5	18.5	18.4
7/12/2011	18.7	18.6	18.7	18.9	18.8	18.8	19.0	18.7
7/13/2011	19.0	18.9	19.0	19.2	19.2	19.1	19.3	18.9
7/14/2011	18.9	18.7	18.8	19.0	19.0	18.9	19.1	18.8
7/15/2011	18.5	18.4	18.5	18.7	18.7	18.6	18.8	18.5
7/16/2011	18.6	18.5	18.6	18.8	18.8	18.8	18.8	18.6
7/17/2011	18.7	18.6	18.7	18.9	18.9	18.8	18.8	18.7
7/18/2011	18.8	18.7	18.9	19.1	19.1	19.0	19.0	18.8
7/19/2011	18.6	18.5	18.6	18.8	18.8	18.8	18.9	18.6

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
7/20/2011	18.5	18.4	18.5	18.7	18.7	18.6	18.7	18.5
7/21/2011	18.4	18.2	18.4	18.4	18.4	18.3	18.7	18.4
7/22/2011	18.0	18.1	18.6	18.3	18.3	18.3	18.4	18.2
7/23/2011	N/A	18.4	18.6	18.7	18.7	18.7	18.7	18.4
7/24/2011	N/A	18.8	19.1	19.3	19.3	19.2	19.1	18.8
7/25/2011	N/A	18.3	18.5	18.7	18.7	18.7	18.9	18.6
7/26/2011	N/A	18.7	18.8	19.3	19.3	19.4	19.2	18.9
7/27/2011	N/A	19.3	19.2	19.3	19.2	19.4	19.7	19.4
7/28/2011	N/A	19.7	19.6	19.6	19.5	19.6	20.0	19.7
7/29/2011	N/A	19.9	20.1	20.1	20.0	20.1	20.2	20.0
7/30/2011	N/A	20.0	20.2	20.3	20.2	20.2	20.4	20.2
7/31/2011	N/A	20.4	20.5	20.6	20.5	20.5	20.8	20.5
8/1/2011	N/A	20.3	20.4	20.5	20.5	20.5	20.6	20.4
8/2/2011	N/A	20.1	20.2	20.3	20.2	20.2	20.3	20.1
8/3/2011	N/A	20.2	20.6	20.8	20.7	20.7	20.6	20.5
8/4/2011	N/A	20.7	20.8	21.0	20.9	20.9	21.0	20.9
8/5/2011	N/A	21.2	21.2	21.4	21.3	21.3	21.5	21.3
8/6/2011	N/A	21.2	21.2	21.4	21.3	21.3	21.4	21.3
8/7/2011	N/A	21.1	21.1	21.3	21.2	21.2	21.3	21.2
8/8/2011	N/A	21.0	21.1	21.3	21.2	21.2	21.3	21.1
8/9/2011	N/A	21.0	20.9	21.0	21.0	21.0	21.3	21.1
8/10/2011	N/A	20.9	20.7	20.8	20.8	20.8	21.1	21.0
8/11/2011	N/A	20.7	20.6	20.8	20.7	20.7	20.9	20.8
8/12/2011	N/A	20.6	20.6	20.8	20.7	20.7	20.9	20.7
8/13/2011	N/A	20.1	20.4	20.6	20.5	20.5	20.8	20.5
8/14/2011	N/A	20.6	20.4	20.4	20.3	20.3	21.0	20.7
8/15/2011	N/A	20.5	20.4	20.4	20.3	20.3	21.0	20.6
8/16/2011	N/A	20.5	20.5	20.4	20.3	20.3	21.0	20.7
8/17/2011	N/A	20.6	20.5	20.5	20.4	20.4	21.2	20.8
8/18/2011	N/A	20.6	20.5	20.6	20.5	20.5	21.0	20.7
8/19/2011	N/A	20.8	20.6	20.4	20.3	20.4	21.1	20.9
8/20/2011	N/A	20.8	20.9	20.9	20.7	20.8	21.2	21.0
8/21/2011	N/A	20.3	20.7	20.8	20.6	20.7	21.0	20.7
8/22/2011	N/A	20.5	20.4	20.3	20.1	20.2	21.1	20.9
8/23/2011	N/A	20.9	20.9	20.8	20.7	20.7	21.2	21.0
8/24/2011	N/A	21.1	21.1	21.1	21.0	21.0	21.4	21.2
8/25/2011	N/A	21.4	21.3	21.5	21.4	21.5	21.7	21.5
8/26/2011	N/A	21.7	21.4	21.6	21.5	21.6	22.0	21.8
8/27/2011	N/A	21.5	21.4	21.6	21.5	21.6	22.0	21.9
8/28/2011	N/A	21.0	21.1	21.0	20.9	21.0	21.9	21.7
8/29/2011	N/A	21.6	21.2	21.2	21.1	21.2	22.3	22.1
8/30/2011	N/A	21.7	21.1	20.7	20.7	20.6	22.1	21.8
8/31/2011	N/A	21.3	20.7	20.0	19.9	19.8	21.7	21.4
9/1/2011	N/A	21.1	20.5	19.9	19.8	19.8	21.4	21.1
9/2/2011	N/A	20.9	20.3	19.8	19.8	19.8	21.1	20.9
9/3/2011	N/A	20.2	20.0	19.6	19.6	19.6	20.6	20.4
9/4/2011	N/A	20.1	19.8	19.2	19.1	19.2	20.8	20.5
9/5/2011	N/A	20.0	20.0	19.6	19.5	19.6	21.0	20.2
9/6/2011	N/A	20.1	20.2	19.8	19.7	19.8	20.7	20.3
9/7/2011	N/A	20.3	20.1	19.7	19.6	19.7	20.7	20.6

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
9/8/2011	N/A	20.6	20.5	20.1	20.0	20.1	20.9	20.8
9/9/2011	N/A	20.4	20.6	20.4	20.3	20.4	20.9	20.7
9/10/2011	N/A	20.4	20.6	20.2	20.2	20.3	21.0	20.8
9/11/2011	N/A	20.5	20.3	20.0	19.9	20.0	21.0	20.9
9/12/2011	N/A	20.7	20.7	20.8	20.7	20.8	21.2	21.0
9/13/2011	N/A	21.2	20.6	20.3	20.2	20.3	21.5	21.3
9/14/2011	N/A	21.1	20.5	20.2	20.1	20.1	21.3	21.1
9/15/2011	N/A	20.9	19.9	19.5	19.4	19.3	21.2	20.8
9/16/2011	N/A	20.4	19.4	18.7	18.6	18.5	20.8	20.4
9/17/2011	N/A	19.8	18.8	17.9	17.8	17.7	20.3	19.7
9/18/2011	N/A	19.5	19.4	18.6	18.5	18.5	20.3	19.7
9/19/2011	N/A	19.4	19.5	18.8	18.7	18.8	19.8	19.4
9/20/2011	N/A	19.1	19.2	18.3	18.2	18.2	19.6	19.1
9/21/2011	N/A	18.9	19.2	18.0	17.9	17.9	19.3	18.9
9/22/2011	N/A	18.8	19.4	18.0	18.0	18.0	19.1	18.8
9/23/2011	N/A	18.9	19.9	19.0	18.9	19.1	19.1	18.9
9/24/2011	N/A	19.2	19.2	18.8	18.7	18.7	19.4	19.2
9/25/2011	N/A	19.1	18.9	18.8	18.7	18.8	19.3	19.1
9/26/2011	N/A	18.3	18.1	17.7	17.7	17.6	18.6	18.4
9/27/2011	N/A	18.1	18.2	17.8	17.7	17.7	18.4	18.2
9/28/2011	N/A	17.8	17.7	16.8	16.7	16.7	18.1	17.8
9/29/2011	N/A	17.6	17.6	16.6	16.6	16.6	18.0	17.7
9/30/2011	N/A	17.7	17.8	16.8	16.7	16.8	18.0	17.8
10/1/2011	N/A	17.7	18.0	17.1	17.1	17.1	18.0	17.7
10/2/2011	N/A	17.5	18.0	16.8	16.7	16.7	17.8	17.5
10/3/2011	N/A	17.5	18.0	16.8	16.7	16.7	17.7	17.5
10/4/2011	N/A	17.3	17.7	16.6	16.5	16.5	17.6	17.4
10/5/2011	N/A	16.9	17.1	15.8	15.7	15.7	17.2	17.0
10/6/2011	N/A	16.7	17.2	16.3	16.2	16.2	17.0	16.8
10/7/2011	N/A	16.7	17.2	16.1	16.1	16.0	17.0	16.7
10/8/2011	N/A	16.5	17.2	15.7	15.6	15.6	16.8	16.6
10/9/2011	N/A	16.5	17.3	15.8	15.7	15.7	16.8	16.5
10/10/2011	N/A	16.4	16.9	15.7	15.7	15.6	16.7	16.4
10/11/2011	N/A	16.1	16.6	15.4	15.4	15.3	16.4	16.2
10/12/2011	N/A	15.4	15.8	14.3	14.2	14.1	15.8	15.5
10/13/2011	N/A	15.1	15.9	14.4	14.3	14.3	15.5	15.2
10/14/2011	N/A	15.1	15.6	14.4	14.5	14.5	15.4	15.1
10/15/2011	N/A	15.0	15.5	14.5	14.9	14.8	15.4	15.1
10/16/2011	N/A	15.1	15.5	14.4	14.9	14.8	15.4	15.1
10/17/2011	N/A	15.0	15.4	14.4	14.8	14.7	15.3	15.0
10/18/2011	N/A	14.9	15.3	14.3	14.8	14.7	15.3	15.0
10/19/2011	N/A	15.0	15.5	14.5	14.8	14.8	15.3	15.0
10/20/2011	N/A	15.1	15.9	14.9	15.0	14.9	15.4	15.1
10/21/2011	N/A	15.0	15.8	14.3	14.8	14.8	15.3	15.0
10/22/2011	N/A	14.8	15.8	14.4	14.7	14.7	15.2	14.9
10/23/2011	N/A	14.7	15.4	13.9	14.5	14.5	15.1	14.8
10/24/2011	N/A	14.3	14.8	13.3	14.2	14.1	14.8	14.5
10/25/2011	N/A	14.0	14.3	12.8	13.9	13.8	14.5	14.2
10/26/2011	N/A	13.6	13.8	12.0	13.4	13.2	14.1	13.7
10/27/2011	N/A	13.1	13.7	11.9	13.0	12.9	13.7	13.3

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
10/28/2011	N/A	13.1	13.6	11.9	12.9	12.8	13.5	13.2
10/29/2011	N/A	13.0	13.5	12.0	12.8	12.8	13.5	13.1
10/30/2011	N/A	13.1	13.4	12.2	12.9	12.9	13.5	13.2
10/31/2011	N/A	13.0	13.0	11.9	12.8	12.7	13.4	13.1
11/1/2011	N/A	12.7	12.8	11.5	12.6	12.4	13.2	12.8
11/2/2011	N/A	12.5	12.7	11.2	12.3	12.2	13.0	12.6
11/3/2011	N/A	12.4	12.6	11.4	12.2	12.2	12.9	12.5
11/4/2011	N/A	12.0	11.9	10.8	11.9	11.8	12.6	12.2
11/5/2011	N/A	11.8	11.5	10.4	11.6	11.5	12.4	12.0
11/6/2011	N/A	11.4	11.3	10.0	11.3	11.1	12.0	11.6
11/7/2011	N/A	11.1	10.7	9.5	11.0	10.8	11.7	11.3
11/8/2011	N/A	10.8	10.4	9.5	10.8	10.6	11.4	10.9
11/9/2011	N/A	11.0	10.9	10.1	11.1	10.9	11.6	11.2
11/10/2011	N/A	11.0	10.8	10.0	11.1	10.9	11.6	11.1
11/11/2011	N/A	10.9	10.5	9.6	10.9	10.7	11.5	11.0
11/12/2011	N/A	10.6	10.1	9.3	10.6	10.4	11.2	10.7
11/13/2011	N/A	10.1	9.8	9.1	10.1	9.9	10.7	10.2
11/14/2011	N/A	10.2	9.8	9.0	10.3	10.0	10.8	10.4
11/15/2011	N/A	9.8	9.3	8.5	9.8	9.6	10.5	9.9
11/16/2011	N/A	9.5	8.8	7.9	9.5	9.2	10.2	9.6
11/17/2011	N/A	9.4	9.1	8.3	9.4	9.2	10.0	9.5
11/18/2011	N/A	9.6	9.3	8.7	9.7	9.5	10.2	9.7
11/19/2011	N/A	9.5	9.0	8.3	9.5	9.3	10.1	9.6
11/20/2011	N/A	9.1	8.4	7.6	9.1	8.9	9.8	9.3
11/21/2011	N/A	9.0	8.6	7.9	9.0	8.8	9.6	9.1
11/22/2011	N/A	9.0	9.0	8.3	9.1	8.9	9.6	9.1
11/23/2011	N/A	9.4	9.6	9.2	9.5	9.4	10.0	9.5
11/24/2011	N/A	9.2	9.0	8.5	9.3	9.1	9.8	9.3
11/25/2011	N/A	9.0	8.7	8.1	9.0	8.8	9.6	9.1
11/26/2011	N/A	8.9	8.9	8.4	9.0	8.9	9.5	9.0
11/27/2011	N/A	8.9	8.8	8.2	9.0	8.8	9.5	9.0
11/28/2011	N/A	8.8	8.7	8.2	8.9	8.7	9.4	8.9
11/29/2011	9.0	8.8	8.7	8.2	8.9	8.7	9.4	8.9
11/30/2011	8.7	8.7	8.4	7.9	8.7	8.6	9.3	8.8
12/1/2011	8.5	8.3	8.0	7.3	8.1	7.8	9.0	8.5
12/2/2011	8.1	7.9	7.7	6.8	7.1	6.9	8.7	8.1
12/3/2011	8.0	7.9	7.7	6.9	7.2	7.0	8.8	8.1
12/4/2011	7.8	7.7	7.3	6.6	6.9	6.7	8.6	7.9
12/5/2011	7.7	7.5	7.1	6.4	6.7	6.5	8.5	7.7
12/6/2011	7.5	7.4	6.8	6.0	6.3	6.1	8.1	7.5
12/7/2011	7.5	7.3	6.8	5.9	6.3	6.1	8.1	7.5
12/8/2011	7.5	7.4	7.0	6.2	6.6	6.4	8.1	7.5
12/9/2011	7.3	7.2	6.7	5.8	6.3	6.1	7.9	7.3
12/10/2011	7.1	6.9	6.5	5.5	6.0	5.8	7.9	7.1
12/11/2011	6.8	6.7	6.4	5.6	6.0	5.8	7.6	6.9
12/12/2011	6.5	6.3	6.0	5.2	5.6	5.4	7.3	6.5
12/13/2011	6.2	6.1	5.6	4.6	5.1	4.9	6.8	6.1
12/14/2011	6.7	6.6	6.1	5.2	5.6	5.4	7.3	6.7
12/15/2011	6.6	6.5	6.3	5.6	5.9	5.8	7.3	6.6
12/16/2011	6.7	6.7	6.5	5.9	6.2	6.0	7.4	6.7

Date	Low Level Outlet Pipe -Auto- (Deg. C)	Top of Reach 1 -Logger- (Deg. C))	End of Reach 1 -Logger- (Deg. C)	End of Reach 3 -Logger- (Deg. C)	Top of R4 Habitat Channel -Logger- (Deg. C)	End of R4 Habitat Channel -Logger- (Deg. C)	Tailrace at Pump Intake -Auto- (Deg. C)	Tailrace at Pump Intake -Logger- (Deg. C)
12/17/2011	6.7	6.6	6.4	5.9	6.2	6.1	7.3	6.6
12/18/2011	6.8	6.8	6.6	6.1	6.4	6.2	7.4	6.8
12/19/2011	6.7	6.6	6.4	5.8	6.1	6.0	7.3	6.7
12/20/2011	6.6	6.5	6.2	5.6	6.0	5.8	7.2	6.5
12/21/2011	6.1	6.0	5.6	5.1	5.4	5.2	7.1	6.2
12/22/2011	5.5	5.4	5.0	4.2	4.6	4.4	6.5	5.6
12/23/2011	5.1	4.9	4.9	4.3	4.7	4.5	6.0	5.2
12/24/2011	5.1	5.0	4.9	4.3	4.6	4.4	6.2	5.3
12/25/2011	4.9	4.8	5.0	4.4	4.7	4.6	6.0	5.2
12/26/2011	4.7	4.6	4.8	4.4	4.6	4.5	5.9	5.0
12/27/2011	4.8	4.7	4.8	4.3	4.6	4.4	5.8	5.0
12/28/2011	5.2	5.2	5.5	5.2	5.4	5.3	6.4	5.5
12/29/2011	5.2	5.2	5.6	5.5	5.6	5.5	6.6	5.6
12/30/2011	5.0	4.9	5.2	5.1	5.2	5.1	6.6	5.4
12/31/2011	4.8	4.7	4.7	4.2	4.5	4.4	6.3	5.2

APPENDIX C: MINIMUM FLOW DEVIATION REPORTS

FEDERAL ENERGY REGULATORY COMMISSION
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 637-081-Washington
Lake Chelan Hydroelectric Project

September 28, 2011

Ms. Michelle Smith
Licensing & Compliance Manager
Public Utility District No. 1 of Chelan County
P.O. Box 1231
Wenatchee, WA 98807-1231

Subject: Instream Flow and Ramping Rate Deviations Pursuant to Article 405 of the License

Dear Ms. Smith:

This is in response to your filing submitted on May 18, 2011, pertaining to a deviation from instream flow and ramping rates requirements at the Lake Chelan Hydroelectric Project, FERC No. 637. You submitted the filing pursuant to Article 405 of the license, [1] and your approved Operations Compliance and Monitoring Plan (Plan).[2]

License Requirements

Article 405 of the license requires you to file a Plan that describes how you will comply with the instream flows, ramping rates, and tailrace flows, as set forth in Article 7 of the Lake Chelan Settlement Agreement, (Agreement) and Chapter 7 of the Comprehensive Plan attached to the Agreement. Under the Agreement, you are required to maintain a minimum instream flow of 320 cfs into Reach 4 of the Chelan River, for

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[1] See, Order on Offer of Settlement and Issuing New License, 117 FERC ¶ 62,129, issued November 6, 2006.

[2] See, Order Modifying and Approving Operations Compliance and Monitoring Plan Article 405, 121 FERC 62,152, issued November 30, 2007.

steelhead trout spawning, from March 15 through May 15, and to maintain minimum instream flows of 80 cfs into Reach 1-3, from July 16 through May 14. In addition, under Article 405 of the license you are required to notify the Washington Department of Ecology (Ecology) and the Commission within 48 hours after you become aware of any deviation from the minimum flow requirements.

In accordance with the approved Plan, you are required to file a report with the Commission, within 30 days of any deviation from minimum flow requirements, lake levels or ramping rates. The report must to the extent possible, identify the cause, severity, and duration of the incident, and any observed or reported adverse environmental impacts resulting from the incident. The report must also include: operational data necessary to determine compliance with the license requirements regarding minimum flows, lake levels, and ramping rates, as appropriate; a description of any corrective measures implemented at the time of occurrence and the measures implemented or proposed to ensure that similar incidents will not recur; and comments or correspondence, if any, received from the resource agencies and others regarding the incident.

Instream Flow and Ramping Events

In the filing, you reported that during the afternoon of April 18, 2011, instream flow and ramping rate deviation events occurred at the project. This occurred at the same time that project operations shifted minimum spawning period flows into Reach 4 of the Chelan River from the Pump Station to the Low Level Outlet (LLO). You report that the deviation was due to an undetected problem with the Control System Logic that caused a LLO gate to close rather than to open a second gate, as was expected by your plant operator. Therefore, your operator contacted personnel near the site of the LLO, and they were able to open the control panel at the low level outlet and use manual override to reopen the gate and restore the required flow.

In the filing, you explain that the event began at about 14:07 hours with LLO flows at 320 cfs. A manual override was performed at 14:16 hours, reversing the closing of the first slide gate. Then, a manual opening of the second slide gate was performed at about 14:22 hours. Flows from the LLO changed from 320 cfs at 14:08 hours to a low 133.3 cfs at 14:18 hours, then flows began increasing and reaching 322.2 cfs at 14:32 hours. The effects of the LLO gate closure resulted in flows below the required minimum flow of 320 cfs for a period of 35 minutes and water levels decreasing at about nine inches in Reach 4, and exceeding the two inches per hour maximum ramping rate. In addition, minimum flow and ramping rate deviations occurred in Reaches 1-3 of the Chelan River. The LLO flows were below the required minimum flow of 80 cfs for a period of nine

minutes and water level also decreased exceeding the two inches per hour ramping rate. LLO flows were stabilized and have been maintained at between 330 cfs to 340 cfs since the event. You state in the filing, that the gates will remain on manual control until the automated control system can be reprogrammed and tested.

In addition, you state in the filing, that no adverse biological effects were observed as a result of the incident. Visual observations using security cameras determined that pools in Reach 1 below the LLO were not dewatered during the incident. No fish stranding or mortality was observed in Reach 4 either during the event or noted during surveys conducted the next day. Furthermore, you state in the filing that you reported the deviation to the Commission's Portland Regional Office and Ecology via electronic correspondence on April 20, 2011, within 48 hours of when you became aware of the incident.

Conclusion

After reviewing the information included in your report, we have determined that the instream flow and ramping rate deviations that occurred on April 18, 2011, will not constitute a violation of the project license. The incident was caused by a malfunction of the automated control system logic, and you took care of the situation, by manually operating the gates. No adverse biological impacts were observed as a result of the incident. Your filing adequately fulfills the reporting requirements pursuant to Article 405 of the license and your approved Plan. Thank you for your cooperation. If you have any questions concerning this letter, please contact Anumzziatta Purchiaroni at (202) 502-6191, or by e-mail at anumzziatta.purchiaroni@ferc.gov.

Sincerely,

William Guey-Lee

William Guey-Lee
Chief, Engineering Resources Branch
Division of Hydropower Administration
and Compliance

FEDERAL ENERGY REGULATORY COMMISSION
Washington, D. C. 20426

OFFICE OF ENERGY PROJECTS

Project No. 637-081-Washington
Lake Chelan Hydroelectric Project

October 21, 2011

Ms. Michelle Smith
Licensing & Compliance Manager
Public Utility District No. 1 of Chelan County
P.O. Box 1231
Wenatchee, WA 98807-1231

Subject: Minimum Flow and Ramping Rate Deviations Pursuant to Article 405 of the License

Dear Ms. Smith:

This is in response to your filing submitted on June 16, 2011, pertaining to deviations from minimum flow and ramping rates requirements at the Lake Chelan Hydroelectric Project, FERC No. 637. You submitted the filing pursuant to Article 405 of the license, [1] and your approved Operations Compliance and Monitoring Plan (Plan).[2]

License Requirements

Article 405 of the license requires you to file a Plan that describes how you will comply with the instream flows, ramping rates, and tailrace flows, as set forth in Article 7 of the Lake Chelan Settlement Agreement, (Agreement) and Chapter 7 of the Comprehensive Plan attached to the Agreement. Under the Agreement, you are required to maintain a minimum flow of 320 cfs into Reaches 1 through 4 of the Chelan River, for steelhead trout spawning, from May 15 through July 15 during high runoff years. In

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[1] See, Order on Offer of Settlement and Issuing New License, 117 FERC ¶ 62,129, issued November 6, 2006.

[2] See, Order Modifying and Approving Operations Compliance and Monitoring Plan Article 405, 121 FERC 62,152, issued November 30, 2007.

addition, the project must not exceed two inches per hour ramping rate, for the purpose of preventing stranding of fish in the Chelan River. Furthermore, under Article 405 of the license you are required to notify the Washington Department of Ecology (Ecology) and the Commission within 48 hours after you are aware of any deviation from the minimum flow requirements.

In accordance with the approved Plan, you are required to file a report with the Commission, within 30 days of any deviation from minimum flow requirements, lake levels or ramping rates. The report must to the extent possible, identify the cause, severity, and duration of the incident, and any observed or reported adverse environmental impacts resulting from the incident. The report must also include: operational data necessary to determine compliance with the license requirements regarding minimum flows, lake levels, and ramping rates, as appropriate; a description of any corrective measures implemented at the time of occurrence and the measures implemented or proposed to ensure that similar incidents will not recur; and comments or correspondence, if any, received from the resource agencies and others regarding the incident.

Instream Flow and Ramping Events

In the filing, you explain that the minimum flow of 320 cfs as required for high runoff years, was not met on May 15, and 17, 2011, for about one hour, and three hours, respectively. On May 15 at about 9:00 PM, the Low Level Outlet (LLO) control system partially closed one of the gates, even though no commands were given to move the gate. The partial gate closure was due to a second programmable logic controller (PLC), which was linked to the slide gate operating motors through a different logic path. The incident resulted in flows below minimum levels, from 320 cfs to 285 cfs for about one hour. Water levels in Reach 4 of the Chelan River decreased by 3 inches over a 30 minute time period.

On May 17, 2011, a second incident occurred when personnel were attempting to repair the LLO gate position indicators, which were giving inaccurate flow readings. The PLC was rebooted, and the LLO flow meter also rebooted and began to indicate that LLO flow was exceeding 500 cfs. A plant operator partially closed the LLO gates, based on this flow meter information, which later was proven to be false. This event resulted in flows decreasing to about 250 cfs before the flow meter readings were determined to be inaccurate. Subsequently, when water levels began to decrease in Reach 4, personnel reset the LLO slide gates to a previous setting to restore water levels in Reach 4 to those observed when flows were known to be near 330 cfs. This incident also resulted in a flow reduction lasting for about 3 hours, with water level decreasing 4 inches in the first

hour and about 2.5 inches during the second hour. You determined that the incident was caused by a malfunction of the LLO flow meter. Since the malfunction of the flow meter, the LLO has been operated to maintain Reach 4 water levels at the elevations recorded when flow releases ranged from 330-340 cfs. The flow meter was returned to service on May 24, but the LLO remains on manual control, until the automated control system can be reprogrammed and tested. You state in the filing, that since the incidents the LLO has been disconnected from the PLC's operating motors to prevent further incidents.

In addition, you state, that no adverse biological effects were observed as a result of these incidents. Chinook fry that were observed in Reach 4 during surveys conducted on May 10 and May 18 were seen to be rearing in shoreline areas with water depths greater than 6 inches. No fish stranding or other adverse ecological effects were observed as a result of these flow and ramping rate deviations. Furthermore, you state that you reported the deviations to the Commission's Portland Regional Office and Ecology via electronic correspondence on May 19, 2011, within 48 hours of when you became aware of the incident. No comments were received regarding the incidents.

Conclusion

After reviewing the information included in your report, we have determined that the minimum flow and ramping rate deviations that occurred on May 15, and May 17, 2011, will not constitute violations of the project license. The incidents were caused by a malfunction of the PLC, and you restored the flow by disconnecting the gate motors from the PLC system and manually operating the LLO gates to maintain the minimum flow and ramping rate requirements. You indicate that the LLO will remain manual with the automated system disconnected until the control logic has been revised to allow remote manual operation. No adverse biological impacts were observed as a result of the incident. Your filing adequately fulfills the reporting requirements pursuant to Article 405 of the license and your approved Plan. Thank you for your cooperation. If you have any questions concerning this letter, please contact Anumzziatta Purchiaroni at (202) 502-6191, or by e-mail at anumzziatta.purchiaroni@ferc.gov.

Sincerely,

William Guey-Lee

William Guey-Lee
Chief, Engineering Resources Branch
Division of Hydropower Administration
and Compliance

APPENDIX D: CONSULTATION RECORD

Chelan PUD provided a draft of the 2011 Annual Flow Report to the USGS and members of the CRFF and LCRF in accordance with the requirements of the FERC Order Modifying and Approving Operations Compliance and Monitoring Plan, Article 405, under Ordering Paragraph (B):

> "The licensee shall allow the resource agencies, Tribes and non-governmental organizations specified under Article 405, 30 days to provide comments and/or recommendations on their report before filing with the FERC. The filing shall include comments and/or recommendations from the consulted entities and the licensee's response to any comments. If the licensee does not adopt a recommendation, the report shall include the licensee's reasons, based on project-specific information."

On February 29, 2012, the following individuals were sent draft copies for review. No comments were received to date.

NAME	***AGENCY***	***Comments***
Irle, Pat	Washington State Department of Ecology	
Caldwell, Brad	Washington State Department of Ecology	
Korth, Jeffrey	Washington State Department of Fish and Wildlife	
Simon, Graham	Washington State Department of Fish and Wildlife	
Heiner, Bruce	Washington State Department of Fish and Wildlife	
Willard, Catherine	United States Department of Agriculture – Forest Service	
Martinez, Alex	United States Department of Agriculture – Forest Service	
Glesne, Reed	National Park Service	
Lewis, Steve	United States Fish and Wildlife Service	
Domingue, Rich	National Marine Fisheries Services	
Marco, Jerry	Confederated Tribes of the Colville Reservation	
Rose, Bob	Yakama Indian Nation	
Merkle, Carl	Confederated Tribes of the Umatilla Indian Reservation	
Goedde, Robert	City of Chelan	
Archibald, Phil	Lake Chelan Sportsman Association	
Drzymkowski, Robert	United States Geological Survey	
Fraser, Bill	Washington State Parks and Recreation Commission	
Harris, Jim	Washington State Parks and Recreation Commission	
McLellan, Steve	Washington State Recreation and Conservation Office	
Petersen, Wai	Manson Parks and Recreation Department	
Uhlhorn, Richard	Lake Chelan Recreation Association	
O'Keefe, Thomas	American Whitewater	