



PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

February 28, 2017

VIA ELECTRONIC FILING

Honorable Kimberly D. Bose, Secretary
FEDERAL ENERGY REGULATORY COMMISSION
888 First Street, NE
Washington, DC 20426

Re: **Lake Chelan Hydroelectric Project No. 637**
Article 405b – 2016 Annual Lake Level Report

Dear Secretary Bose:

The Federal Energy Regulatory Commission (Commission) issued the “Order Modifying and Approving Operations Compliance and Monitoring Plan (Plan), Article 405” on November 30, 2007. The Plan satisfied the License Article 405 requirement of the “Order on Offer of Settlement and Issuing New License”¹ (License) and “Order on Rehearing”² for the Lake Chelan Hydroelectric Project (Project) on November 6, 2006, and April 19, 2007, respectively.

Under Ordering Paragraph (C) modifying the Plan under Article 405, Chelan PUD is required to file the following report with the Commission.

(C) The licensee shall file annually with the Commission by February 28, beginning in 2009, their Annual Lake Level Report. 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 Commission. 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. Based on review of the report, the Commission reserves the right to require changes to the project to ensure compliance with the license.

¹ 117 FERC ¶ 62,129

² 119 FERC ¶ 61,055

In accordance with the above Order requirement, Chelan PUD hereby files the 2016 Annual Lake Level Report. This report compares monthly actual and minimum (target) lake levels; and runoff volume forecasts and other factors influencing achievement of targeted lake levels. A final draft of this report was provided to the resource agencies, Tribes and non-governmental organizations specified for 30-day review, which ended February 17, 2016 (see Section 6). No comments were received.

Please do not hesitate to contact me regarding any questions or comments regarding this plan.

Regards,



Jeffrey G. Osborn
License Compliance Supervisor
Public Utility District No. 1 of Chelan County
jeff.osborn@chelanpud.org
(509) 661-4176

Enclosure: Lake Chelan 2016 Annual Lake Level Report

LAKE CHELAN ANNUAL LAKE LEVEL REPORT 2016

LICENSE ARTICLE 405

Final

**LAKE CHELAN HYDROELECTRIC PROJECT
FERC Project No. 637**

February 28, 2017



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

TABLE OF CONTENTS

SECTION 1: EXECUTIVE SUMMARY	2
SECTION 2: INTRODUCTION	3
SECTION 3: COMPARISON OF ACTUAL AND TARGET LAKE LEVELS	4
SECTION 4: ACTUAL AND FORECASTED RUNOFF	6
SECTION 5: DECISIONS RELATED TO LAKE LEVEL.....	7
SECTION 6: CONSULTATION	9

LIST OF TABLES

Table 1: Comparison of Actual and Target Lake Levels	2
Table 2: Comparison of Actual and Target Lake Levels	4
Table 3: Runoff Volume Forecasts for April 1 – July 31, 2016	6

LIST OF FIGURES

Figure 1. 2015-2016 Lake Chelan Elevations.....	5
---	---

SECTION 1: EXECUTIVE SUMMARY

The Public Utility District No. 1 of Chelan County, Washington (Chelan PUD) received a new license (License)¹ from the Federal Energy Regulatory Commission (FERC) on November 6, 2006, authorizing Chelan PUD to operate the Lake Chelan Project (Project) for a period of 50 years. License Article 405 requires Chelan PUD to file annually with FERC a report comparing monthly actual and target lake levels, runoff volume forecasts, and other factors influencing achievement of target lake levels.

During 2016, Chelan PUD managed lake levels as runoff forecasts evolved through winter and spring. Runoff forecasts for the April 1 to July 31 time period were for 106% of average runoff on February 1, 109% of average runoff on March 1, and 116% of average runoff on April 1. Actual runoff for the April 1 – July 31 time period was just over 116% of average. Lake levels were managed, as defined in Chapter 8 of the Lake Chelan Comprehensive Plan,² to meet all operating objectives, except one, and lake level targets for the year 2016. The reducing high flows in the Chelan River objective was not met due to record inflows in April 2016, a simultaneous generating unit overhaul reducing generating capability by half and continued very high inflow forecasts throughout May and early June that threatened to result in the reservoir elevation going above the license limit of 1,100 feet.

The table below compares monthly actual and lake level targets May through October 2016. Chelan PUD manages lake levels following an annual draft and refill cycle, generally beginning in August, which starts to release water from Lake Chelan to meet operating objectives and for power generation from September through March, then refills Lake Chelan from April through July.

Table 1: Comparison of Actual and Target Lake Levels

Date	License Target Lake Level (feet)	2016 Actual Lake Level (end of day)* (feet)	Difference between Actual and Target Lake Level (feet)
May 1, 2016	1,087.6	1,096.4	8.8
June 1, 2016	1,094.0	1,098.3	4.3
July 1, 2016	1,098.0	1,099.8	1.8
August 1, 2016	1,099.0	1,099.6	0.6
September 7, 2016	1,098.7	1,098.9	0.2
October 1, 2016	1,097.2	1097.4	0.2

* USGS Gage #12452000 Lake Chelan at Chelan

¹ Federal Energy Regulatory Commission Order on Offer of Settlement and Issuing New License and Order on Rehearing for the Lake Chelan Hydroelectric Project No. 637 were issued November 6, 2006, and April 19, 2007, respectively, to the Public Utility District No. 1 of Chelan County.

² Final Lake Chelan Comprehensive Settlement Agreement for the Lake Chelan Project No. 637, dated October 8, 2003.

SECTION 2: INTRODUCTION

The Public Utility District No. 1 of Chelan County, Washington (Chelan PUD) received a new license (License)³ from the Federal Energy Regulatory Commission (FERC) on November 6, 2006, authorizing Chelan PUD to operate the Lake Chelan Project (Project) for a period of 50 years. The License sets a minimum lake level of 1,079 feet and a maximum lake level at 1,100 feet. Chelan PUD manages lake levels within the minimum and maximum elevations according to license operating objectives and for power generation.

The License establishes monthly target lake levels for the period from May 1 through October 1 that Chelan PUD will try to attain consistent with the license operating objectives for flood control, protection of fish resources, recreation, and prevention of erosion. Chelan PUD monitors snowpack in the Lake Chelan runoff basin and predicts snowmelt runoff volume from December through August. Chelan PUD manages power generation and spill to reach lake level targets by using runoff volume and precipitation forecasts, past experience with runoff timing and actual lake levels.

License Article 405 requires Chelan PUD to file annually with FERC a report comparing monthly actual and target lake levels, runoff volume forecasts and other factors influencing achievement of lake level targets. This Lake Level Report documents decisions and other information regarding achievement of monthly target lake levels beginning May 2016 through October 2016.

Chelan PUD is using a hydropower system simulation model (CHEOPS) developed specifically to assist with lake level management decisions. The CHEOPS computer model uses historical information, a target curve, and operational constraints to provide a predictive tool for making operational decisions. Historical information includes a data set of Lake Chelan hydrologic variables which now dates back to 1929. A target curve is a collection of elevations with corresponding dates which are used to guide the computer model and subsequent operating decisions. Operational constraints include minimum and maximum generation limits and spill requirements or limitations. The use of a target curve, in conjunction with professional experience and actual hydrologic behavior of the lake environment, provides the best available basis for balancing license objectives and the likelihood of being within reasonable predictive probability of meeting monthly lake level targets.⁴ In some years, late runoff may affect the ability to meet lake level targets, and, therefore, lake level targets would be met as soon as practicable.

³ Federal Energy Regulatory Commission Order on Offer of Settlement and Issuing New License and Order on Rehearing for the Lake Chelan Hydroelectric Project No. 637 were issued November 6, 2006, and April 19, 2007, respectively, to the Public Utility District No. 1 of Chelan County.

⁴ Section 3.1 of Chapter 8, Final Lake Chelan Comprehensive Settlement Agreement for the Lake Chelan Project No. 637, dated October 8, 2003.

SECTION 3: COMPARISON OF ACTUAL AND TARGET LAKE LEVELS

The table below compares monthly actual and target lake levels from May through October 2016. Lake levels are recorded at the end of the day, 2400 hours. Chelan PUD manages lake levels following an annual draft and refill cycle, generally beginning in August, which starts to release water from Lake Chelan to meet operating objectives, lake level targets, and for power generation from September through March, then refills Lake Chelan from April through July (Figure 1). Lake levels were managed successfully using generation and spill as defined in Chapter 8 of the Lake Chelan Comprehensive Plan.

Table 2: Comparison of Actual and Target Lake Levels

Date	License Target Lake Level (feet)	2016 Actual Lake Level (end of day)* (feet)	Difference between Actual and Target Lake Level (feet)
May 1, 2016	1,087.6	1,096.4	8.8
June 1, 2016	1,094.0	1,098.3	4.3
July 1, 2016	1,098.0	1,099.8	1.8
August 1, 2016	1,099.0	1,099.6	0.6
September 7, 2016	1,098.7	1,098.9	0.2
October 1, 2016	1,097.2	1,097.4	0.2

* USGS Gage #12452000 Lake Chelan at Chelan

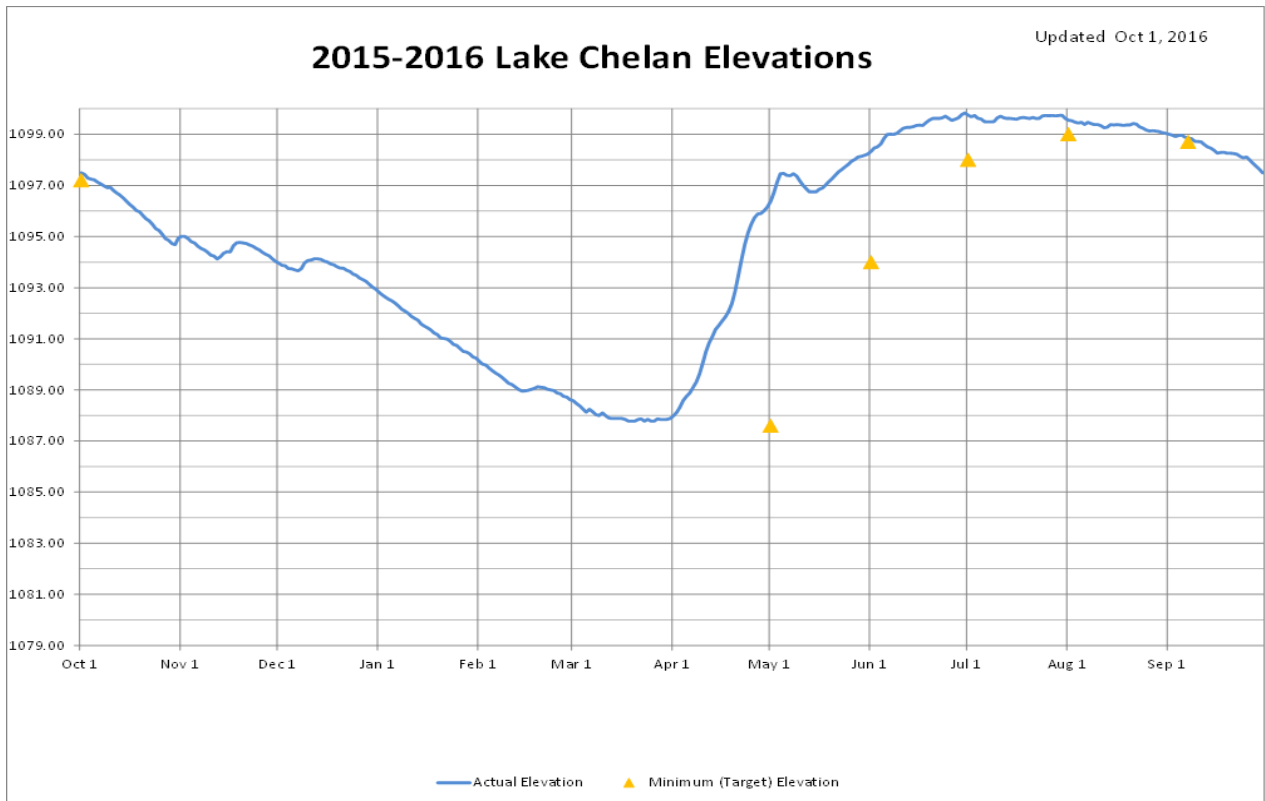


Figure 1. 2015-2016 Lake Chelan Elevations

SECTION 4: ACTUAL AND FORECASTED RUNOFF

April 1 through July 31, 2016, runoff forecasts for the Chelan Basin were produced on February 1, March 1, and April 1 of 2016. The runoff forecast on February 1 of 106% was above average, the runoff forecast on March 1 increased slightly to 109% of average, and the runoff forecast on April 1 increased considerably more to 116% of average. Runoff volume forecasts and lake level are summarized below in Table 3.

Table 3: Runoff Volume Forecasts for April 1 – July 31, 2016

Date	Forecasted Percent of Average Runoff	Forecasted Runoff Volume (SFD)
February 1	106%	556,606
March 1	109%	572,359
April 1	116%	609,116

Actual runoff for April 1 through July 31 was just over 116% of average, producing 609,492 second-foot-days (SFD)⁵ of water.

⁵ The volume of water represented by a flow of 1 cubic foot per second for 24 hours.

SECTION 5: DECISIONS RELATED TO LAKE LEVEL

Chelan PUD manages Lake Chelan lake levels with the intent of meeting operating objectives, target lake levels (to the extent consistent with the objectives), and providing efficient operation of Chelan PUD generating resources. All operating objectives, with the exception of reducing high flows in the Chelan River, and monthly target lake levels were achieved in 2016. The reducing high flows in the Chelan River objective was not met due to record inflows in April 2016, a simultaneous generating unit overhaul reducing generating capability by half and continued very high inflow forecasts throughout May and early June that threatened to result in the reservoir elevation going above the license limit of 1,100 feet. Details are provided later in this section.

Operations during the fall of 2015 are summarized in this paragraph, as these operations set up operations for 2016. After the return of unit A1 from an overhaul on October 8, 2015, generation through December 2015 was scheduled at near maximum to provide reservoir draft, to create room for spring runoff, to provide flood control, and to generate electricity. Snowpack accumulation by the end of December 2015 was already well over average. Additionally, inflows were considerably greater than average and inflow projections showed a continuing upward trend. Considering actuals to date and forecasts, there was the expectation of having plenty of water to meet tailrace security flows for Chinook salmon later in the winter.

Table 4: Lake Chelan Basin Percent of Average Precipitation for fall/winter 2015/2016

	October 2015	November 2015	December 2015	January 2016	February 2016	March 2016
% of 85-yr Average	203%	141%	186%	141%	121%	170%

The lake level on January 1, 2016 was 1,092.8 feet. Generation continued to be scheduled at near maximum month average capacity during January, February and through mid-March in order to continue to draft the reservoir, while still retaining enough water to maintain tailrace security flows through March. Accumulated inflows remained higher than average. A construction project along the Chelan River in the City of Chelan was scheduled for two weeks in March. In order to keep lake levels low enough for construction to be completed (1,088.0 feet), moderate amounts of spill, up to 1940 cfs, were begun in late February. Because lake levels were higher than average, rather than reduce spill to minimum requirements and begin a pumping operation to provide spawning flows for steelhead in the spring, the spill was maintained at required spawning flow level. Additionally, in mid-March, a scheduled six week overhaul of unit A2 began.

The reservoir reached a higher than average low point of 1,087.77 feet on Mar 20, 2016, despite near maximum generation for most of the fall and winter and the aforementioned spill, due to higher than average accumulated inflows. The April through July runoff forecast on April 1 was at 116% of average.

April was approximately six degrees warmer than average. This translated into the highest April inflows to Lake Chelan in 64 years. Due to the record inflows and the outage that reduced generation capability by half, lake levels climbed rapidly in April. On April 27, 2016, spill was increased for headwater control, and continued intermittently through July 7, to manage the refill rate of Lake Chelan in order to meet license objectives and lake level targets. May inflows were also extremely high. On May 5, 2016 the lake level was 1,097.5 feet. High inflow forecasts were threatening to result in the reservoir elevation going above the license limit. Once unit A2 was returned to service on May 5, generation remained at full capability until mid-June. Refill timing was early, with over 88% of the April 1 to July 31 runoff occurring by July 1 (80% is considered average).

One of the priority operating objectives is to reduce high flows in the Chelan River (below 6,000 cfs)⁶ to protect fish habitat. Due to the extreme nature of the year and aforementioned events, that operating objective was not met in 2016. Spill for headwater control resulted in a peak hourly flow of 9,140 cfs in the Chelan River on May 5 and a maximum daily average flow of 9,120 cfs also on May 5. Lake level management did provide adequate flood control and resulted in meeting minimum required flows in the Chelan River, both priority operating objectives.

When not spilling for headwater control, spill remained at approximately 200 cfs through July 15, to meet fish flow objectives in Reach 4 of the Chelan River. Increase in spill above 80 cfs is required in average runoff years (80% to 118% water year is considered average).

Once inflows dropped below turbine capacity, briefly in mid-June and permanently for the season in July, light load generation and then heavy load generation were reduced. On August 1, the lake elevation was above the target elevation of 1,099.0 at 1,099.6. A maximum end-of-hour lake level of 1,099.86 feet was achieved on June 30, and a maximum daily average lake level of 1,099.82 feet was achieved also on June 30.

The reservoir was gradually drafted through August and early September and reached the September 7 minimum lake level target of 1,098.7 feet on September 9. The reservoir continued to be gradually drafted to just above the October 1 minimum lake level target of 1,097.2 feet on that date. Beginning shortly after October 1, the reservoir draft stagnated considerably through October and November with near record inflows during this period. Generation remained at full capability for all but a few hours. In November, spill from the reservoir was used to provide spawning flows for Chinook salmon rather than a pumping operation due to the significant inflows. In December 2016, full generation continued while inflows began to moderate and the reservoir picked up its draft. These fall actions were taken to provide reservoir draft, to create room for spring runoff, to provide flood control, and to generate electricity.

⁶ Section 3.1 of Chapter 8, Final Lake Chelan Comprehensive Settlement Agreement for the Lake Chelan Project No. 637, dated October 8, 2003.

SECTION 6: CONSULTATION

As required in Article 405, Chelan PUD distributed a draft copy of this report on January 18, 2017, to February 17, 2017 (31 days) to the following resource agencies, Tribes and non-governmental organizations for review and comment (see email attached).

Agency	Contact
Washington Department of Ecology	David Bowen, Mark Peterschmidt, Breean Zimmerman
U.S. Geological Survey (USGS)	Nick Elwell
NOAA National Marine Fisheries Service	Justin Yeager
U.S. National Park Service	Annelise Lesmeister, Ashley Rawhouser, Hugh Anthony
U.S. Forest Service	Kari Grover-Wier, Paul Willard, Emily Johnson
U.S. Fish and Wildlife Service	Steve Lewis
Washington Department of Fish and Wildlife	Graham Simon, Travis Maitland
Washington State Parks and Recreation Commission	Ryan Layton
Washington State Recreation and Conservation Office	Karen Edwards
Confederated Tribes of the Colville Reservation	Bill Towey
The Yakama Nation	Bob Rose
The Confederated Tribes of the Umatilla Indian Reservation	Carl Merkle
City of Chelan	Mike Cooney, Mike Jackson
Citizen, Senior Fisheries Biologist	Phil Archibald
Manson Parks and Recreation Department	Robin Pittman
Lake Chelan Recreation Association	Richard Uhlhorn, Jim Urness
American Whitewater	Tom O'Keefe

Sokolowski, Rosana

From: Osborn, Jeff
Sent: Monday, February 27, 2017 11:08 AM
To: Sokolowski, Rosana
Subject: FW: Lake Chelan Annual Lake Level Report
Attachments: Draft LC 2016 Annual Lake Level Report 011717.docx

Rosana: Please see the email below submitting the draft 2016 Lake Chelan Annual Lake Level Report for agency and public review. Per the email, I requested comments to be sent to me by Friday, February 17, 2016. I received no comments on the draft report.

Jeff

Jeff Osborn
License Compliance Supervisor
Public Utility District No. 1 of Chelan County
327 North Wenatchee Avenue
PO Box 1231
Wenatchee, WA 98807-1231
Phone: 509-661-4176
FAX: 509-661-8108
Email: jeff.osborn@chelanpud.org

From: Osborn, Jeff
Sent: Wednesday, January 18, 2017 4:39 PM
To: David Bowen; Mark Peterschmidt; Breean Zimmerman; Nick Elwell; Justin Yeager; Annelise Lesmeister; Ashley Rawhouser; Hugh Anthony; Kari Grover Wier; Paul Willard; Emily Johnson; Steve Lewis; Graham Simon; Travis Maitland; Bill Towey; Bob Rose; Carl Merkle; Mike Cooney; 'Mjackson@cithyofchelan.us'; 'Ryan.layton@parks.wa.gov'; 'Info@mansonparks.com'; 'karen.edwards@rco.wa.gov'; Phil Archibald; 'richard@richarduhlhorn.com'; 'jamesurness@hotmail.com'; 'okeefe@amwhitewater.org'
Cc: Keating, Becky L; Hays, Steve; Smith, Michelle; Sokolowski, Rosana
Subject: Lake Chelan Annual Lake Level Report

PUBLIC UTILITY DISTRICT NO. 1 of CHELAN COUNTY
P.O. Box 1231, Wenatchee, WA 98807-1231 • 327 N. Wenatchee Ave., Wenatchee, WA 98801
(509) 663-8121 • Toll free 1-888-663-8121 • www.chelanpud.org

Re: Lake Chelan Hydroelectric Project No. 637
License Article 405 – 2016 Annual Lake Level Report

It is that time of year again! Please find the 2016 Lake Chelan Annual Lake Level Report attached for your review and comment.

We plan to finalize and submit the 2016 Lake Level Report to the Federal Energy Regulatory Commission on February 28, 2016. For your information, we've provided a summary and links to this License requirement below.

Please submit your comments to me at jeff.osborn@chelanpud.org on or before the end of the day on **February 17, 2016**. All comments received and Chelan PUD responses will be included in the final report submitted to FERC.

If you have any questions, please feel free to contact me at 509-661-4176. Thank you, very much, for taking time out of your busy schedules to review the report.

Jeff

Jeff Osborn
License Compliance Supervisor
Public Utility District No. 1 of Chelan County
327 North Wenatchee Avenue
PO Box 1231
Wenatchee, WA 98807-1231
Phone: 509-661-4176
FAX: 509-661-8108
Email: jeff.osborn@chelanpud.org

FERC License Order, November 6, 2006 :

<http://www.chelanpud.org/documents/9009.pdf>

(b) a provision to file with the Commission within one year of the issuance date of the license, and annually thereafter, a report comparing monthly actual and target lake levels; and runoff volume forecasts and other factors influencing achievement of targeted lake levels; and (c) an implementation schedule. The licensee shall prepare the plan after consultation with **the Washington Department of Ecology; NOAA National Marine Fisheries Service (NMFS, U.S. Geological Survey (USGS), U.S. Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, Washington State Parks and Recreation Commission, Washington Interagency Committee for Outdoor Recreation, Confederated Tribes of the Colville Reservation, the Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, City of Chelan, Lake Chelan Sportsman's Association, Manson Parks and Recreation Department, Lake Chelan Recreation Association, and American Whitewater.**

Order Modifying and Approving Operations Compliance and Monitoring Plan, Article 405, November 30, 2007:

http://www.chelanpud.org/departments/licensingCompliance/lc_implementation/ResourceDocuments/9494_1.pdf

(C) The licensee shall file annually with the Commission by February 28, beginning in 2009, their Annual Lake Level Report. 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 Commission.