Evaluation and Findings Report

on the

Application for Certification Pursuant to Section 401 of the Federal Clean Water Act

Submitted by
Portland General Electric Company
for the
Clackamas Hydroelectric Project
(FERC No. 2195)

Pursuant to
Oregon Administrative Rules Chapter 340, Division 48
Prepared by:
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1. INTRODUCTION

Portland General Electric owns and operates a hydroelectric facility on the Clackamas River, in Clackamas County, Oregon. The facility includes seven dams, six reservoirs, and four powerhouses, and is described in more detail in Section 3.2 below. The Federal Energy Regulatory License for this project expired on August 31, 2006. Portland General Electric Company (PGE) applied to the Federal Energy Regulatory Commission (FERC) in August, 2004, for a new license to continue operation of this project, officially referred to as the Clackamas Project, FERC No. 2195. PGE selected an alternative licensing process to renew its operating license. This process was based on cooperation and collaboration with federal and state resource agencies, Native American Tribes, local governments, non-governmental organizations (NGO's), and interested members of the public. PGE intended this process to include sound science, shared knowledge and open communication. In March of 2006, PGE and 32 other parties submitted an Offer of Settlement to FERC regarding the Clackamas Project operations and resource protection, mitigation and enhancement measures (PME's) to be included in the new license for the Project.

As part of the FERC relicensing process, PGE must obtain a water quality certification for the Project from the Oregon Department of Environmental Quality (ODEQ; Department), pursuant to the requirements of Section 401 of the Federal Clean Water Act, 33 U.S.C. §1341, and Oregon Administrative Rules Chapter 340, Division 48. PGE originally filed a Draft Section 401 Application as required by state rule (Oregon Administrative Rule 340-48-0020(5)) on October 7, 2003. PGE also filed a final Section 401 Application on August 18, 2004. In June of 2005, PGE filed a Settlement Agreement with FERC, and on June 30, 2005, PGE withdrew the August 18, 2004 application and concurrently submitted a new § 401 Application. This application was withdrawn on May 2, 2006, and a new application, reflecting the March 2006 Settlement Agreement was filed on December 28, 2006. This application was in turn withdrawn on November 15, 2007 and a new application was filed on June 20, 2008.This latter application included additional measures to address impacts in the lower Clackamas River.

As required by ORS Chapter 543A, PGE filed a Notice of Intent to Reauthorize its project on October 22, 1998. PGE's Final License Application to FERC in August, 2004 also served as application to renew PGE's Oregon water rights for the Clackamas Project. PGE has also filed a request for a basin exception that will be required to facilitate issuance of the new water right.

This Evaluation Document is ODEQ's evaluation and findings regarding the June 2008 § 401 Application for the federal Clean Water Act § 401 certification. The record generated in the process of reviewing the § 401 application, all supplemental information submitted by PGE, and all materials received as part of the public review process, are considered part of the record regarding the § 401 application.

2. REQUIREMENTS FOR CERTIFICATION

2.1 Applicable Federal and State Law

Section 401 of the Federal Clean Water Act (Clean Water Act or CWA), 33 USC §1341, establishes requirements for State certification of proposed projects or activities that may result in any discharge of pollutants to navigable waters. Before a Federal agency may issue a permit or license for any project that may result in any discharge of pollutants to navigable waters, the state must certify that the proposed project will comply with applicable provisions of Sections 301, 302, 303, 306, and 307 of the Clean Water Act and any state regulations, including state water quality standards, adopted to implement these sections. The state is further authorized to condition any granted certification to assure compliance with state water quality standards and other appropriate water quality-related requirements of state law.

DEQ is the agency of the State of Oregon designated to carry out the certification functions prescribed by § 401 of the Clean Water Act for state waters. DEQ must act on an application for certification in a manner consistent with the following federal and state requirements:

Federal Requirements:
Sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act. These sections prescribe effluent limitations, water quality related effluent limitations, water quality standards and implementation plans, national standards of performance for new sources, and toxic and pretreatment effluent standards.

State Requirements:
OAR 340-041 and 340-048-0005 to 340-048-0050: These rules were adopted by the Environmental Quality Commission (EQC) to prescribe the state's water quality standards (OAR 340-041) and procedures for receiving, evaluating, and taking final action upon a § 401-certification application (OAR 340-048). The rules include requirements for general information such as the location and characteristics of the project, as well as confirmation that the project complies with appropriate local land use plans and any other requirements of state law that have a direct or indirect relationship to water quality.

ORS 468B.040: This state statute prescribes procedural requirements and findings with which DEQ must comply as it makes a decision on a § 401-certification application. This statute makes reference to the federal law requirements, state water quality rules, and other requirements of state law regarding hydroelectric projects.

ORS 197.180(1): This statute requires state agency actions to be consistent with acknowledged land use plans and implementing regulations, or if a plan is not acknowledged, compatible with state land use goals. Findings must support the state agency action.

ORS 543A: This statute establishes procedures for coordination among state agencies in the reauthorization of federally licensed hydroelectric projects, including state certification of water quality.

EQC rules identify the information that must be included in an application for § 401 certification (OAR 340-048-0020(2)). The application together with information provided during public comment and interagency coordination is essential to support the following determinations to be made by DEQ pursuant to § 401 of the Federal Clean Water Act and state law:
• The determination of whether to issue or deny certification.
• The determination of conditions which are appropriate to include in any granted certificate.
• Development of findings as required by ORS 468B.040 and ORS 197.180(1).

2.2 General Application of State Water Quality Standards

Oregon water quality standards are contained in Oregon Administrative Rule (OAR) Chapter 340, Division 41 entitled "Department of Environmental Quality Water Pollution Division 41 Water Quality Standards: Beneficial Uses, Policies, and Criteria for Oregon." The water quality standards in Division 41 are composed of three elements: beneficial uses, numeric and narrative criteria, and the antidegradation policy, and are further implemented through Total Maximum Daily Loads (TMDLs) as applicable. The role of each of these is explained below.

2.2.1 Beneficial Uses

The Federal Clean Water Act and Oregon water quality standards are structured to require that water quality be protected and maintained so that existing and potential beneficial uses of public waters are not impaired or precluded by degraded water quality. The regulatory approach used is to: (1) identify beneficial uses that are recognized as significant with regard to water quality protection; (2) develop and adopt criteria for significant water quality parameters that are necessary to protect the identified beneficial uses; (3) establish and enforce discharge limitations for each source that is permitted to discharge treated wastes into public waters to assure that water quality standards are not violated and beneficial uses are not impaired; and (4) establish and implement "best management practices" for a variety of "land

management" activities to minimize their contribution to lower water quality standards and impairment of beneficial uses.

Beneficial uses to be protected have been identified generally for each river basin in Oregon and specifically for significant stream reaches within some basins. The State's designated beneficial uses to be protected in the Clackamas Basin, where PGE's Clackamas Project is located, are listed in OAR 340-041-0340, Table 340A, and Figures 340A and 340B. These uses include public, private, domestic, and industrial water supply; irrigation; livestock watering; fish & aquatic life; wildlife & hunting; fishing; boating; water contact recreation; aesthetic quality; and hydropower.

2.2.2 Narrative and Numeric Criteria

Generally, the assumption is made that if water quality meets the numeric and narrative criteria for the most sensitive beneficial use, then the criteria is fully protective of all the beneficial uses. Water quality criteria have been adopted for water quality parameters that are most significant or useful in regulating pollution. These criteria take the form of both numeric limits and narrative statements and have been established based on best available information at the time they were adopted. Development of water quality standards is a continuing process. As new information becomes available, standards for additional parameters may be added and existing numeric and narrative criteria may be revised to better reflect the intent of protection of the identified beneficial uses.

2.2.3 Antidegradation Policy

Oregon's antidegradation policy (OAR 340-041-0004) applies to all surface waters. In the case of bodies of water that meet water quality standards, it provides for the maintenance of existing water quality. Specifically, the policy states that the existing quality of high quality waters (i.e., waters meeting water quality standards) shall be maintained and protected unless the Environmental Quality Commission makes certain rigorous findings of need. For water quality-limited waters, water quality may not be lowered; that is, these waters have a no degradation status.

2.2.4 Total Maximum Daily Loads (TMDLs)

DEQ develops, and the U.S. Environmental Protection Agency approves, total maximum daily loads (TMDLs) for waters listed as water quality-limited pursuant to CWA §303(d). A TMDL identifies the amount of a specific pollutant that a water body can receive and still meet water quality standards and support the beneficial uses designated in that waterbody. A TMDL also identifies wasteload allocations for point sources of pollutants and load allocations for non-point sources. For hydroelectric projects located on water quality-limited waterbodies, a § 401 certification may serve as the means for implementing load allocations assigned to the project. DEQ may require a nonpoint source such as a hydroelectric facility to submit and implement a temperature management plan ((OAR 340-041-0028(12)(h)), or a TMDL Implementation Plan (OAR 340-042-0080). Rules for developing, issuing and implementing TMDLs are in OAR 340-42-0025—0080.

3. PROJECT INFORMATION AND SUMMARY OF PROJECT

3.1 Applicant Information

3.1.1 Name and Address of Project Owner (Applicant)

Portland General Electric Company
121 SW Salmon Street
Portland, Oregon 97204

3.1.2 Name and Address of Owner's Official Representative

Julie A. Keil, Hydro Licensing and Water Rights
Portland General Electric Company
121 SW Salmon Street
Portland, Oregon 97204
(503) 464-8864

3.1.3 Documents Filed in Support of § 401 Application

PGE has filed the following documents in support of its § 401 Application for a new operating license for the Clackamas Hydroelectric Project:

Application for Certification Pursuant to Section 401 of the Federal CWA for the Clackamas Project, June 2008, and supplemental filings to amend the application
Application for Certification Pursuant to Section 401 of the Federal CWA for the Clackamas Project, December 2006.
License Application for PGE's Clackamas Hydroelectric Project FERC Project No 2195, License Application, August, 2004
Technical Reports circulated prior to the license submission are included as electronic files in the License Application, and are not listed separately here. Reports discussed in this § 401 Evaluation are referenced individually, and identified in Section 10, References,
Settlement Agreement Concerning the Relicensing of the Clackamas River Hydroelectric Project—FERC Project Number 2195, March, 2006.
Offer of Settlement, Joint Explanatory Statement, Project No. 2195. Portland General Electric Company. 2006.
Initial Information Package for the Clackamas River Hydroelectric Project, Oak Grove Fork Project-FERC No. 125 and North Fork Project-FERC No. 2195

3.1.4 Notification of Complete Application

On February 18, 2009, DEQ notified PGE that it deemed the Application for § 401 Certification received on June 20, 2008 for the Clackamas Project to be administratively complete for processing.

3.2 Project Description and Proposed Operations

Detailed descriptions of the project and its current operations are included in the License Application to FERC, (August, 2004). A detailed legal description is included in Exhibit G, while more general project descriptions are included in Exhibit A. A short description of the project is provided here. The Project is located in the Clackamas River Basin in Clackamas County, Oregon. The Clackamas River Basin lies southeast of the city of Portland, includes part of the Portland metropolitan area, and reaches up to the headwaters in the Cascade Mountains.

The Project consists of two hydropower developments, the Oak Grove Development and the mainstem developments, collectively referred to as the North Fork Development (Figure 1). These were originally licensed under two separate FERC licenses (FERC Numbers 135 and 2195,) that were combined under a single license in June, 2003 (FERC P-2195).

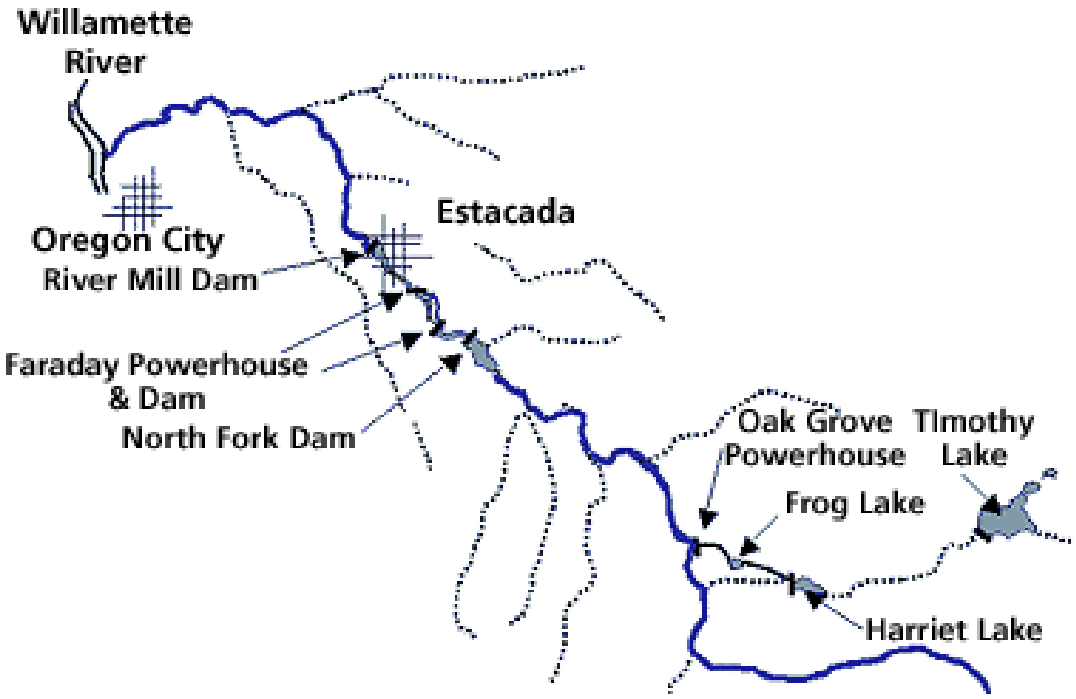

Figure 1. A map showing the Oak Grove and North Fork Developments in the Clackamas Basin.

3.2.1 Clackamas Project Facilities

The Oak Grove Development:
The Oak Grove Development, which is the uppermost of the Project developments, is located on both the Clackamas River and the Oak Grove Fork of the Clackamas River (Oak Grove Fork). The Oak Grove Fork joins the mainstem Clackamas River at river mile (RM) 52.2. For the purposes of this report, river miles start at the mouth of the Clackamas River, and are continuous up the Oak Grove Fork. The Oak Grove Powerhouse is located on the Clackamas River mainstem at approximately RM 46.8. Further upstream, Timothy Lake (RM 68.7) serves as the storage reservoir for the Oak Grove Fork Development. Water released from Timothy Lake Dam flows down the upper Oak Grove Fork to Lake Harriet (RM 57.7). Approximately one mile downstream from Timothy Lake Dam, a portion of the river's flow is diverted to Eugene Water and Electric Board's (EWEB) Stone Creek Project (FERC Project No. 5264). The Stone Creek Powerhouse discharges back to the Oak Grove Fork approximately 3.5 miles upstream of Lake Harriet. This EWEB project was licensed separately and is not part of this relicensing. Water from Lake Harriet Dam is diverted to Frog Lake, and through penstocks to the Oak Grove Powerhouse. The entire Oak Grove Development, except for the western portion of its transmission line, lies within the Mt. Hood National Forest.

The Oak Grove Powerhouse and Harriet Lake were completed in 1924. At the time of construction, this powerhouse had the highest head of any powerhouses in existence. The difference in water level above and below a powerhouse is referred to as "head." The greater this vertical distance, the larger the head is, and the more power that can be generated from the increased force of water hitting the turbines. Harriett Lake was rehabilitated in 1985-1986 to address cracks in the dam. Frog Lake was built to allow peaking generation at the Oak Grove Powerhouse and was completed in 1953. This lake was renovated in 1997 to address leakage and land slide risks. Timothy Lake was completed in 1956 to improve power generation during low flow periods between September and April.

The North Fork Development:
The North Fork Development includes the North Fork Dam and Reservoir, the Faraday Diversion Dam, Faraday Diversion Reach, Faraday Lake, dam and powerhouse, and River Mill Dam and powerhouse (Figure 1). These three mainstem powerhouses are located in sequence on the Clackamas River

between RM 29.2 and RM 22.3. Water released from North Fork Dam is diverted by the Faraday Diversion Dam into Faraday Lake, with approximately 120 cfs remaining in the mile-long Faraday Diversion Reach. Water is released from Faraday Lake via the Faraday Powerhouse into Estacada Lake, formed by River Mill Dam. Water released from River Mill Dam flows into the lower Clackamas River.

These three power-generating facilities have a considerable range in age. The Faraday development was the oldest of the three, having been completed in 1907. Flood damage later required a reconstruction of the diversion dam in 1966. River Mill Dam was completed in 1911, with additional turbines added to the dam in 1927 and 1952. North Fork Dam was operational in 1958.

3.2.2 Waters of the State Potentially Impacted by Project

The Oak Grove Fork and the Clackamas River are influenced by the project for approximately 75 miles, from PGE's Timothy Lake impoundment in the Cascades to the mouth of the Clackamas at its confluence with the Willamette River. Project operations result in storage of water in the reservoirs, diversions from river reaches, power generation releases, and spills at various locations in the river system. Consequently, the hydrologic regime is altered relative to the natural flow for much of the river. Changes in travel times, velocities, and water depths alter the temperature and water quality response of the Oak Grove Fork and Clackamas River relative to the pre-Project conditions.

Water quality concerns associated with reservoirs are typically associated with increased storage times and stratification, conditions which, with appropriate nutrient input, can lead to algal blooms. In turn, these impacts can alter water quality and temperatures of the discharged water and affect water quality variables such as dissolved oxygen (DO), chlorophyll *a*, and pH. Reservoirs may also alter the water temperature of downstream reaches. The Clackamas Project also includes flow diversions. In addition to the resultant reduction in flows in the bypassed reaches, such diversions can also increase water temperature, and affect other water quality parameters such as dissolved oxygen and pH.

The waters of the state impacted by the Project are described below
Timothy Lake: Timothy Lake causes the most upstream project-related modification to the flow regime. Situated at about 3200' above sea level, the lake is located high in the Oak Grove watershed with the dam at river mile 68.7. Approximately 3.5 miles of the Oak Grove Fork Basin have been inundated by Timothy Lake. The reservoir receives significant inflow not only from the upper Oak Grove Fork but also from Crater Creek and Cooper Creek. Timothy Lake, like most deep reservoirs (the maximum dam height is 105') is highly stratified in summer, resulting in higher surface temperatures relative to the streams upstream of the reservoir. The phytoplankton community in the reservoir also differs from the periphyton present in the shallow streams upstream of the reservoir. The reservoir is characterized as mesotrophic or moderately productive, and is commonly dominated by *Anabaena,* a cyanobacteria or blue-green algae species. Operation of the reservoir results in periods when the existing discharge is greater than inflow, for example during reservoir drawdown in fall, and periods when the outflow is less than inflow such as during reservoir refill in spring. The outlet is situated at an elevation 70' below the dam, and thus releases relatively deep water from the system. The maximum discharge is 675 cfs, but the Howell Bunger valve is not operated higher than 500 cfs due to observed vibration. Timothy has a surface area of 1430 acres and a gross storage capacity of 69,000 acre-feet.

Upper Oak Grove Fork: The upper Oak Grove Fork from RM 68.4 to RM 58.7 is a 9.7-mile-long reach that receives water from the Timothy Lake discharge. This reach receives significant input from groundwater, so the influence of the Timothy Lake discharge on the upper Oak Grove Fork is limited to the uppermost portion of this reach. The impact of Timothy Lake is most significant during periods when the lake is being drawn down and refilled. During the refill period (based on April 2000 through October 2001 conditions), the minimum discharge from Timothy Lake is about 20 cfs, and is lower than the 50 to 100 cfs inflow to Timothy Lake that occur during the same period. This reach is also strongly influenced by groundwater flows. Approximately 30 cfs of groundwater enters the Oak Grove Fork about 400 meters downstream of the discharge from Timothy Lake. By the time water reaches Lake Harriet at river mile 57.7, surface and groundwater accretion largely mask the effect of Timothy Lake operation on flow, temperature, and water quality.

Lake Harriet: Lake Harriet is a 0.88-mile long reservoir created by a dam located at RM 57.7 that supplies water to Frog Lake for discharge through the Oak Grove Powerhouse. Lake Harriet has a maximum depth of 68' and an average travel time through Lake Harriet is about 10 hours. There is little stratification, and water quality and temperature are consistent with the inflow to the reservoir from the Oak Grove Fork. There is continued accretion due to groundwater inflow along the upper Oak Grove Fork such that summer flow through this reach is approximately 300 cfs at Lake Harriet.

Frog Lake: Buried pipeline carries water from Harriett Lake into the 50' deep Frog Lake. This lake serves as a forebay to the Oak Grove Powerhouse. It was originally constructed in 1953 and was renovated in 1997 to make the lake smaller, addressing leakage and downslope stability issues. Storage capacity in Frog Lake is 252 acre-feet. The outlet of Frog Lake consists of two penstocks that deliver water to the Oak Grove Powerhouse, at an elevation 870-880 feet lower than the Frog Lake. When there is sufficient water, the Oak Grove Powerhouse is operated in a peaking mode, fluctuating the lake surface elevation by up to 10'.

Lower Oak Grove Fork: Nearly all water is diverted at Lake Harriet to the Oak Grove Powerhouse, with only spring-melt and storm-event flows in excess of 600 cfs passing over the spillway to the lower Oak Grove Fork. The lower Oak Grove Fork from RM 57.7 to RM 52.2 is characterized by low flow, which results solely from groundwater and surface water accretion within that reach. The summer flows of approximately 10-20 cfs in the Oak Grove Fork downstream of Lake Harriet are considerably lower than the 300 cfs base flows that would occur without the Project in place, resulting in higher water temperatures than would occur in the absence of the Project.

Upper Clackamas River: The upper Clackamas River reach impacted by the Project extends from RM 52.2 at the confluence with Oak Grove Fork to the upper end of North Fork Reservoir at RM 32.4. The primary Project effect in this reach is the decreased flow that occurs between the Oak Grove Fork (river mile 52.2) and the Oak Grove Powerhouse (river mile 46.8) caused by the water diversion from the Oak Grove Fork and sent to the powerhouse. During the critical summer period, the 350-400 cfs flow in this approximately five-mile-long reach comes mainly from the upper Clackamas. Natural summer flow in this reach would approximate 700-750 cfs of combined flow from the Clackamas and the Oak Grove Fork. Clackamas River waters upstream of the Oak Grove confluence are not affected by PGE's hydroelectric project.

North Fork Reservoir to River Mill Dam: The North Fork Development consists of North Fork Reservoir and North Fork Dam, Faraday Diversion Dam, Faraday Lake, the Faraday Diversion reach, and Estacada Lake and River Mill Dam. The reservoir storage and the operation of the powerhouses modify hydrologic conditions in this region from RM 32.4 to RM 22.3. The effect of these reservoirs on flow and water surface elevation is complex. Stratification in the reservoirs on the Clackamas mainstem is weak or non-existent. The series of reservoirs and pools on the mainstem are operated to mimic run of river conditions, where the outflow from River Mill Dam is equal to the inflows to North Fork Reservoir. The main effects of the reservoirs on hydraulics are deeper water, reduced velocities, and increased residence times.

North Fork Reservoir: This lake extends from RM 32.4 to RM 29.2 and has a normal maximum surface area of 350 acres. Average annual travel time through North Fork Reservoir is about 3.8 days. During the low flow summer period, travel times range up to two weeks. North Fork Reservoir exhibits the strongest stratification of the three reservoirs, which in both 2000 and 2001 had a maximum temperature difference between the epilimnion and hypolimnion of about 3 ºC. North Fork Reservoir is operated in a power-production peaking mode; releasing more water to generate more power in the morning, evening, or both, and less water during the remainder of the day. However, the daily variation in water surface elevation is limited to 5 feet, somewhat constraining generation and reservoir impacts. North Fork peaking is re-regulated in Faraday Lake, to meet the requirement that outflow at River Mill Dam is equal to inflows to North Fork Reservoir.

The Faraday Diversion Pool: This extends the base of the North Fork Dam (RM 29.2) to the Faraday diversion dam at RM 27.6. The pool has a normal maximum surface area of 55 acres. A tunnel diverts water to Faraday Lake.

The Faraday Diversion Reach: This is the original Clackamas River Channel, and has a more river-like character than the Faraday Diversion Pool. It extends from RM 27.6 to RM 25.3, between the Faraday Diversion Dam and the Faraday Powerhouse, and has a minimum flow of 120 cfs.

Faraday Lake: Faraday Lake is located just to the west of and runs parallel to the Faraday Diversion Reach. The lake has a storage capacity of 430 acre-feet with a short residence time, less than one day.

Estacada Lake: Both Faraday Lake and Faraday Diversion Reach flow into Estacada Lake. This lake impounds the river from RM 22.3 to RM 25.3 and has a normal maximum surface area (with 3-ft flashboards in place) of 150 acres. Estacada Lake can range up to 80' in depth. Travel time through Estacada Lake is about 1.8 days.

Lower Clackamas River: The Lower Clackamas River receives regulated discharge from the River Mill Dam, which is operated to minimize fluctuations to the lower river. Average annual travel time in this reach from RM 23.1 to the confluence with the Willamette River is approximately 11 hours; summer travel time is approximately 22 hours. The major effect of the Project on the lower river is that the water discharged at River Mill has a higher average temperature and less diurnal variation relative to the variation that would occur at this location if the Project were not in place. As the river flows downstream, diurnal heating due to solar radiation helps recover the natural temperature signature

3.2.3 Adjacent Land Use and Ownership

Land use in the vicinity of the Clackamas Project consists largely of forested and rural residential and agricultural use. The U.S. Forest Service (USFS), Mt. Hood National Forest owns the land adjacent to the Project area upstream of North Fork Reservoir. Most of the basin around and downstream of North Fork Reservoir is held by private landowners. The State of Oregon owns McIver Park, which is located on the west side of the Clackamas River downstream of River Mill Dam. Land ownership and management within the Project boundary (a total of approximately 3,596 acres) is summarized in Table 1. Approximately 2,372 acres (66 percent) of this area are owned by the USFS. Lands owned by PGE comprise 913 acres (25 percent), and other privately owned lands account for approximately 200 acres (6 percent).

Table 1. Land ownership and management within the Project boundary (Source: METRO 1997).

Land Owner	Acres	Percentage
United States Government		
Mt. Hood National Forest (USFS)	2,372	66%
Bureau of Land Management	111	3%
Private (excluding PGE)	200	6%
PGE Owned Lands	913	25%
Total	3,596	100%

3.2.4 Operations Proposed in the Settlement Agreement

In March of 2006, PGE, DEQ and 31 other parties signed a Settlement Agreement (2006) that resolves issues surrounding the issuance of a FERC order to provide a new license for this project. The parties agreed on conditions and operations to protect the resources and interests of all the parties. The Settlement Agreement was submitted to FERC to amend the PGE license application. It describes the agreed upon operations and proposes language for license articles to reflect those operating procedures and other license conditions. Proposed operations include such measures as reservoir surface water elevations, instream flow requirements, seasonal flow schedules, habitat enhancements, and fish passage and sorting improvements, among many others. The proposed operations are numerous and

detailed and are not summarized in this section. A detailed description can be found in the Settlement Agreement.

PGE's June 2008 Application for a § 401 Certificate is based on the operations agreed upon in the Settlement Agreement. The Settlement Agreement operations that affect water quality are described in the § 401 Application and are summarized appropriately throughout Section 5 of this document.

4. BENEFICIAL USES AND WATER QUALITY STATUS OF THE CLACKAMAS RIVER

This Evaluation Report includes a review of the Project impact on each applicable water quality standard. Water quality standards are comprised of three elements, the beneficial uses to be protected, the water quality criteria intended to protect those uses and the antidegradation policy that protects existing water quality from degradation. In order to support the beneficial uses, different water quality criteria may apply to different times and reaches within those waterbodies. This section of the Evaluation Report identifies which beneficial uses have been designated in the Clackamas River. It also summarizes the known water quality impairments documented in the River. The detailed discussion regarding the Project impact on water quality standards is in Section 5.

4.1 Beneficial Uses in the Clackamas Basin

The aquatic beneficial uses that are designated by Oregon water quality standards in the Clackamas River are: public, private and domestic water supply; irrigation; livestock watering; wildlife and hunting; fishing; fish and aquatic life; boating; water contact recreation; aesthetic quality; and hydropower [OAR 340-41-0340 Table 340A]. Fish and aquatic life is a designated use that is further defined in the water quality rules [Figures 340A and 340B of OAR 340-41] and is summarized below (Table 2). These more detailed fish uses determine which numeric temperature and dissolved oxygen criteria are applicable to various reaches of the Clackamas River. The water quality criteria for these uses are described in detail in sections 5.2.5 and 5.2.1 of this document.

Table 2. Fish and Aquatic Life Use Designations in the Clackamas Basin.

Fish Use	River Miles	Applicable Time Period
Core cold water spawning for anadromous fish	From river mile 8 upstream to the barrier falls on the Lower Oak Grove Fork at river mile 56	September 1-June 15
Core cold water spawning for resident trout	From the upper watershed down to the barrier falls at river mile 56	January 1-June 30; The spawning criterion for dissolved oxygen applies, but there is no spawning criterion for temperature; the rearing criterion applies year round in this reach.
Core cold water rearing	From upper water shed down to Clackamas river mile 8 throughout the drainage	At location and time periods when the spawning criteria does not apply
Cold water spawning	Clackamas River mouth to Clear Creek confluence at river mile 8	October 15-May 15
Cold water rearing	Clackamas River mouth to Clear Creek confluence at river mile 8	May 16-October 14

4.2 Threatened and Endangered Aquatic Species in the Clackamas River Basin

Significant population units that are included on state or federal lists of endangered or threatened species, and occur in or migrate through the Clackamas River, are listed in Table 3. The summary is included here both to highlight the sensitive nature of the aquatic resources in the basin, and because the application of some state water quality criteria depend on the endangered species status.

Table 3. Aquatic species with populations Identified as at risk in the Clackamas Basin, accompanied by related listing information

Species	Ecologically Significant Unit	Federal Listings	State Listings
Coho	Lower Columbia River	Threatened	Endangered
Fall Chinook	Lower Columbia River	Threatened	Critical
Winter Steelhead	Lower Columbia River	Threatened	Critical
Pacific Lamprey		Species of Concern	Vulnerable
Coastal Cutthroat Trout	Southwestern Washington/Columbia River	Species of Concern	Vulnerable
Northern Red-Legged Frog		Species of Concern	Vulnerable

4.3 Water Quality Impairment in the Clackamas River Basin

Oregon DEQ is required to maintain a list of waters that have poor water quality and thus fail to support their beneficial uses. This list is required under the federal Clean Water Act's section 303(d) and in Oregon Administrative Rule (OAR 340-41-0046), and is commonly referred to as either the list of water quality limited waters, or the 303(d) list. Waterbodies included on this list may be subject to specified treatment under some DEQ actions, such as developing permit conditions and antidegradation review. In addition, DEQ must develop Total Maximum Daily Loads (TMDL) for these water bodies. TMDLs establish pollutant load allocations that will protect that waterbody from violating water quality standards, thus re-establishing support for the beneficial uses. Procedures for the issuance and implementation of TMDLs are described in Oregon rule (OAR 340-42).

The Lower Clackamas River has been included on DEQ's list of water quality impaired waters, since 1998. Two parameters are included, bacteria, as measured by *E. coli*, and water temperature (Table 4). These reaches and listings were addressed by the Willamette Basin TMDL (2006). The TMDL was completed and approved by EPA in September 2006. It provides a load allocation for temperature to the Clackamas project. No allocation was provided to the project for bacteria, as it does not contribute bacteria to the river system.

In order to issue a § 401 Water Quality Certification, DEQ will evaluate the § 401 Application to determine whether the Project, as operated under the proposed new conditions, will contribute to water quality violations. When a hydroelectric project is operated on a waterbody that has impaired water quality, the proposed operations will be evaluated to determine whether they comply with the allocations provided for the project in the TMDL.

Table 4. Water Quality Limited Status of the Clackamas River

Parameter	Clackamas River Miles	Season for Listing	Date of TMDL Issuance
Bacteria (*E. coli*)	0-15 Mouth of the Clackamas to confluence with Eagle Creek	10-20% of some samples collected exceeded the 406 colony count criteria	Willamette Basin TMDL, Approved by EPA in September 2006
Temperature	0-22.9 Mouth of the Clackamas to Tailrace of River Mill Dam	76% of data violated summer temperature criteria	Willamette Basin TMDL, approved by EPA in September 2006

5. EVALUATION OF COMPLIANCE WITH STATE WATER QUALITY STANDARDS

5.1 Water Quality Standards Evaluated in this § 401 Review

As with any proposed activity that requires a § 401 Water Quality Certification, some water quality standards are more likely to be affected than others. This section identifies which water quality standards are not likely to be violated by PGE's Clackamas hydroelectric project (Table 5) and which standards might be violated (Table 6). Section 5.2 then provides a detailed analysis of the proposed project operating conditions on each water quality standard that might be affected by the Project.

5.1.1 Water Quality Standards not of Concern

Table 5 lists the water quality standards that DEQ does not expect to be affected by the Clackamas Hydroelectric Project. PGE proposed that the Clackamas River Hydroelectric Project does not impact these water quality standards. DEQ agrees with this interpretation, because there are no known pollutant sources resulting from the Project or its operation that may impact these standards. Further, these standards are not known to cause problems at other hydroelectric plants or impoundments.

Table 5. Water quality criteria that are not expected to be affected by the Clackamas Hydroelectric Facility.

Standard	Brief Description	Project Impact not Expected
Bacterial Pollution	Limits in-water concentration of bacterial cells, because bacteria can cause or be an indicator of vectors that cause disease. [OAR 340-41-009]	Project does not discharge or provide sources of human or animal waste that could be washed into adjacent waters.
Development of fungi	The development of fungi or other deleterious growth not allowed [OAR 340-41-007(11)]	The Project does not discharge nutrients or substances that contribute to fungal growth.
Radioisotopes	Not allowed above maximum permissible concentrations in drinking water, or in fish, shellfish, or wildlife tissue [OAR 340-41-007(16)]	The Project does not add radioactive substances to water.
Total Dissolved Solids	Limit of 100 mg/L in the Willamette Basin [OAR 340-41-033]	The Project does not add anything to water that would increase TDS and impoundments are not likely to increase TDS in downstream waters.
Sediment	Bottom deposits deleterious to habitat and aquatic life are not allowed [OAR 340-41-007(13-14)].	Dam's retention of sediment is more problematic than sediment release.

In the § 401 Application, PGE proposed that turbidity, and discoloration, scum and oily sleeks are standards that are not impacted by the Project. DEQ has found that these may be impacted by hydroelectric projects in general. Thus, they are included in Section 5.2 along with other criteria that may be impacted by the Project and their impact at the Clackamas Project is evaluated in this document.

5.1.2 Water Quality Standards of Potential Concern

The standards that are of potential concern for this project are listed in Table 6. The § 401 Application has been evaluated to determine whether the new license operations will contribute to water quality violations for the following criteria. The discussion and findings of this evaluation are included in the Section 5.2 below. Section 5.2 describes what evidence provides reasonable assurance that the Project will not contribute to water quality degradation or eventual impairment under the new license. The Evaluation also indicates whether the PGE must follow specified operating conditions at this project to ensure that water quality will be protected.

Table 6. Water Quality Standards that are potentially affected by the Clackamas Hydroelectric Project.

Standard	Brief Description	Potential Impact
Dissolved Oxygen	Sufficient concentrations of dissolved oxygen are necessary to support aquatic life [OAR 340-041-0016].	Hydroelectric dams may influence the aquatic environment in ways that lower dissolved oxygen concentrations by increasing algal and plant productivity, or by increasing the accumulation of oxygen demanding sediment.
pH	Limits are between 6.5-8.5 [OAR 340-041-0021].	Impoundments may contribute to pH violations, usually through increased algal populations.
Total Dissolved Gas	Protects aquatic life from gas bubble disease, caused by water that is supersaturated with atmospheric gases [OAR 340-041-0032].	Water falling from height and plunging deeply into a pool can result in supersaturated water. High TDG is commonly observed below waterfalls and impoundment spillways.
Nuisance Algae, Taste and Odor and Deleterious Conditions Narrative Criteria	Action limit that triggers a management plan, based on chlorophyll a concentration [OAR 340-041-0019]. The creation of tastes and odors or toxic or other deleterious conditions are not allowed. [OAR 340-041-007(12)] Conditions offensive to the senses of taste, touch site or smell are not allowed. [OAR 340-041-007(15), aesthetic conditions]	Nuisance algae can be high in impoundments and can be related to pH, dissolved oxygen and to toxic algae or algae that causes palatability problems in fish or drinking water. Algal blooms and low dissolved oxygen conditions may contribute to aesthetic problems, taste and odor problems or deleterious or toxic conditions, and may be related to project operations.
Temperature	Water temperature must be protective of aquatic communities [OAR 340-041-0028].	Impoundments may alter water temperature and thermal regimes by both altering retention times within reaches and by changing water depths. Both of these factors may change exposure time to heating and cooling influences.

Biocriteria	Protects aquatic communities from cumulative impacts of all potential impairment [OAR 340-041-0011].	Impact to aquatic communities from increased turbidity and sedimentation; flow changes due to project operations; and changes in sediment, gravel and large woody debris recruitment due to impoundment detention.
Narrative Criteria	Highest and Best Practicable Treatment Objectionable discoloration, scum, oily sheen, floating solids or coating aquatic life with oil films is not allowed [OAR 340-041-0007(14)].	The highest and best practicable treatment must be implemented to maintain water quality at the highest level possible. Oil is used in project turbines and transformers, so there is some risk of oil release at hydroelectric projects.
Toxic material	Buildup of toxic material that affects aquatic life or human uses is not allowed [OAR 340-041-0033].	Impoundments can increase the concentration of toxic material associated with sediment that accumulates where water velocities are lowered.
Turbidity	Generally not to exceed 10% over background; limited-duration activities permitted in a § 404 or § 401 certificate are allowed, even when increases exceed this level [OAR 340-041-0036].	High turbidity may result from disturbing sediments and suspending fine material in the water column, or from high concentrations of algae.
Antidegradation	Protects existing water quality by preventing unnecessary additional water quality degradation [OAR 340-041-0004].	Must be addressed when new license conditions will lower existing water quality conditions, even though standard violations are not anticipated.
Three Basin Rule	Guards against additional sources of pollution to the Clackamas, Santiam and McKenzie Rivers [OAR 340-041-0350]	Project is located in a basin protected by this rule.

5.2 Evaluation for Standards of Potential Concern

This section provides the detailed evaluation of the Project relationship to each water quality standard that might be impacted by the Project. The § 401 review includes the text of each water quality standard, a description of the current conditions, the potential impact that the Project may have on water quality, DEQ's evaluation of the Project impacts and finally, DEQ's findings regarding the Project relationship to each water quality standard. DEQ may use several tools to evaluate the Project's impacts, including data submitted by the applicant, data collected by DEQ, data from other projects, site-specific study results, modeling results and information from studies in the scientific literature.

As can be seen in the brief project description in Section 3.2 of this document, PGE's Clackamas hydroelectric project is somewhat complex and consists of several components. Impacts from project operations may result from operations at each portion of the project. Therefore, the § 401 evaluation will look at each water quality parameter for each section of the project. This section will first present the language of the water quality standard. Then for each project reach this text will present a discussion of the existing water quality condition, the proposed Protection, Mitigation and Enhancement measures, and whether these measures will result in compliance with the water quality standard. Operating conditions may be included in the § 401 Certification to ensure that the measures are implemented in such a way that water quality standards will be maintained.

5.2.1 Dissolved Oxygen

Dissolved oxygen (DO) is necessary for aquatic life. Maintaining adequate concentrations of DO is vitally important for supporting fish, invertebrates, and other aquatic life. Some aquatic species such as salmonids are very sensitive to reduced concentrations of DO. This sensitivity also varies between various life stages such as egg, larvae, and adults, and between different life processes such as feeding, growth, and reproduction.

DO levels within gravels (intergravel DO, or IGDO) directly influence the survival of salmonid embryos. Many of the salmonids spawn in gravel redds. The critical DO levels for the developing embryos occur in the intergravel zone surrounding the eggs at these redds. High water column DO levels are not necessarily indicative of adequate IGDO levels, and vary depending on several interrelated factors including water column concentrations, the percentage of fine sediment in the gravel pores, sediment oxygen demand, and oxygen demand of the eggs.

Water Quality Standard

Excerpts from Oregon's dissolved oxygen standard are included here.

340-041-0016 Dissolved Oxygen

(*1) Dissolved oxygen (DO): No wastes may be discharged and no activities must be conducted that either alone or in combination with other wastes or activities will cause violation of the following standards: The changes adopted by the Commission on January 11, 1996, become effective July 1, 1996. Until that time, the requirements of this rule that were in effect on January 10, 1996, apply:*

(a) For water bodies identified as active spawning areas in the places and times indicated on the following Tables and Figures set out in OAR 340-041-0101 to OAR 340-041-0340: Tables 101B, 121B, 180B, 201B and 260B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B, (as well as any active spawning area used by resident trout species), the following criteria apply during the applicable spawning through fry emergence periods set forth in the tables and figures:

(A) The dissolved oxygen may not be less than 11.0 mg/l. However, if the minimum intergravel dissolved oxygen, measured as a spatial median, is 8.0 mg/l or greater, then the DO criterion is 9.0 mg/l;

(B) Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 11.0 mg/l or 9.0 mg/l criteria, dissolved oxygen levels must not be less than 95 percent of saturation;

(C) The spatial median intergravel dissolved oxygen concentration must not fall below 8.0 mg/l.

(b) For water bodies identified by the Department as providing cold-water aquatic life, the dissolved oxygen may not be less than 8.0 mg/l as an absolute minimum. Where conditions of barometric pressure, altitude, and temperature preclude attainment of the 8.0 mg/l, dissolved oxygen may not be less than 90 percent of saturation. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 8.0 mg/l as a 30- day mean minimum, 6.5 mg/l as a seven-day minimum mean, and may not fall below 6.0 mg/l as an absolute minimum (Table 21);

(c) For water bodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum. At the discretion of the Department, when the Department determines that adequate information exists, the dissolved oxygen may not fall below 6.5 mg/l as a 30-day mean minimum, 5.0 mg/l as a seven-day minimum mean, and may not fall below 4.0 mg/l as an absolute minimum (OAR 340-41, Table 21);

The Clackamas River supports anadromous salmonids throughout much of the basin. From the mouth upstream to Clear Creek (river mile 8) the river supports anadromous spawning between October 15 and May 15. Spawning upstream of Clear Creek to the base of the barrier falls on the lower Oak Grove Fork occurs between September 1 through June 15. Anadromous salmonids are restricted to reaches downstream of the barrier falls on the Oak Grove Fork at river mile 56. Resident trout upstream of the falls spawn between January 1 and June 30.

The dissolved oxygen criteria that apply to the Project reach change with both river mile and season. Table 7 identifies where, when and which numeric dissolved oxygen criteria apply within the Project reaches.

Table 7. Applicable Dissolved Oxygen Criteria for PGE's Clackamas Project.

Reach	Use	Dates	Dissolved Oxygen Criteria
Timothy Lake downstream to Barrier Falls on Oak Grove Fork	Resident Trout rearing	July 1-December 31	8 mg/L, or with intensive sampling, meet the criteria listed in OAR-340-041-0016 & Table 21
	Resident Trout Spawning	January 1-June 30	11 mg/L: if IGDO is ≥ 8, then DO must be ≥9 mg/L
Barrier Falls on Oak Grove Fork to Clackamas Confluence with Clear Creek	Anadromous Rearing	June 16-August 31	8 mg/L, or with intensive sampling, meet the criteria listed in OAR-340-041-0016 & Table 21
	Anadromous Spawning	September 1-June 15	11 mg/L: if IGDO is ≥ 8, then DO must be ≥ 9 mg/L
Clackamas from Clear Creek to Willamette Confluence	Anadromous Rearing	May 16-September 30	8 mg/L, or with intensive sampling, meet the criteria listed in OAR-340-041-0016 & Table 21
	Anadromous Spawning	October 1-May 15	11 mg/L: if IGDO is ≥ 8, then DO must be ≥ 9 mg/L

Current Water Quality Status

PGE monitored water quality throughout the project area from April 2000 through October 2001. Dissolved oxygen data were collected using electronic probes that were confirmed at least once daily using a chemical method known as Winkler's titration. Samples were collected monthly during the colder winter months, and biweekly from June-December.

Dissolved oxygen concentrations were generally high throughout the Clackamas Project area, easily meeting the applicable water quality criteria. Values lower than the applicable criteria occurred in some project reaches. Summertime dissolved oxygen at depth in Timothy Lake and the North Fork Embayment were low, although surface water concentrations remained above the 8 mg/L criterion at both sites (Figure 2).

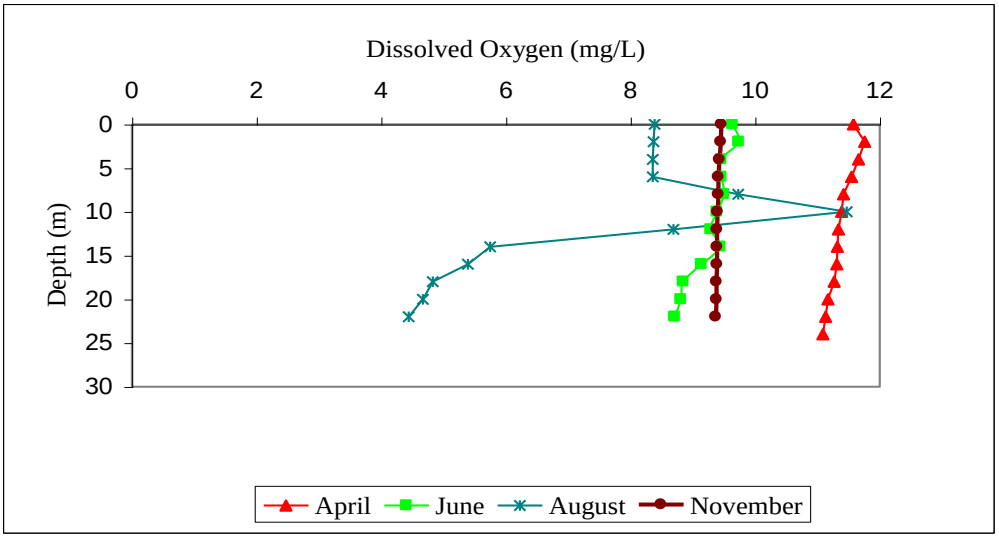

Figure 2. Timothy Lake Site C Dissolved Oxygen vertical profiles, April, June, August, and November 2000.

In the Timothy Lake tailrace of the Oak Grove Fork, low dissolved oxygen was observed during very low flow releases from Timothy Lake. For flow releases less than 10 cubic feet per second (CFS), flow is released through a pipe, and not through the Howell Bunger Valve. The Howell Bunger valve forces water through a narrow opening that disperses it into the atmosphere to dissipate erosional energy at the site. This valve both dissipates energy thus decreasing erosion and aerates water with low dissolved oxygen to a saturated level.

Dissolved oxygen values at riverine sites throughout the Project area remain higher than 10 mg dissolved oxygen/L, but fall below the 11 mg/L spawning criteria during the "shoulder periods" (beginning and ending) of the spawning periods. These sites are:

Oak Grove Fork between Timothy Lake and Lake Harriet
Oak Grove Fork Downstream of the Barrier Falls
Clackamas River between the Oak Grove Powerhouse and North Fork Reservoir
North Fork Dam Tailrace
Faraday Diversion Reach
River Mill Dam Tailrace

The water quality model results for the Clackamas River immediately upstream of the Oak Grove Powerhouse show this typical pattern of dissolved oxygen and violations during the spawning period in Figure 3 (PGE 401 Application, 2008).

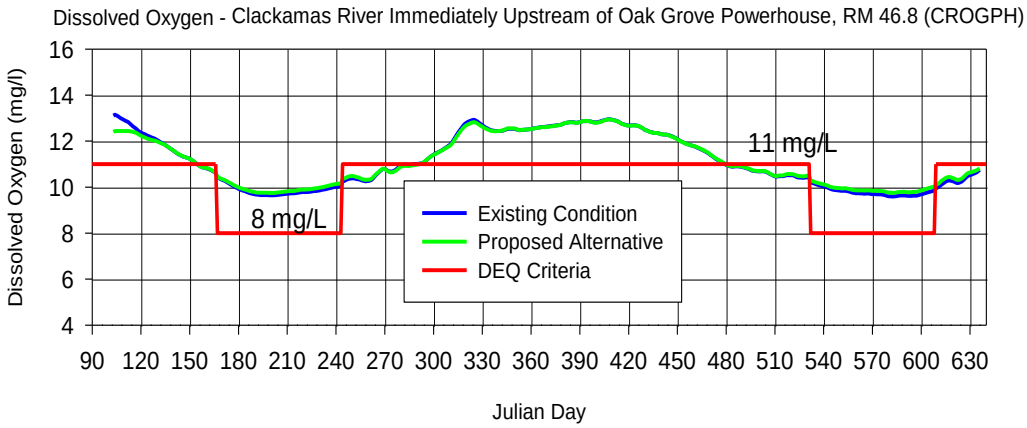

Figure 3. Predicted DO in the Clackamas River system – Existing vs. AIP Alternative, Clackamas River Immediately Upstream of Oak Grove Powerhouse, RM 46.8 (CROGPH).

In September, although dissolved oxygen levels are on the rise, they do not hit the 11 mg/L criteria by the beginning of the spawning period. In mid-spring, the dissolved oxygen dips below 11 mg/L before the end of the spawning period. In both cases, dissolved oxygen is still quite high, not dipping below 10 mg/L. At both times, per cent saturation is below 95%, so the lowering dissolved oxygen is not entirely due to different water temperatures experienced with the season.

The requirement for high concentrations of surface water dissolved oxygen during the spawning season is intended to protect intergravel dissolved oxygen (IGDO). EPA studies have shown that IGDO can be as much as 3 mg/L lower than surface water oxygen (ODEQ, 1994). However, IGDO may be much closer to surface water dissolved oxygen levels. Thus the Oregon criterion for surface water dissolved oxygen during the spawning period may be lower if intergravel dissolved oxygen is 8 mg/l or higher.

IGDO is difficult to measure, and the methods used can cause harm to existing redds and spawning grounds. For this reason, PGE did not measure IGDO during their monitoring efforts in 2000-2001. However, because some surface water dissolved oxygen values exhibited seasonally low values, PGE measured IGDO at several sites in the spring and fall of 2005. Table 8 shows the results of this work (PGE 401 Application, 2008).

Table 8. Ranges of spatial median intergravel dissolved oxygen (IGDO) values, by site, in the Oak Grove Fork and Clackamas River during spring and fall 2005.

	Range of spatial median of IGDO measurements (mg/L)	
Sampling site	**Spring 2005**	**Fall 2005**
Oak Grove Fork:		
Timothy Lake tailrace	8.1 – 9.7	-
Upstream of Lake Harriet	8.6 – 10.3	-
Ripplebrook Campground	7.7 – 9.6	8.4 – 9.4
Clackamas River:		
Indian Henry Campground	8.8 – 10.3	7.7 – 10.5
Upstream of North Fork Reservoir	8.1 – 10.0	9.3 – 10.3
Faraday Diversion reach	8.7 – 10.1	9.4 – 10.8
McIver State Park	8.8 – 9.5	-
Near Eagle Creek	8.7 – 9.6	1.8 – 9.8 [1]

[1]DO measurements in artificial redds likely influenced by hyporheic flow.

Potential Impact of New License

Hydroelectric facilities can impact dissolved oxygen by altering upstream hydrology and by altering nutrient cycles. When water velocity is decreased, then water may have more contact time with sediment in a given river reach. This may act to decrease the dissolved oxygen concentration by increasing the contact time with sediment that has a high oxygen demand. Dissolved oxygen can also be reduced if the lower water velocity results in warmer water temperatures that decrease the solubility of oxygen in water. Nutrient cycles can be influenced in hydroelectric reservoirs, resulting in greater algal growth. This may in turn alternately increase dissolved oxygen as algal productivity soars, and decrease dissolved oxygen as algal populations crash and the resulting organic material creates an oxygen demand.

PGE's proposed operating conditions include both potential increases in residence times as well as increased minimum flows. At Timothy and Harriet Lake PGE proposes water surface elevations higher than the existing license. In general, this practice tends to increase residence time, which in turn has the ability to decrease dissolved oxygen levels. However, minimum flows downstream of both lakes will be increased, so the higher lake levels may not alter retention times. The water quality model was used to predict the impacts that changing lake elevations might have on several water quality parameters.

PGE proposes to increase minimum flows downstream of several project facilities. Increased flows generally act to lower water temperature. Colder water can hold a higher concentration of dissolved gas than warmer water. Thus, increased flows are generally expected to improve dissolved oxygen conditions. The water quality model was used to predict dissolved oxygen levels under the proposed operating conditions at all of these sites.

Timothy Lake: Under the new license, the lake will still be used to retain water from high flow events for downstream power generation. However, both maximum and minimum flows levels released from the lake throughout the year will more closely parallel the natural hydrology. The water quality model shows that surface water dissolved oxygen will remain similar to current conditions. Dissolved oxygen at depth may be somewhat lower than current condition, depending on algal activity in the reservoir. Timothy Lake is not highly productive, therefore it is difficult to accurately model algal activity. The small differences that the water quality model predicts for changes in chlorophyll and dissolved oxygen may not be significant. (PGE § 401 Application, 2008; Chapter 7).

Oak Grove Fork from Timothy to Harriett Lake: PGE proposes to increase minimum flows in this reach. Low dissolved oxygen values were observed when flows were so low that the Howell Bunger valve was not used to deliver Timothy Lake water to this reach. Future minimum flow regimes will be sufficiently high to require use of the Howell Bunger valve at all times, so the low dissolved oxygen episodes observed will no longer occur. The water quality model that predicted future project operations was run assuming that the Howell Bunger valve would always be in use. This model run predicted no decreases in dissolved oxygen in the reach, and only minor increases during summer. The model predicts year-round dissolved oxygen concentrations greater than 10 mg/L.

Oak Grove Fork Downstream of Harriet Lake: The proposed operations call for major changes at the Harriet Lake Dam. Currently, only storm flows greater than 600 cfs find their way downstream of Harriet Lake. A new flow control structure at Harriet Lake will allow year-round minimum flows downstream of the dam. The proposed flows change with the season in an attempt to mimic seasonal conditions. Figure 4 (PGE 401 Application, 2008) shows that the expected dissolved oxygen levels under the new license will be higher than the existing condition.

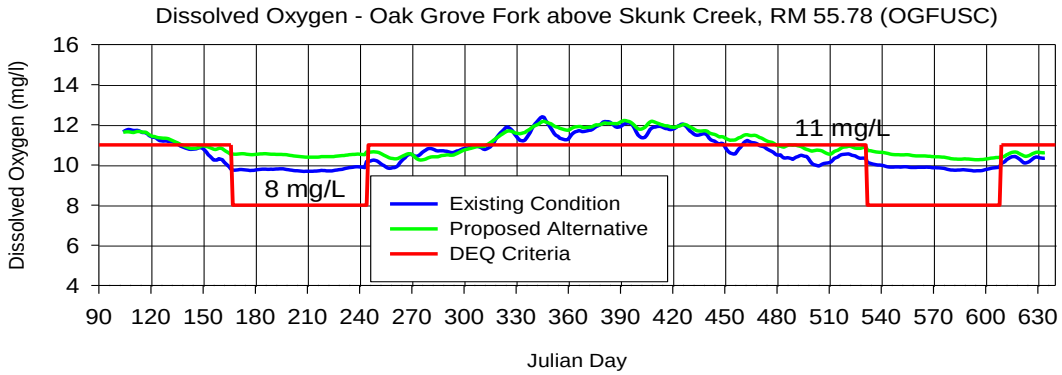

Figure 4. Predicted DO in the Clackamas River system – Existing vs. Settlement Alternative, Oak Grove Fork above Skunk Creek, RM 55.78 (OGFUSC).

Clackamas River Downstream of Oak Grove Fork: This reach will also benefit from increased instream flows in the lower Oak Grove Fork. However, the water quality model predicts only minor improvements in dissolved oxygen in this reach. Existing levels in this reach are already quite high and generally in compliance with the standard. Dissolved oxygen levels are somewhat lower than the 11 mg/L criteria during the shoulders of the spawning season. These have also been shown to be compliant with the criteria because intergravel dissolved oxygen is sufficiently high to lower the applicable surface water criteria to 9 mg/L.

North Fork Reservoir through Estacada Lake: Few changes in operations are proposed for North Fork and Estacada Lakes. The three-reservoir reach on the mainstem Clackamas will be operated as it is now so that inflows to North Fork Reservoir will be released from Estacada Lake. Under the new license, within this three–lake complex, power generation and water levels will be managed to allow for some peak power generation, increased flows in the Faraday Diversion Reach, and overall net inflow at North Fork equal to outflow at Estacada Lake. The water quality model for these proposed operations shows very little change in dissolved oxygen over these reaches under the proposed conditions for North Fork Reservoir, the Faraday Diversion Reach or Estacada Lake. Minor deviations from existing conditions show slight increases in dissolved oxygen, not decreases.

River Mill Dam Tailrace: Proposed operations at this site are not expected to differ from current operations, as the outflows from Estacada Lake are currently managed to reflect inflow to North Fork Reservoir. Water quality modeling for dissolved oxygen at this site shows no differences between existing and proposed project operations.

Downstream of River Mill Tailrace: Dissolved oxygen concentrations in this reach are generally high. Similar to other sites in the Clackamas basin, concentrations at the beginning and end of the spawning season are somewhat lower than the 11 mg/L criterion. The water quality model projecting PGE's future operations show no changes to existing dissolved oxygen conditions in this reach.

DEQ Evaluation

Based on the results reported above for the current condition and the potential impacts that new operations may have on water quality, it appears that dissolved oxygen concentrations will be largely unchanged under the new license. Two exceptions to this occur: at some times the hypolimnion of Timothy Lake may show lower dissolved oxygen concentrations; and increased minimum flows downstream of Harriet Lake show clear improvement in dissolved oxygen. Minor exceedances of the 11 mg/L dissolved oxygen criterion along the Oak Grove Fork and Clackamas River sites persist in the model results for the proposed operations.

Timothy Lake:

Dissolved oxygen conditions in Timothy Lake meet the applicable criteria in the surface layer, and in the middle layer of the lake. Values at depth in the lake are below the numeric criterion during warm summer months.

Both existing data and the water quality model prediction under the new operating conditions for Timothy Lake show that the middle layer, or metalimnion, is the zone of Timothy Lake that meets water quality criteria for temperature, dissolved oxygen, and pH and is sufficient to support beneficial uses . Cold water here is close enough to the surface to support algal growth, which in turn can improve dissolved oxygen conditions. Increases in oxygen are often observed in this middle layer during summer months. No pH violations have been observed at Timothy Lake, although pH values are sometimes elevated during algal blooms. The volume of this layer provides sufficient habitat for beneficial uses sensitive to low oxygen and high temperatures, including resident trout.

Oak Grove Fork Downstream of Harriet Lake: The increased minimum flows in this reach are expected to improve dissolved oxygen concentrations in the reach. However, the improvements are not predicted to fully address the low dissolved oxygen during the shoulders of the spawning period. IGDO measurements in the lower Oak Grove Fork showed high values, allowing the 9 mg/L dissolved oxygen criterion to apply. PGE will perform both surface water dissolved oxygen and IGDO monitoring to confirm the continued compliance of new operations with the dissolved oxygen standards.

Clackamas River from the Oak Grove Fork Downstream to Eagle Creek: PGE measured IGDO at several sites along the Clackamas River from the upper Oak Grove reach to downstream of River Mill Dam. The sampling plan, methods and results are available in the § 401 Application (PGE 2008, in the attached Water Quality Monitoring and Management Plan Appendix 1) The results (PGE § 401 Application, Table 9.4.4) showed IGDO values exceeded 8 mg/L and demonstrate that the 9 mg/L surface water criterion applies as a spawning period criterion. This criterion was met at all stations with measured data. In addition, the continuous dissolved oxygen results predicted by the water quality model were in compliance with the 9 mg/L value.

Project-wide Summary: For most project reaches, dissolved oxygen concentrations predicted under the proposed operating conditions change little compared to existing good quality conditions. An exception to this is found in the lower Oak Grove Fork. Here, dissolved oxygen concentrations are expected to increase as a result of the significant increases for instream flow to the reach. To ensure that the results predicted by the water quality model are accurate, PGE has proposed to continue monitoring dissolved oxygen and IGDO under the new license once the new flow regimes have been implemented. The Water Quality Monitoring and Management Plan for Dissolved Oxygen will be finalized once the schedule for changes in operations under the new license is available. A draft monitoring plan is available in the WQMMP. The timing, locations and number of seasons to be monitored may be refined by PGE, reviewed by the Fish Committee and approved by DEQ prior to its implementation.

DEQ Findings

The § 401 Certificate Condition 2 includes conditions to ensure that PGE's operations are in compliance with water quality standards. These include:

- A requirement to include monitoring for dissolved oxygen in Timothy and North Fork Reservoirs as part of the Blue-Green Algae Monitoring Plan to ensure that dissolved oxygen conditions remain suitable in Timothy Lake and North Fork Reservoir once future changes to lake elevation and downstream flow releases are implemented
- Always use the Howell Bunger valve or device that will achieve similar aeration to deliver water from Timothy Lake to the Oak Grove Fork
- Implement the Monitoring Plan for intergravel and surface water dissolved oxygen (Chapter 3 of the Water Quality Monitoring and Management Plan, Exhibit A of the § 401 Certificate).

The inclusion of these conditions in conjunction with available data provide DEQ with reasonable assurance that the reaches of the Clackamas River influenced by the Project will be in compliance with Oregon dissolved oxygen water quality standards.

5.2.2 Hydrogen Ion Concentration (pH)

Water Quality Standard

The balance of acid and alkaline substances in water is indicated by the pH value. Values range from 1 (very acid) to 14 (very alkaline). Most streams in Oregon have pH values falling somewhere between 6.5 and 8.5. There may be seasonal fluctuations in the pH number due to substances entering the water from land or bio-chemical activity in the water, including influences from in-water plant growth. Since fish and other aquatic life in any particular stream have evolved under specific pH conditions, it is important to set a pH standard that reflects natural conditions and will prevent any intolerable acid/alkalinity levels. The Willamette Basin pH standard has been set at a tolerance range of 6.5 to 8.5 to coincide with the locally natural range. The applicable rule language is included here:

OAR 340-041-0021

pH

(*(1) Unless otherwise specified in OAR 340-041-0101 through 340-041-0350, pH values (Hydrogen ion concentrations) may not fall outside the following ranges:*
(b) Estuarine and fresh waters: 6.5 – 8.5.
(2) Waters impounded by dams existing on January 1, 1996, which have pHs that exceed the criteria are not in violation of the standard, if the Department determines that the exceedance would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria.

OAR 340-041-0345

Water Quality Standards for this [Willamette] Basin

(*(1)pH (hydrogen ion concentration). pH values may not fall outside the following ranges:*
(a) All basin waters (except main stem Columbia River and Cascade lakes): 6.5 to 8.5.

Current Water Quality Status

PGE collected water quality data at several sites throughout and downstream of the Clackamas Project from Timothy Lake to the lower Clackamas River. Data were collected between April 2000 and October 2001. Data from PGE's water quality report are excerpted below. Site names are abbreviated, and the codes are identified in Table 9.

Table 9. Site names and river miles for sampling locations included in Figure 5.

Location	Site Code	River Mile
Timothy Lake Outlet at Valve	TIMOUT	68.7
Oak Grove Fork above Harriet	OGFHAR	58.7
Clackamas River upstream of Oak Grove Fork	CRUOGF	52.3
Oak Grove Fork at mouth	OGFMTH	52.2
Clackamas River upstream of Oak Grove Powerhouse	CROGPH	46.8
Oak Grove Powerhouse	CROGTR	46.8
Clackamas R. Upstream of Roaring River	CRUPRR	42.9
Clackamas River Upstream of Fish Creek	CRUPFC	40.5
Clackamas R Upstream of North Fork Res	CRUNFR	32.4
North Fork Tailrace	NOFKTR	29.2
River Mill Tailrace	RIMITR	22.3
Clackamas R. upstream of Eagle Creek	CRUPEC	15.7
Clackamas River at Carver Bridge	CRATCB	7.9

Figure 5 shows the range and median pH values at Clackamas sites measured by PGE between April 2000 and April 2001. This graph indicates that pH values exceeded the pH standard of 8.5 at only two sites, and that no low pH violations, values below 6.5, were observed.

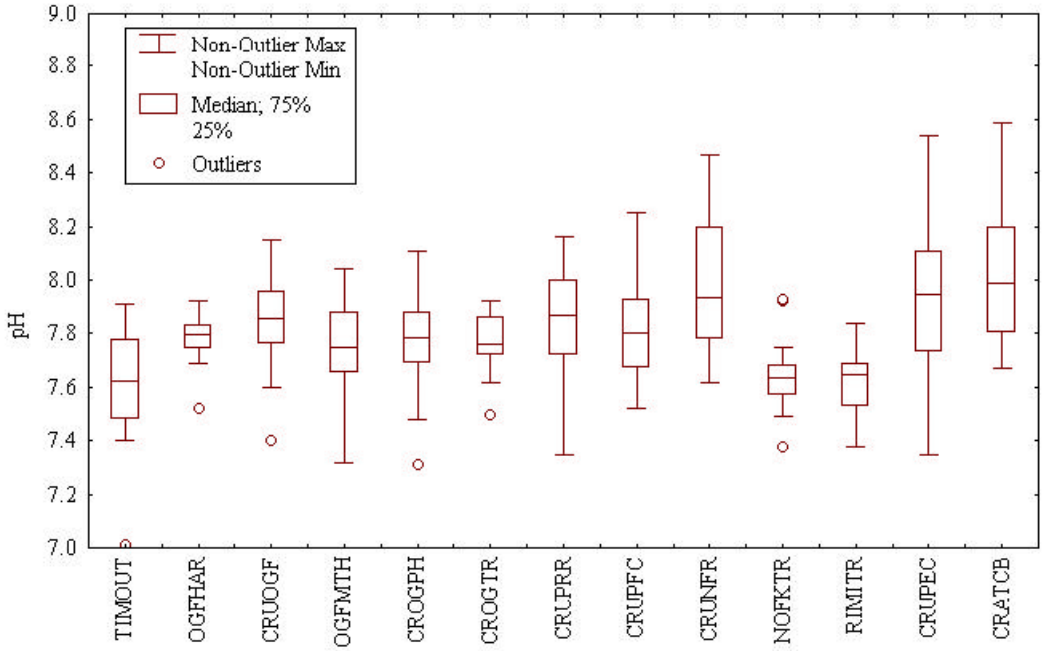

Figure 5. pH at Clackamas River mainstem study sites, April 2000-April 2001, from EES Consulting (2004).

High pH values were also observed in groundwater seeps that provide water to the Oak Grove Fork within a half mile of the Timothy Lake tailrace. One routinely measured seep had pH values that exceeded 8.5 on two occasions in July 2000, and generally had pH measures ranging from 8.06 to 8.53 (pH was lower than 8.0 only when the groundwater was influenced by snowmelt). Surface water values

of pH in riverine sites within the upper and middle Clackamas River did not exceed 8.5 during the 2000–2001 studies.

Individual pH exceedances in the lower mainstem near Eagle Creek and Carver Bridge are summarized in Table 10.

Table 10. Dates and ranges of exceedances at riverine monitoring sites, 2000–2001 from PGE's Application for § 401 Certification.

Site	Dates of Exceedance	Exceedances
Clackamas R. upstream of Eagle Cr. (CRUPEC)	9/18/00	8.54
Clackamas R. at Carver Bridge (CRATCB)	10/16/00, 9/10/01, 9/24/01	8.59, 8.74, 8.82

Somewhat high pH values were observed in vertical profiles of Timothy Lake during June, 2000. Values were below pH 8.5, and were concurrent with algal blooms of Chrysophytes and Cyanophytes. No pH exceedances were observed. A few elevated values were also observed in the inlet to North Fork Reservoir, where algal blooms occur on occasion. Values greater than 8.5 were not observed in remaining project reservoirs; Harriett Lake, lower North Fork Reservoir, Faraday Lake or Estacada Lake

Potential Impact of New License

The potential impact that hydroelectric projects have on pH in aquatic systems usually occurs as a result of altering hydrology that impacts the aquatic community. Hydroelectric plants to not discharge pollutants that alter the acidity or alkalinity of water. If they impact the pH of the Project waters, it is generally by creating conditions that encourage lush growth of aquatic plants. Altering hydrology may slow down water velocities, increase water temperatures and ultimately influence the concentration of available nutrients. All of these conditions have the potential to increase algal growth. As they use light energy to convert carbon dioxide into sugars and thus chemical energy, plants alter the carbon dioxide and associated carbonate concentrations dissolved in water. Heavy plant growth causes large swings in the carbonate concentration, which leads to changes in pH of the water.

PGE does propose to alter operations at some Project Reservoirs. Timothy Lake will be lowered more slowly in early fall under the new license, and higher minimum flows will be maintained downstream of Timothy Lake. The outlet to Harriett Lake will be modified to raise the elevation of the lake surface by one foot, and to allow instream flows downstream of Harriett Lake. No changes in operation are proposed for North Fork Reservoir or Estacada Lake. PGE does propose to alter operations at Faraday Lake to reduce heating in that reach of the project.

The CE-QUAL-2E model constructed and calibrated for all project reaches was used to predict changes in pH that might occur with the proposed changes in operations at the various reservoirs. This model predicts that pH may increase in Timothy Lake during summer months under the proposed operations. These increases are correlated with predicted increases in chlorophyll. Small increases in pH were also predicted for North Fork Reservoir. Although the predicted changes are small in magnitude, the water quality model suggests that pH values may exceed the standard of 8.5 at some depths on some occasions.

DEQ Evaluation

Water quality in the Clackamas is generally good, and this is also demonstrated in the pH data collected by PGE throughout the Project area. Groundwater adjacent to the Project, and flowing into the Oak Grove Fork generally has pH values above 8.0, and sometimes has values that exceed 8.5. There is no reason to believe that PGE project operations influence the high groundwater values.

High summertime pH values were also observed at two sites in the lower Clackamas River. These high pH values were likely caused by photosynthetic activity. Although pH from River Mill Dam ranged from 7.3 to 7.8 (well within compliance with ODEQ criteria), there was a general increase in pH downstream. During a three-day monitoring event in mid-August 2000, the lower river tended to be most affected by

photosynthetic activity as measured by diurnal variations in pH. The lower river sites (RM 8.3 and RM 2.5) had greater diurnal variation than upstream sites at River Mill tailrace, North Fork Reservoir, and Faraday Lake. The pH fluctuated up to 0.9 units from the afternoon high to the nightly low at the lower river sites. In comparison, River Mill tailrace pH changed less than 0.1 units, and at Faraday Lake and North Fork forebay, pH varied 0.3 to 0.5 units diurnally. Both downstream locations with elevated pH are considerably downstream of PGE's project facilities, and have influences from other tributaries and land uses.

No pH violations have been documented in Project reservoirs, although values at sites in Timothy Lake and North Fork Reservoir are sometimes higher than 8.0. The water quality model predicts small increases in chlorophyll and related increases in pH in Timothy Lake, and even smaller changes to North Fork Reservoir. The CE-QUAL 2E water quality model was peer reviewed and well calibrated. However, the model may not be extremely accurate at predicting algal dynamics and bloom formation in a system like the Clackamas that has a relatively low productivity level. The models do suggest that pH values may on occasion approach or exceed the water quality standard of 8.5 in Timothy Lake and North Fork Reservoir.

Both existing data and the water quality model prediction for the new operating conditions for Timothy Lake show that the middle layer, or metalimnion, is the zone of Timothy Lake that meets water quality criteria for temperature, dissolved oxygen, and pH and is sufficient to support beneficial uses. Cold water here is close enough to the surface to support algal growth, which in turn can improve dissolved oxygen conditions. Increases in oxygen are often observed in this middle layer during summer months. No pH violations have been observed at Timothy Lake, although pH values are sometimes elevated during algal blooms. The volume of this layer provides sufficient habitat for beneficial uses sensitive to high temperatures, including resident trout. Additional cold water habitat can be found in the 'mini-estuaries' of Timothy Lake where the three major tributaries enter the lake, delivering cold water and creating pockets of cold water refugia within the lake.

Under the Settlement Agreement, PGE is already implementing the Blue-Green Algae Monitoring Plan and will continue to do so under the new license. Two goals of the monitoring plan are to characterize the relationship between Project operations and algae bloom formation, and to identify linkages between algal conditions, taste and odor problems, and potential toxicity. Details of this plan will be completed within six months of the new FERC license. However, pH values are closely linked to algal activity, so DEQ expects that pH monitoring will be included in the Blue-Green Monitoring Plan.

DEQ Findings

Under the new license, PGE will be monitoring water quality conditions for increases in pH, and will be evaluating the impact of project operations on the formation of algal blooms. The main project-related cause of increases in pH will be from increased frequency and intensity of algal blooms. Through the Blue-Green Monitoring Plan, PGE is committed to identify links between project operations and bloom formation. PGE is also committed to search for and implement measures that will minimize blue-green bloom formation.

Oregon's water quality standard recognizes that reservoirs may cause pH values to be exceeded, and does not consider the exceedance to be violations of the standard "*if the Department determines that the exceedance would not occur without the impoundment and that all practicable measures have been taken to bring the pH in the impounded waters into compliance with the criteria."* (OAR 340-041-0021). The Blue-green Algae Monitoring Plan will provide the information necessary to identify all practicable steps that may be taken to address elevated pH.

With the inclusion of the § 401 Certificate Condition 3 to include monitoring for pH in the Blue-green Algae Monitoring program described in the Water Quality Monitoring and Management Plan (§ 401 Certificate , Exhibit A), DEQ has reasonable assurance that PGE's operation of the Clackamas Project will meet Oregon's water quality standards for pH.

5.2.3 Total Dissolved Gas

Water Quality Standard

The supersaturation of atmospheric gases in water may cause crippling or lethal gas bubbles to form in the tissues of fish. The total dissolved gas standard is designed to prohibit discharges or activities that will result in atmospheric gases reaching known harmful concentrations once dissolved in water.

Total dissolved gas (TDG) can be introduced to water in several ways. Two necessary elements for TDG formation are a source of gases in water often referred to as entrainment and sufficient pressure on the water-bubble mixture to force the gas phase into solution. Spillways at hydroelectric projects increase TDG in surface water in the same way as natural waterfalls (Lindroth, 1957). The momentum of the fall carries the water and entrained gases to depth in the pool. Under increased hydrostatic pressure in the plunge pool, the entrained gases are driven into solution, causing supersaturation of dissolved gases. Large spillways are commonly used at hydroelectric facilities to control upstream water elevations and manage the direction of flow to downstream locations. However, smaller spillways may also be constructed at hydroelectric projects. Spillways used to increase currents that improve fish guidance through project areas, or provide alternate passageways through fish bypass systems may also increase TDG in the spill water released through these systems. Often, water routed this way may be a small percentage of flow through the system, so significant increases in TDG may not be observed downstream. However, depending on the project design, localized areas can be impacted. Water passage through turbines can also increase TDG if air sources are available in the turbine casing. In powerhouses with high head, the draft tube vacuum can become so high that water reaches the vaporization point. Gas bubbles created this way can lead to cavitation, a condition where gas bubbles combined with high turbulence can accelerate turbine-runner erosion. Introduction of air to these turbines will equilibrate vapor pressures, thus minimizing bubble formation, decreasing cavitation-related damage. However, introducing air to a turbine chamber can also lead to high TDG levels, as the air is pressurized into solution within the chamber. The amount of cavitation and TDG introduced in turbine chambers tends to differ with different turbine characteristics, so changing turbine runners may increase TDG flowing out of the turbines.

OAR 340-041-0031

Total Dissolved Gas

(1) Waters will be free from dissolved gases, such as carbon dioxide, hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such water.

(2) Except when stream flow exceeds the ten-year, seven-day average flood, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 110 percent of saturation. However, in hatchery-receiving waters and other waters of less than two feet in depth, the concentration of total dissolved gas relative to atmospheric pressure at the point of sample collection may not exceed 105 percent of saturation.

Current Water Quality Status

Spill events are not common on the Clackamas River mainstem, and 2000-2001, the years that water quality studies were conducted for the new license, were characterized by low flow, so few spill events were sampled. For this reason, an operational spill conducted in May of 2001 as part of a smolt survival study was sampled. TDG was measured at River Mill and North Fork dams on the dates and at the locations indicated in Table 11.

Table 11. Powerhouse flow, spill, water temperature, and total dissolved gas (as percent saturation) at selected Project locations (From the § 401 Application 2008, Table 9.8-2).

Site	Date	Powerhouse Flow (cfs)	Spill (cfs)	Water Temperature (ºC)	Total Dissolved Gas (% saturation)
North Fork Dam	5-18-01	2,800	2,000		
North Fork tailrace				8.7	111.2
Above Faraday Diversion Dam				8.9	112.8
Below Faraday Diversion Dam				9.0	106.0
North Fork Dam	4-16-02	5,400	1,700		
Above Faraday Diversion Dam				5.3	104.5
River Mill Dam	4-25-00	0	3,640		
Tailrace (right bank)				7.1	102.9
Tailrace (left bank)				7.1	103.4
River Mill Dam	4-16-02	4,140	2,994		
River Mill Tailrace[1]				5.3	101.5
McIver Park				5.4	102.2

[1]Spill and powerhouse flow combined.

Two different criteria apply to these sites. The intake for the ODFW Estacada Fish Hatchery is just downstream of River Mill Dam, so the 105% TDG criterion will apply downstream of River Mill Dam near the hatchery intake, and the 110% criterion will apply at the North Fork site. The water quality standard for total dissolved gas accounts for the fact that high TDG levels may not be avoidable under extremely high flow conditions. The ten-year, seven-day average high flood flow at the Estacada gage near River Mill Dam is 21,000 cfs. This value was calculated from data at the Estacada gage collected between 1959 and 1987. The TDG criterion will not apply to either North Fork Dam or River Mill Dam when flows exceed this level.

In the data above, TDG measured at the River Mill sites did not exceed the 105% saturation criterion. Data were available for two dates, one during a smolt survival study with all river flow running over the spillway. The other date had 2990 cfs spill and 4140 cfs through the powerhouse for a total river flow of 7130 cfs. River flow can be much greater, and could result in higher spill to river flow ratios at this site. No other data sources for higher flows have been identified for this evaluation.

At the North Fork site, spill was just less than half of the river flow (Table 11). Total dissolved gas slightly exceeded the 110 % ODEQ criterion below North Fork Dam on May 18, 2001 (111.2 % in the tailrace and 112.8 % farther downriver, upstream of the Faraday Diversion Dam). A spill of 2000 cfs would normally occur at a river flow of 7400 cfs; due to the smolt study the spill occurred at an approximate total flow of 5000 cfs. Given the high spill to river flow ratio, these TDG results may be higher than TDG that would normally be observed at a river flow of 5000 cfs. In fact, the April 2002 data for this site show that with 5400 cfs of river flow and only 1700 cfs of spill, observed TDG was 104 %.

To put the sampled flows in context, the frequency and magnitude of spill at North Fork Dam from 1971 through 2000 is shown in Table 12 (PGE 401 Application; Table 9.8-3). The TDG data collected reflect flows up to 7400 cfs at the North Fork and River Mill Dam sites. This value exceeds the average maximum flows observed at these sites, but is lower than the 10 year seven-day average flood flow of 21,000 cfs.

Table 12. Average maximum spill, maximum monthly spill, and average number of days on which spill occurred, 1971 – 2000. (From PGE's 401 Application, June 2008, Table 9.8-3). These are described in the text as flow and spill levels for North Fork Dam.

Month	Average maximum spill (cfs)[1]	Maximum monthly spill (cfs) for the period or record (year in parentheses)	Average number of days on which spill occurred[2]
Jan	5,874	18,302 (1972)	6.3
Feb	4,730	17,515 (1982)	4.6
Mar	1,930	6,628 (1972)	3.7
Apr	1,895	15,161 (1991)	1.9
May	397	2,450 (1996)	1.4
Jun	597	6,300 (1971)	0.5
Jul	51	1,522 (1986)	0.1
Aug	17	510 (1986)	0.6
Sep	0	0	0
Oct	1,212	12,950 (1994)	0.4
Nov	4,638	14,597 (1995)	4.1
Dec	5,908	15,413 (1980)	5.9

[1]Average maximum spill for each month within an individual year (e.g., 1971) was calculated by taking the average of the peak spill values for all spills during that month; the monthly average for the period 1971 – 2000 (shown in the table above) was calculated as the average of the monthly averages for all individual years.
[2]Average number of days for a particular month (shown in the table above) was calculated as the average of the average monthly values over the period or record

Spill at Faraday Powerhouse is extremely rare. Since 1970, spill has occurred only once at the Faraday Powerhouse, i.e., during the 1996 flood (D. Cramer, PGE biologist, personal communication). Short duration, controlled spills are scheduled every 5 years to test the spill gates. At the time that FERC approved a license amendment to replace turbine runners at the Faraday Powerhouse, they also required monitoring for total dissolved gas to determine whether runner replacements contributed TDG. No spill occurred at the time these samples were collected, and all data were below the 110% criterion applicable at this site.

Proposed Operations

Under the Settlement Agreement, PGE will install a surface collector at the North Fork Dam to improve downstream fish passage. This will be complete in year 5 of the new license, but will be followed by testing to determine whether the collector and other fish passage improvements are sufficient to meet the downstream fish passage criteria. By year 3 of the new license, prior to installing the collector, PGE will install a fish guidance net in the North Fork forebay. If the net proves effective in guiding fish, during the spring and fall migration periods, PGE will limit powerhouse flows, and intentionally spill water over the spillway. PGE will spill all flow in excess of 3500 cfs up to 7500 cfs. When river flow exceeds 7500 cfs, PGE will spill 4000 cfs. At 10,500 cfs and above, the powerhouse will be run at capacity, with remaining flow spilled. This spill pattern will continue until the Tier 1 fish passage standard has been met.

When unscreened spill persists for more than one hour at North Fork Dam during major smolt migrations in spring (April 1-June 30) and fall (October 1- December 15), PGE will spill 50% of the river flow at Faraday and 400 cfs at River Mill Dam. Spill duration at the lower dams depends on the duration of spill at North Fork Dam.

DEQ Evaluation

PGE has provided the dam height and spillway plunge depth for the powerhouses in the North Fork Complex (Table 13). These data suggest that because the dam height at the North Fork Dam is high, it is most likely to contribute TDG to the river. The dam at the Faraday Powerhouse is low, and spill very rarely occurs here, so TDG is least likely to be a problem here.

Table 13. Dam height, depth of plunge pool below spillway, and powerhouse capacity for the mainstem Clackamas Project dams (From § 401 Application, 2008, Table 9.8-1).

		Spill plunge depth (ft)[2]		Powerhouse (cfs)	
Dam	Dam height (ft)	Average	Maximum	Capacity	Maximum flow[3]
North Fork	207	14	18	6,000	5,400
Faraday Diversion	55	13	18	N/A	N/A
Faraday Lake[1]	33	-	< 25	5,120	5,020
River Mill	85	2	15	4,840	4,840

[1]Except for short duration, controlled spills scheduled every 5 years to test spill gates, spill at Faraday Powerhouse has occurred only once since 1970, i.e., during the 1996 flood (D. Cramer, PGE biologist, personal communication).
[2]Plunge pool depths under non-spill conditions; with spill occurring depths can increase by several ft, depending upon the magnitude of spill (D. Cramer, PGE biologist, personal communication).
[3]Maximum flow through the powerhouse under the existing license dictated by existing water rights.

The available data do not represent normal operating conditions at the site, but suggest that TDG may be a problem at North Fork Dam at flows when spill equals or exceeds powerhouse flow. PGE has proposed a TDG monitoring program to gain more information about TDG at high flows.

Intentional spill events are intended to improve fish survival. However, these may impair survival if high TDG levels occur. In order to characterize the effects of these spill events PGE has included these events in its proposed Water Quality Monitoring and Management Plan (WQMMP) for TDG. This plan is appended to the proposed § 401 certificate.

The Water Quality Monitoring and Management Plan also identifies the steps that will be taken if the monitoring data show that TDG standards are exceeded during spill events.

DEQ Findings

Limited data collected during a spill testing event in the North Fork Spillway indicate that TDG may develop during spills at this facility. The Water Quality Monitoring and Management Plan provides a monitoring program and schedule for TDG measurements at project facilities under the new license. In addition, PGE will monitor TDG conditions during spill events that are conducted to improve downstream fish passage. If exceedances of the applicable TDG standard occur, PGE will work with DEQ to identify and implement solutions that will lower the TDG concentrations.

With the inclusion of § 401 Condition 4 that requires PGE to implement the Water Quality Monitoring and Management Plan for Total Dissolved Gas, DEQ has reasonable assurance that the Clackamas Project will be in compliance with the standard for Total Dissolved Gas.

5.2.4 Nuisance Algae, Taste and Odor, and Aesthetic Conditions

Dense algal blooms can be aesthetically offensive as they change the color of a lake, produce algal mats or slime that is offensive both from both visual and tactile perspectives, or as they produce odors that can be detected some distance from the lake shore. Oregon's nuisance algae standard was developed to identify conditions that may be considered offensive based on the biomass of algae in water samples. Chlorophyll is one of the main photosynthetic plant pigments, and is responsible for the green color of plant species so chlorophyll is often used as a measure of algal biomass. Oregon's standard allows for the creation of a management plan for lakes characterized by high chlorophyll levels.

DEQ water quality standards prohibit the creation of tastes, odors, or the creation of offensive aesthetic conditions. No nutrients are discharged by the hydroelectric project. However, by retaining water in reservoirs and altering hydrology in the system, hydroelectric projects may affect reservoir retention time and water quality, including nutrient cycling. This influence can lead to algae blooms which may be aesthetically offensive, cause taste or odor problems, and potentially, in the case of blue-green algae also known as cyanobacteria, create toxic conditions for water that is ingested.

Oregon also has narrative criteria for the creation of tastes, odors or toxic conditions. This rule may be violated by algal blooms that impart an undesirable taste, or may produce toxins in drinking water. Blue-green algae have been known to contribute to taste and odor problems in drinking water through their production of a chemical known as geosmin. In addition, some blue-green algal species can produce potent neurotoxins or liver toxins.

Because of the potential for the Clackamas project to create algal blooms, water quality standards governing nuisance blooms, taste and odor and aesthetic conditions are evaluated together.

OAR 340-041-0019

Nuisance Algae

(1) The following values and implementation program must be applied to lakes, reservoirs, estuaries and streams, except for ponds and reservoirs less than ten acres in surface area, marshes and saline lakes:
(a) The following average Chlorophyll a values must be used to identify water bodies where phytoplankton may impair the recognized beneficial uses:
(A) Natural lakes that thermally stratify: 0.01 mg/1;
(B) Natural lakes that do not thermally stratify, reservoirs, rivers and estuaries: 0.015 mg/1;
(C) Average Chlorophyll a values may be based on the following methodology (or other methods approved by the Department): A minimum of three samples collected over any three consecutive months at a minimum of one representative location (e.g., above the deepest point of a lake or reservoir or at a point mid-flow of a river) from samples integrated from the surface to a depth equal to twice the secchi depth or the bottom (the lesser of the two depths); analytical and quality assurance methods must be in accordance with the most recent edition of Standard Methods for the Examination of Water and Wastewater.
(2) Upon determination by the Department that the values in section (1) of this rule are exceeded, the Department may:
(a) In accordance with a schedule approved by the Commission, conduct such studies as are necessary to describe present water quality; determine the impacts on beneficial uses; determine the probable causes of the exceedance and beneficial use impact; and develop a proposed control strategy for attaining compliance where technically and economically practicable. Proposed strategies could include standards for additional pollutant parameters, pollutant discharge load limitations, and other such provisions as may be appropriate. Where natural conditions are responsible for exceedance of the values in section (1) of this rule or beneficial uses are not impaired, the values in section (1) of this rule may be modified to an appropriate value for that water body;
(b) Conduct necessary public hearings preliminary to adoption of a control strategy, standards or modified values after obtaining Commission authorization;
(c) Implement the strategy upon adoption by the Commission.
(3) In cases where waters exceed the values in section (1) of this rule and the necessary studies are not completed, the Department may approve new activities (which require Department approval), new or additional (above currently approved permit limits) discharge loadings from point sources provided that it is determined that beneficial uses would not be significantly impaired by the new activity or discharge.

OAR 340-041-0007

Taste, Odor, and Toxic Conditions

Statewide Narrative Criteria
(12) The creation of tastes or odors or toxic or other conditions that are deleterious to fish or other aquatic life or affect the potability of drinking water or the palatability of fish or shellfish may not be allowed;
(15) Aesthetic conditions offensive to the human senses of sight, taste, smell, or touch may not be allowed;

Current Water Quality Status

Algal blooms have been observed in project reservoirs. Blue-green species are common in Timothy Lake and have been observed in North Fork Reservoir. In a 1988 publication, Bullock et al. (1988) noted that *Anabaena* spp. (blue-green algae species) were the most abundant phytoplankton species in Timothy Lake during late June. A review of phytoplankton sampling in Timothy Lake (Sweet, 1998) also indicated

that *Anabaena flos-aquae* accounted for 32 percent and 29 percent of phytoplankton (by density) in June 1992 and 1994, respectively. PGE has already initiated a monitoring program to identify blue-green blooms in project reservoirs. During the 2005 monitoring period for this program, blue-green algae blooms were observed in Timothy Lake and North Fork Reservoir, but algae cell densities did not reach levels that initiate sampling for toxicity or notification for the public to avoid the water.

In mid September 2001, the Clackamas River Water Board received complaints concerning a foul taste in drinking water obtained from the Clackamas River (PGE § 401 Application). Prior to and at the time of the complaints, blue-green algae, mainly *Anabaena flos aquae* and *Anabaena planctonica*, were abundant in North Fork Reservoir. Both algae species are known to produce geosmin, a chemical that produces a musty or foul taste in water. *Anabaena spp.* are commonly found in North Fork Reservoir in late summer, (EES Consulting, 2004; Carpenter 2003), but usually below the levels observed in summer of 2001. Therefore, it appears that reduced flows, which resulted in a more stratified, lentic system, are likely to have been the cause of the blue-green algae bloom and taste and odor problems observed in 2001.

Taste and odor events and blue-green algae blooms also occurred in North Fork Reservoir in the summer of 1994. The 1994 water year was also dry, with summer flows similar to 2001 summer flows, strengthening the theory that blue-green algae blooms, and resulting taste and odor problems, may be linked to low flows. However, blue-green algal blooms may not always contribute to taste and odor events, and other conditions may contribute. For instance, despite the observed blue-green algae blooms in 2005, water providers with withdrawals on the lower Clackamas River did not report any significant taste and odor events.

PGE has implemented a pre-license monitoring program for blue-green algae that triggers both the notification of downstream water users and sampling for toxic conditions when blooms reach specified cell densities. To date, observed blooms have not been dense enough to warrant analysis for cyanotoxins, the toxins produced by blue-green algae (cyanobacteria).

PGE collected water quality data from project waterbodies during 2000 and 2001 at sites in each project reservoir. Average chlorophyll concentrations were highest in Timothy Lake, but these values did not exceed 5 µg/L. Individual samples collected in August 2000 from Timothy Lake at had values as high as 26 µg/ L because they captured a mid-depth bloom of blue-green algae. However, when the chlorophyll samples taken at depth were averaged as indicated in the standard, values did not exceed 5 µg/L. Chlorophyll data collected at North Fork, Faraday and Estacada Lakes were lower with no single samples exceeding 5 µg/L.

DEQ Evaluation

Average chlorophyll data collected at project lakes were much lower than the action levels identified in rule that indicate potential nuisance levels. However, there is clear evidence that blue-green algae species occur in project reservoirs, and from time to time blooms do form. As noted above, characteristics of the blue-green species may result in nuisance conditions, cause taste and odor problems or release toxic compounds. The Clackamas River is a source of drinking water for 6 different municipal providers. All of these withdraw water downstream of North Fork Reservoir; The City of Estacada withdraws water just downstream of North Fork Dam, the other five withdraw water much closer to the mouth of the Clackamas River. Thus the potential for a toxic bloom poses a substantial concern for human health in the region. Blooms in project reservoirs have also been a suspected contributor to taste and odor complaints in drinking water.

Due to a lack of understanding of bloom dynamics, and to the low nutrient levels that characterize the Clackamas system, the water quality model is not able to accurately predict bloom formation. Therefore, PGE, ODEQ, and other signatories to the Settlement Agreement agreed to implement a two-phased (pre- and post-license issuance phases) monitoring and notification program to alert affected parties when blue-green algae bloom conditions exist (Settlement Agreement, 2006, Exhibit F). The objectives of the program are to protect people from exposure to toxic conditions, characterize the relationship between Project operations and algae bloom formation, and to identify linkages between algal conditions, taste

and odor problems, and potential toxicity. The monitoring and management program was developed in consultation with the Blue-Green Team, consisting of PGE, ODEQ and other interested parties to the Settlement Agreement.

Pre-license monitoring began in spring 2005 and was designed to identify potential toxic-forming events, establish notification levels for public recreation, and evaluate taste/odor relationships associated with algal blooms. The pre-license program will continue until the new FERC license is issued and the post-license program is implemented. Post-license monitoring will be designed to address the three pre-license monitoring objectives and to develop an understanding of bloom-forming conditions and their relationship to Project operations. The monitoring and notification program will include creation of an action plan for public notification of substantial bloom events, and creation of an Action Plan for sharing monitoring data and interpreting results.

Results of the pre-license monitoring will inform development of the post-license monitoring program, which will be designed to provide an understanding of the conditions that produce blue-green algae blooms in Timothy Lake and North Fork Reservoir and the relationship of blooms to Project operations. If, after an appropriate interval of monitoring, a correlation between blue-green algae abundance and taste and odor problems is demonstrated, PGE will consult with ODEQ and the Blue-Green Team to develop a reservoir management strategy, or a suitable alternative, to mitigate any Project-induced component of the taste and odor problems.

DEQ Findings

Existing data show that there is a reasonable chance that algal blooms may form and contribute to odor problems in and near project reservoirs or to downstream drinking water users. PGE, DEQ and the Settlement Parties crafted an adaptive-management approach to document the problem, and to understand both the impairment and potential management strategies to address bloom formation. Chapter 4 of the Water Quality Monitoring and Management Plan describes how the blue-green algae monitoring plan will be implemented. In addition, this strategy is described in the Settlement Agreement (2006) in proposed license article 17 and Exhibit F. DEQ has included § 401 Condition 5 to require PGE to implement the Blue-green algae monitoring and management program to ensure that PGE addresses potential taste, odor and algal toxin production related to project operations.

5.2.5 Temperature

Water Quality Standard

Water temperature has a profound effect on organisms that live or reproduce in the water. This is particularly true of Oregon's native "cold-water" fish such as salmon, bull trout and steelhead and for some amphibians (frogs and salamanders) and macroinvertebrates (aquatic insects). When water temperature becomes too high, salmon and trout (salmonids) suffer a variety of ill effects. With increasing temperature, salmonids experience sub-lethal effects of impaired feeding, decreased growth rates, reduced resistance to disease and parasites, increased sensitivity to toxics, intolerance during migration, reduced ability to compete with more temperature-resistant species and increased vulnerability to predation. If temperatures are high enough for sustained periods, mortality occurs. Elevated temperatures may also adversely affect other important water quality parameters (such as dissolved oxygen). The temperature standard criteria were established, using available information, with the primary intent of protecting the resident salmonid populations. Language in the standard recognizes that natural water temperatures may exceed the desirable numeric criteria established in the standard for protection. When water temperatures are above the numeric criterion, discharges of waste and activities caused by human uses may not exceed 0.3º C collectively.

Pertinent excerpts of the applicable State standards for temperature are included here. The salmonid uses and related temperature criteria present in the affected reaches of the Clackamas basin are listed in Table 2 of this evaluation report. (see Table 2 in Section 4.1, Beneficial Uses).

The Clean Water Act also requires that a list of impaired waters be produced showing waters that do not meet water quality standards and thus do not support beneficial uses. This list is known as the 303(d)

list, named after the applicable section of the federal Clean Water Act. Once a waterbody is included on this list, the Clean Water Act requires the establishment of a Total Maximum Daily Load (TMDL) for the pollutant sources on the waterbody. The TMDL specifies the maximum amount of pollutant each source may contribute to the impaired waterbody such that the waterbody will meet the applicable water quality standards. In addition to specifying the pollutant load, the TMDL includes a Water Quality Management Plan where the state outlines what actions will be taken to implement the TMDL. Rules that provide guidance for DEQ to establish TMDLs are included in Oregon Administrative Rule 340-042. The last section of this rule (OAR 340-042-0080) outlines implementation steps for the TMDL, and is included below. As described in this rule, DEQ requires sources and designated management agencies to submit implementation plans that show how the TMDL allocations will be met.

The Lower Clackamas River was included on the 303(d) list because it is impaired by temperature (Table 4, Section 4.3). DEQ has completed TMDLs for temperature, bacteria and mercury for the entire Willamette Basin, including the Clackamas Basin (Willamette Basin TMDL, 2006). The Temperature TMDL provided a load allocation of 0.15° C increase for PGE's Clackamas Project at the point of maximum thermal impact in the Clackamas River.

Oregon Administrative Rule (OAR) 340-041-0028
Temperature
(1) Background. Water temperatures affect the biological cycles of aquatic species and are a critical factor in maintaining and restoring healthy salmonid populations throughout the State. Water temperatures are influenced by solar radiation, stream shade, ambient air temperatures, channel morphology, groundwater inflows, and stream velocity, volume, and flow. Surface water temperatures may also be warmed by anthropogenic activities such as discharging heated water, changing stream width or depth, reducing stream shading, and water withdrawals.
(2) Policy. It is the policy of the Commission to protect aquatic ecosystems from adverse warming and cooling caused by anthropogenic activities. The Commission intends to minimize the risk to coldwater aquatic ecosystems from anthropogenic warming, to encourage the restoration and protection of critical aquatic habitat, and to control extremes in temperature fluctuations due to anthropogenic activities. The Commission recognizes that some of the State's waters will, in their natural condition, not provide optimal thermal conditions at all places and at all times that salmonid use occurs. Therefore, it is especially important to minimize additional warming due to anthropogenic sources. In addition, the Commission acknowledges that control technologies, best management practices and other measures to reduce anthropogenic warming are evolving and that the implementation to meet these criteria will be an iterative process. Finally, the Commission notes that it will reconsider beneficial use designations in the event that man-made obstructions or barriers to anadromous fish passage are removed and may justify a change to the beneficial use for that water body.
(3) Purpose. The purpose of the temperature criteria in this rule is to protect designated temperature sensitive beneficial uses, including specific salmonid life cycle stages in waters of the State.
(4) Biologically Based Numeric Criteria. Unless superseded by the natural conditions criteria described in section (8) of this rule, or by subsequently adopted site-specific criteria approved by EPA, the temperature criteria for State waters supporting salmonid fishes are as follows:
(a) The seven-day-average maximum temperature of a stream identified as having salmon and steelhead spawning use on subbasin maps and tables set out in OAR 340-041-0101 to OAR 340-041- 0340: Tables 101B, and 121B, and Figures 130B, 151B, 160B, 170B, 220B, 230B, 271B, 286B, 300B, 310B, 320B, and 340B, may not exceed 13.0 degrees Celsius (55.4 degrees Fahrenheit) at the times indicated on these maps and tables;
(b) The seven-day-average maximum temperature of a stream identified as having core cold water habitat use on subbasin maps set out in OAR 340-041-101 to OAR 340-041-340: Figures 130A, 151A, 160A, 170A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A, may not exceed 16.0 degrees Celsius (60.8 degrees Fahrenheit);
(c) The seven-day-average maximum temperature of a stream identified as having salmon and trout rearing and migration use on subbasin maps set out at OAR 340-041-0101 to OAR 340-041-0340: Figures 130A, 151A, 160A, 170A, 220A, 230A, 271A, 286A, 300A, 310A, 320A, and 340A, may not exceed 18.0 degrees Celsius (64.4 degrees Fahrenheit);

(d) The seven-day-average maximum temperature of a stream identified as having a migration corridor use on subbasin maps and tables OAR 340-041-0101 to OAR 340-041-0340: Tables 101B, and 121B, and Figures 151A, 170A, and 340A, may not exceed 20.0 degrees Celsius (68.0 degrees Fahrenheit). In addition, these water bodies must have coldwater refugia that are sufficiently distributed so as to allow salmon and steelhead migration without significant adverse effects from higher water temperatures elsewhere in the water body. Finally, the seasonal thermal pattern in Columbia and Snake Rivers must reflect the natural seasonal thermal pattern;
(8) Natural Conditions Criteria. Where the department determines that the natural thermal potential of all or a portion of a water body exceeds the biologically-based criteria in section (4) of this rule, the natural thermal potential temperatures supersede the biologically-based criteria, and are deemed to be the applicable temperature criteria for that water body.
(12) Implementation of the Temperature Criteria.
(a) Minimum Duties. There is no duty for anthropogenic sources to reduce heating of the waters of the State below their natural condition. Similarly, each anthropogenic point and nonpoint source is responsible only for controlling the thermal effects of its own discharge or activity in accordance with its overall heat contribution. In no case may a source cause more warming than that allowed by the human use allowance provided in subsection (b) of this rule.
(b) Human Use Allowance. Insignificant additions of heat are authorized in waters that exceed the applicable temperature criteria as follows:
(A) Prior to the completion of a temperature TMDL or other cumulative effects analysis, no single NPDES point source that discharges into a temperature water quality limited water may cause the temperature of the water body to increase more than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after mixing with either twenty five (25) percent of the stream flow, or the temperature mixing zone, whichever is more restrictive; or (B) Following a temperature TMDL or other cumulative effects analysis, waste load and load allocations will restrict all NPDES point sources and nonpoint sources to a cumulative increase of no greater than 0.3 degrees Celsius (0.5 Fahrenheit) above the applicable criteria after complete mixing in the water body, and at the point of maximum impact.
(h) Other Nonpoint Sources. The department may, on a case-by-case basis, require nonpoint sources (other than forestry and agriculture), including private hydropower facilities regulated by a 401 water quality certification, that may contribute to warming of State waters beyond 0.3 degrees Celsius (0.5) degrees Fahrenheit), and are therefore designated as water-quality limited, to develop and implement a temperature management plan to achieve compliance with applicable temperature criteria or an applicable load allocation in a TMDL pursuant to OAR 340-042-0080.
(A) Each plan must ensure that the nonpoint source controls its heat load contribution to water temperatures such that the water body experiences no more than a 0.3 degrees Celsius (0.5 degree Fahrenheit) increase above the applicable criteria from all sources taken together at the maximum point of impact.
(B) Each plan must include a description of best management practices, measures, effluent trading, and control technologies (including eliminating the heat impact on the stream) that the nonpoint source intends to use to reduce its temperature effect, a monitoring plan, and a compliance schedule for undertaking each measure.
(C) The Department may periodically require a nonpoint source to revise its temperature management plan to ensure that all practical steps have been taken to mitigate or eliminate the temperature effect of the source on the water body.
(D) Once approved, a nonpoint source complying with its temperature management plan is deemed in compliance with this rule.
(i) Compliance Methods. Anthropogenic sources may engage in thermal water quality trading in whole or in part to offset its temperature discharge, so long as the trade results in at least a net thermal loading decrease in anthropogenic warming of the water body, and does not adversely affect a threatened or endangered species. Sources may also achieve compliance, in whole or in part, by flow augmentation, hyporheic exchange flows, outfall relocation, or other measures that reduce the temperature increase caused by the discharge.

OAR 340-042-0080

Implementing a Total Maximum Daily Load

(1) Management strategies identified in a WQMP to achieve wasteload and load allocations in a TMDL will be implemented through water quality permits for those sources subject to permit requirements in ORS 468B.050 and through sector-specific or source-specific implementation plans for other sources. WQMPs will identify the sector and source-specific implementation plans required and the persons, including DMAs, responsible for developing and revising those plans.
(2) The Oregon Department of Forestry will develop and enforce implementation plans addressing state and private forestry sources as authorized by ORS 527.610 through 527.992 and according to OAR chapter 629, divisions 600 through 665. The Oregon Department of Agriculture will develop implementation plans for agricultural activities and soil erosion and enforce associated rules as authorized by ORS 568.900 through 568.933 and according to OAR chapter 603, divisions 90 and 95.
(3) Persons, including DMAs other than the Oregon Department of Forestry or the Oregon Department of Agriculture, identified in a WQMP as responsible for developing and revising sector-specific or source-specific implementation plans must:
(a) Prepare an implementation plan and submit the plan to the Department for review and approval according to the schedule specified in the WQMP. The implementation plan must:
(A) Identify the management strategies the DMA or other responsible person will use to achieve load allocations and reduce pollutant loading;
(B) Provide a timeline for implementing management strategies and a schedule for completing measurable milestones;
(C) Provide for performance monitoring with a plan for periodic review and revision of the implementation plan;
(D) To the extent required by ORS 197.180 and OAR chapter 340, division 18, provide evidence of compliance with applicable statewide land use requirements; and
(E) Provide any other analyses or information specified in the WQMP.
(b) Implement and revise the plan as needed.
(4) For sources subject to permit requirements in ORS 468B.050, wasteload allocations and other management strategies will be incorporated into permit requirements.

Current Water Quality Status and DEQ Evaluation

Most sections of this § 401 Evaluation include separate sections for Current Conditions, Potential Impacts of the New License, and DEQ's Evaluation. Several operational changes under the new license will impact water temperatures in various project reaches, so this section of the Evaluation Document will describe current conditions, summarize operational changes proposed under the new license, and then provide DEQ's evaluation of the proposed actions for each reach. The section entitled 'DEQ Findings' summarizes DEQ's proposed decision for the § 401 Certification.

PGE's current operating license issued by FERC for the Clackamas Project expired in August, 2005. PGE initiated efforts to renew its operating license with several steps, including submitting notice to FERC and the Oregon Department of Water Resources that it intended to apply for a new license and water right (respectively), and convening a relicensing work group to support the collaborative relicensing process for the FERC application. Representatives from stakeholder groups who would be affected by or had an interest in the new license agreed to work together to identify the issues posed by the project, to agree on study plans to investigate the issues and their potential solutions, and ultimately to come to consensus on the future operating conditions for the new license. The Alternative Relicensing group included representatives from state and federal agencies, tribes affected by the project, non-governmental organizations, and local jurisdictions. Between 2000 and 2005 this alternative licensing group scoped the issues, developed and reviewed study plans, and identified protective, mitigation and enhancement measures for PGE to implement under the new license. In the spring of 2006, PGE and 32 other parties submitted to FERC a 'Settlement Agreement Concerning the Relicensing of Clackamas River Hydroelectric Project' (Settlement Agreement, 2006). In addition to identifying operational conditions under the new license, this agreement identified protective, mitigation and enhancement measures that PGE would undertake under the new license. This Settlement Agreement became the basis for FERC's Draft Environmental Analysis, which incorporated most of the proposed measures.

One area of impact that was not addressed by the Settlement Agreement was PGE's contribution to river temperature downstream of River Mill Dam. Because no solutions for the downstream heating were

found by the time the Settlement Agreement was submitted, some members of the Settlement Working Group continued to meet to identify what measures should be taken to address the heating contributed by the Clackamas Project.

Through the alternative licensing process, PGE conducted water quality monitoring during 2000 and 2001 along the Clackamas reaches that are affected by the project. PGE used these data to calibrate the water quality model that predicted water temperatures for the project reservoirs and in stream reaches from Timothy Lake down to the mouth of the Clackamas (PGE § 401 Application, 2008). These data are the basis for the description of current conditions presented here. The water quality model constructed by PGE included the entire Oak Grove Fork and Clackamas River downstream of the Oak Grove confluence. The results provide the natural thermal potential temperatures for these reaches, and allow an evaluation of the proposed project impacts to these reaches as well.

The Clackamas River from the mouth to the River Mill Dam tailrace was included on the Clean Water Act § 303(d) list as impaired for water temperature beginning in 1998. This listing was based on Clackamas River water temperatures that exceeded the numeric criteria for the river reach. At that point in time, no water quality modeling had been completed to determine whether water temperatures higher than the numeric criteria were due to anthropogenic sources or natural conditions. DEQ completed a TMDL for the entire Willamette Basin including the Clackamas Basin in September, 2006 (Willamette TMDL, 2006). As part of the TMDL, water quality models were constructed for several reaches throughout the Willamette Basin. PGE's water quality model developed for the relicensing effort was adopted by DEQ in the Willamette Basin TMDL. The TMDL provided an allocation to PGE, requiring PGE to limit its contribution of heat to the lower Clackamas River to no more than 0.15° C between River Mill Dam and the mouth of the Clackamas River.

The current water temperature conditions, a brief description of proposed changes to operations and DEQ's evaluation of the water quality impacts for the proposed operations, presented as separate sections for other parameters in this document, are combined here. Combining these sections together in the § 401 Evaluation Report resulted in a chapter that was easier to read. Only brief descriptions of the proposed operations are included in this document. Additional detail for the changes in operations under the new license are available in the Settlement Agreement (2006) and in PGE's § 401 Application (2008). This section will provide descriptions starting at Timothy Lake in the upper watershed, and continuing downstream.

Timothy Lake: Timothy Lake was created by impounding the upper Oak Grove Fork in 1956. The lake was historically an alpine meadow; a land type dominated by wetlands and low-growing vegetation. There are three main tributaries to Timothy Lake; the Oak Grove Creek, Crater Creek and Cooper Creek. The Oak Grove Fork and Crater Creek are very cold spring-fed systems, so that the flow-weighted mixing model for natural thermal potential temperatures in the pre-dam system predicts very cold water temperatures, generally less than 10° C. Cooper Creek is not much warmer with temperatures ranging up to 12° C. Timothy Lake is 1430 acres in size, with an average summer inflow of 35 cfs. Summer retention time in the lake is fairly long, allowing the surface water to warm. Colder more dense water sinks to the lake bottom, creating a lake with three distinct water layers that do not mix. Water temperatures in the upper layer, also called the epilimnion, become quite warm, as high as 23° C (expressed as a seven-day average of the daily maximum temperatures) during the summer of 2000 and 2001. Deeper water, also called the hypolimnion, remained cold, reaching a seven-day average maximum of 13° C at the lake outlet in the fall. At mid-depth, also called the metalimnion, water temperatures change rapidly with depth. Temperatures in the metalimnion ranged from 8° C to18 °C between depth of 5 and 15 meters.

Under the new license, PGE proposes relatively minor changes to Timothy Lake elevation and changes to downstream flows, including higher minimum flows during summer. These changes are fairly small compared to existing conditions. The water quality model predicts only small changes in temperature for the lake. Stratification will still occur at the same time of year and at the same depths, and predicted water temperatures are slightly lower but very similar to existing conditions.

Surface water temperatures are currently above the numeric criterion of 16° and are predicted to remain high under a new license. However, water temperatures in the middle layer of the lake drop quickly to lower than 16° C, providing cold water habitat for sensitive resident salmonids deeper in the lake. The volume of habitat during July and August that is less than 16° C provides sufficient habitat for beneficial uses that are sensitive to high temperatures including resident trout. During other times of year, the water temperatures throughout the water column remain below the 16° C criterion. Two of the tributaries to Timothy Lake, Crater Creek and Oak Grove Creek, maintain very cold temperatures throughout the summer (<10° C). Cooper Creek is generally colder than 12° C. Of the three major tributaries to the lake, Crater Creek provides the coldest and largest summer time flow. Cold water habitat is available throughout the summer near the mouths of these creeks as they enter the lake.

Both existing data and the water quality model prediction under the new operating conditions for Timothy Lake show that the middle layer, or metalimnion, is the zone of Timothy Lake that meets all three standards. Cold water here is close enough to the surface to support algal growth, which in turn can improve dissolved oxygen conditions. Increases in oxygen are often observed in this middle layer during summer months. No pH violations have been observed at Timothy Lake, although pH values are sometimes elevated during algal blooms. The volume of this layer provides sufficient habitat for beneficial uses sensitive to high temperatures, including resident trout. Additional cold water habitat can be found in the 'mini-estuaries' of Timothy Lake where the three major tributaries enter the lake, delivering cold water and creating pockets of cold water refugia within the lake.

Future changes in project operations may result in pH values that are closer the standard. To determine whether this happens, and address violations if they do, PGE has proposed an algal monitoring program including an adaptive management approach to limit nuisance blooms in Timothy Lake. This program will include monitoring water quality conditions both leading up to and resulting from future algal blooms, as well as designing the monitoring program to inform how operations may affect bloom formation.

The water quality model for Timothy Lake suggests that increased bloom activity under future operations may contribute to pH violations in the lake. The CE-Qual-2E model is appropriate for reservoirs and is well calibrated for general water quality. However, relatively little phytoplankton data were available to calibrate the Timothy Lake model for algal bloom formation. In addition bloom formation is difficult to predict either by models or from pre-bloom data. The level of accuracy surrounding the model prediction for algal community structure at various depths, and in turn predicting increased pH values may be low. Blooms may occur at less intense levels or different locations and not result in standard violations. An adaptive management approach has been proposed to monitor whether future algal blooms cause pH violations. This approach is outlined in the Blue-Green Monitoring Program described in the Water Quality Monitoring and Management Plan for Timothy Lake. The program will include water quality monitoring throughout the water column for temperature, dissolved oxygen and pH. This plan further requires that project modifications be considered to decrease bloom frequency and improve water quality conditions if deemed appropriate.

Timothy Lake is a stratified reservoir that is expected to concurrently meet the water quality criteria for temperature, dissolved oxygen and pH in the metalimnion of the lake under the new license. Values for pH can spike in the lake during algal blooms. The Blue-green Monitoring Program proposed under the new license includes water quality monitoring and an evaluation of project operations if there are bloom-induced water quality problems. This monitoring program provides assurance to DEQ that if water quality issues arise in the future, an adaptive management approach will address them.

The Upper Oak Grove Fork (between Timothy Lake and Harriet Lake): This reach of stream receives outflow from Timothy Lake but is dominated by groundwater seepage flow. The natural summer outflow from Timothy Lake is 35 cfs, while summer low flows into Harriet Lake is about 282 cfs. Stone Creek is also a tributary to this reach of the Oak Grove Fork. This reach is dominated by cold groundwater inflow. This large inflow of groundwater means that summer time water quality of Timothy Lake has only a minor influence on the Oak Grove Fork. Summer water temperature from the outlet of Timothy Creek is cold because the flow is released at about a 65' depth from the lake. PGE monitored water temperatures at the US Geological Survey stream gage at Government Camp, not far downstream of Timothy Lake.

Water temperatures rise rapidly in late September and persist through early November. Annual maximum water temperatures occur at this time, but remain fairly cold at 12° to 13° C, well below the applicable 16° C numeric criterion for this reach.

Temperatures measured just upstream of Harriet Lake show that some heating occurs in the reach. This is attributed to both solar radiation and exposure to warm summer air temperatures. However, at this more downstream point, existing temperatures remain well below the numeric criteria of 16° C year-round. A much smaller impact on water temperature from autumn releases at Timothy Lake is observed upstream of Harriet Lake than in the Timothy Lake tailrace.

Under the new license, PGE proposes changes to the instream flow regime for this reach. More water will be released during the summer months of July and August. Flows in September will be limited, forcing the fall drawdown of the lake to occur over a longer time period. The water quality model predicts warmer temperatures during July and August under the new license, with temperatures beginning to cool down by mid-September. This pattern of thermal release more closely mimics a normal seasonal pattern. Both the observed water temperatures and those predicted under the new operations remain below the 16° C numeric criterion.

Harriet Lake: Lake Harriet is relatively small, at less than 1 mile in length. With summer base flow of about 300 cfs entering the lake from the Oak Grove Fork, retention time in the lake is about 10 hours. Water moving this quickly through the lake provides little time for heating. The lake is not stratified, and monitoring data show water temperatures very similar to the site upstream of Harriet Lake. These values are well below the applicable 16° C numeric criteria.

PGE proposes to increase the elevation of Harriet Lake by one foot, and to construct a flow control structure at the lake outlet that will enable the release of continuous instream flows downstream of Harriet Lake. This flow regime will result in large changes downstream of Harriet Lake, but are not expected to change water temperature conditions within Harriet Lake. Indeed, the water quality model shows only a small difference between the existing and predicted temperatures at a depth of 6 feet in the lake. This minor difference reflects the changes in flow released from Timothy Lake during September. Water temperatures in Harriet Lake will remain well below the 16° C numeric criterion.

Frog Lake: Water diverted from Harriet Lake is sent to Frog Lake through a 4 mile pipeline that is partially buried. Frog Lake is small, about 9 acres in size. This small pond is used as the forebay to the Oak Grove Powerhouse. Depending on water availability to refill the lake, Oak Grove Powerhouse is operated in peaking mode; producing electricity only during the hours of peak electrical demand. Thus the surface elevation of Frog Lake may change significantly on a daily basis. Water temperatures in Frog Lake are quite cold throughout the year, remaining below 12° C for both current conditions as well as those predicted under future operating conditions. Very short residence times in Frog Lake do not provide time for the lake water to increase in temperature, so water delivered to the Clackamas River below the powerhouse is quite cold. Increasing instream flows downstream of Harriet Lake in the Oak Grove Fork will decrease the total volume delivered to Frog Lake and the Powerhouse during summer months. This decrease is not expected to increase temperatures in Frog Lake.

Temperatures in Frog Lake are lower than the 13° C spawning criterion at all times, even during the summer when the 16° C rearing criterion applies. No anadromous fish are present in Frog Lake, so the spawning criterion does not apply at this site. However, water from Frog Lake is delivered to the Clackamas where spawning is a designated use between September 1 and June 15. Water delivered from upstream sources must not contribute to violations in the Clackamas River. The cold temperatures that have been observed and future temperatures predicted by the water quality models will not contribute to water temperature violations within or downstream of Frog Lake.

Lower Oak Grove Fork (Harriet Lake to Clackamas confluence): Under current conditions, no water is released from Harriet Lake. Water detained in Harriet is diverted to Frog Lake and the Oak Grove Powerhouse. Only flows in excess of the 600 cfs diversion capacity to Frog Lake from storms and snow melt result in spill at Harriet Lake to the Lower Oak Grove Fork. Under current operating conditions, flow

in the Lower Oak Grove Fork is generally restricted to accretion flow from groundwater and small tributaries.

A natural waterfall presents a barrier to fish passage about half way between Harriet Lake and the confluence with the Clackamas River. Anadromous fish are present downstream of the waterfall, and spawn between September 1 and June 30, when the colder numeric criteria of 13° C applies. The cold water rearing criterion of 16° C applies during the remaining summer months. PGE monitoring at two sites, one mid-reach and one near the confluence with the Clackamas, showed violations of the numeric criteria during both rearing and spawning periods.

Proposed operations at the Harriet Lake outlet will differ significantly from existing operations. Currently only storm flows in excess of the diversion capacity to Frog Lake spill into the Oak Grove Fork, and water storage at Timothy Lake is managed to avoid this spillage whenever possible. Storms and snow melt generally occur during fall, winter and spring; very few spill events have occurred at Harriet Lake during the summer season. PGE has proposed to release water year round from Harriet Lake, following an elaborate regime. The proposed flows range from 70 to 100 cfs depending on both the season and the water year, with different flow amounts for dry, normal and wet years. Additional water will be released to mimic winter storm flows and spring snow melt events.

The water quality model was used to compare the existing operations and future operations from April 2000 through late September 2001. This model run shows that the instream flows will significantly lower water temperatures in the reach below Harriet Dam. Figure 6 shows the thermal benefit for flow releases into the Lower Oak Grove Fork. Slight warming does occur as water flows downstream in the Oak Grove Fork. However water temperatures remain below the applicable numeric criterion throughout the lower Oak Grove reach.

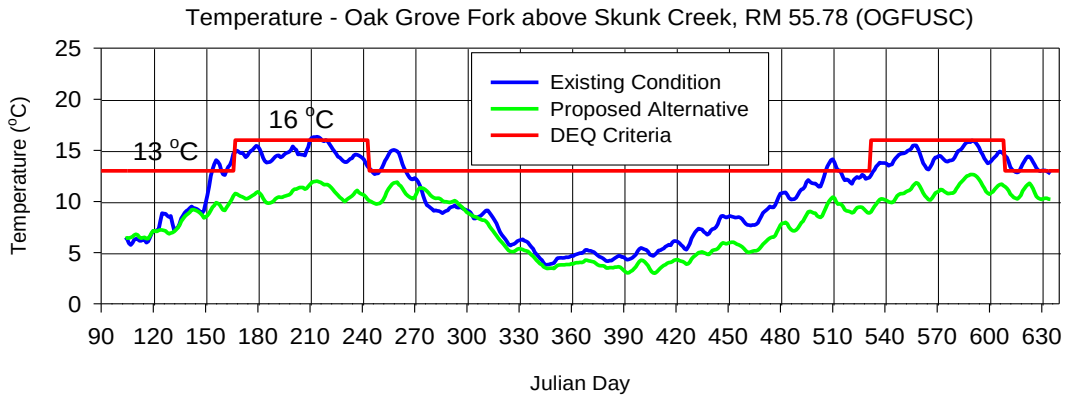

Figure 6. Predicted temperature in the Clackamas River system – Existing vs. SA Alternative, Oak Grove Fork above Skunk Creek, RM 55.78 (OGFUSC). (From the PGE 401 Application, June 2008).

Clackamas River from the Oak Grove Fork to the Oak Grove Powerhouse: There are about five miles of Clackamas River between the Oak Grove Fork and the Oak Grove Powerhouse. This reach is most impacted by the hydroelectric project during summer, when flows in the Oak Grove Fork are diverted to the powerhouse, and flow from the upper Clackamas watershed is low. During summer, base flow from the groundwater-fed Oak Grove Fork is about equal to flow coming down the Clackamas upstream of the Oak Grove confluence. Because the project diverts flow from the Oak Grove Fork, and delivers it to the Clackamas five miles downstream of the Oak Grove Fork, this reach has lower flow than it would without the project in place. Unlike the Oak Grove Fork, the much larger Clackamas watershed upstream of the Oak Grove Fork is dominated by rainfall and snowmelt, so the percentage of flow contributed by the upper Clackamas is greater during wetter months of the year, and the project impact on this reach becomes less apparent. PGE monitoring in this reach shows that water temperatures exceed the numeric criterion often during summer, and occasionally during the spawning season.

The proposed instream flows in the lower Oak Grove Fork will reduce water temperatures compared to the existing conditions. The number of days that temperatures exceed the numeric criterion under the proposed flow scenario compared to current conditions decreases from 30 to 16 in 2000 and 52 to 28 in 2001. When all anthropogenic sources are removed and the numeric criterion is not met, the natural thermal potential temperature becomes Oregon's numeric temperature criteria. Thus, exceedances of the numeric criteria are not violations of the temperature standard when the natural thermal potential temperature is not exceeded.

Natural thermal potential temperatures are estimated using elaborate water quality models such as CE-QUAL-2E or Heatsource that estimate the balance of heat sources and sinks under "natural" conditions, or conditions that represent no human influence. PGE's modeling effort assessed the impact of the project on water quality by demonstrating the difference between existing conditions with and without the project. No effort was made to predict the natural thermal potential water temperatures for the Clackamas River upstream of the Oak Grove Fork Confluence.

When estimates of natural thermal potential temperature are not available, and DEQ needs to estimate a source's thermal impact, DEQ's policy is to assume that the natural thermal potential temperature of the incoming or receiving water would meet the numeric criteria. To determine whether the exceedances of the 16° C or 13° C numeric criteria are considered violations of the temperature standard, for modeling purposes, the water temperatures for the Clackamas River upstream of the Oak Grove Fork were scaled downward so that they never exceeded the numeric criteria. When this boundary condition was used in the model, water temperatures downstream of the confluence of the Clackamas River and Oak Grove Fork did not show violations of the numeric criteria.

This approach shows that with the lower water temperatures in the Oak Grove Fork that result from the proposed instream flows, the reach of Clackamas river between the confluence of the Oak Grove Fork and the Oak Grove powerhouse will no longer violate the applicable temperature criteria.

Clackamas River from the Oak Grove Powerhouse to the inlet of North Fork Reservoir: Clackamas River flows are restored in this reach of river as water diverted from Harriet to Frog Lake is delivered through the Oak Grove Powerhouse to the Clackamas. As noted above, water temperatures in Harriet Lake are cold, residence times in Frog Lake are short, and water is routed through buried pipeline between the lakes and powerhouse. Thus opportunities for heating the diverted water are minimal. Here the cold water is delivered to an open river, allowing solar and air-induced heating to occur in the reach between the Oak Grove Powerhouse and North Fork Reservoir. Water temperatures monitored by PGE in 2000 and 2001 showed few excursions above the applicable numeric criteria. Water quality modeling for this reach showed existing conditions to be equal to natural thermal potential.

Water temperatures in this reach are slightly higher (less than 0.5° C) than under existing conditions. This was attributed to the increased temperature of the instream flow delivered to the lower Oak Grove reach under the proposed operating conditions, compared to the larger volume of very cold water released from the Oak Grove powerhouse. The benefit of increased flows for temperature and other water quality improvements in the Oak Grove Fork is far greater than the slight heating predicted by the model for the Clackamas River downstream of the Oak Grove powerhouse. Water temperatures just downstream of the Oak Grove Powerhouse are quite cold, and rise somewhat quickly due to mixing with upstream Clackamas water and warm air temperatures during summer. Temperatures in the Oak Grove Fork will drop by 2-3° C while temperatures in the Clackamas downstream of the Oak Grove Powerhouse may increase by less than 0.5° C on some days.

Water temperatures in this reach generally remain below the numeric criterion. In addition, the flows diverted for creating power have all been returned to the river. The temperatures of this water are not increased by PGE's operations, instead, they are kept cooler by short retention times, and conveyance through partially buried piping. PGE's activities thus have a cooling, not a warming affect on this reach of the Clackamas, so PGE's operations are in compliance with the temperature criteria in this reach.

North Fork Reservoir: This large and deep reservoir exhibits weak stratification during the warm summer months. River water entering the reservoir is colder than the surface of the lake, indicating that some warming occurs within the lake. The cooler upstream water sinks, sometimes creating a weak thermocline during the August-September time frame. The thermocline is a zone where temperatures change quickly with depth. The density of water changes with temperature, so the thermocline generally prohibits mixing between colder water at depth and warmer water at the surface. However, in North Fork Reservoir the difference in temperature is small (less than 4° C), allowing the layers to mix if there is sufficient wind or if there are changes to inflowing water temperature.

Flows into and out of North Fork Reservoir met either the applicable 16° or 13° C numeric criterion, or the modeled natural thermal potential temperature for Clackamas River water above and below the project, indicating that reservoir temperatures that meet the upstream and downstream natural thermal potential temperatures are in compliance with the temperature standard.

PGE proposes several measures that will improve fish passage through the reservoir. Most of these are not likely to impact water quality in North Fork Reservoir. However, if the primary changes fail to improve fish passage through North Fork Reservoir, PGE will construct a 3000 cfs surface water collector that will direct juvenile fish to the downstream fish ladder. This facility could alter water temperatures in and downstream of the reservoir compared to current conditions. If constructed, the collector will deliver surface water into the project turbines, altering the current flow regime in the reservoir, and changing downstream water temperature as a result.

PGE used the water quality model to quantify temperature changes if the surface collector is installed. This model run included routing up to 3000 cfs of surface flow to the North Fork Powerhouse between March 1 and June 30; no surface withdrawal between July 1- October 14, all surface flow to the powerhouse between October 15 and January 15, and a limit of 500 cfs to the powerhouse between January 15 and the last day of February. These results showed no downstream impacts on temperature compared to the proposed alternative.

PGE will construct the surface collector only after other efforts to improve fish passage have failed. This may happen between 14 and 25 years after the new license is issued. If PGE follows the operations as described above, then DEQ is reasonably assured that the 3000cfs collector will not contribute to temperature violations. However, implementation of this facility is far into the future. If the actual design or operation of the proposed facility differs from that described here, PGE will have to confer with DEQ to determine whether the revised proposal will comply with Oregon water quality standards.

Under current operations, water temperatures in the North Fork Reservoir are in compliance with the temperature standard. The operational changes proposed for North Fork Reservoir are designed to improve downstream fish passage and to protect downstream migrating salmonids, and are not expected to alter water temperatures in the reservoir. Installation of the 3000 cfs surface collector is the most likely measure to alter current temperature conditions, although the water quality model indicates that this will not happen.

The fish passage improvements were agreed to as a suite of adaptive management measures; implementing some measures, testing, and implementing others as needed. If PGE determines that a 3000 cfs surface collector is needed, implementation of the collector will trigger a FERC license amendment, which will allow a future § 401 certification review of the measure.

Faraday Diversion Reach: Much of the water released from North Fork Reservoir is diverted to Faraday Lake. Under the existing operations, about 120 cfs flows through the Faraday Diversion Reach, the original Clackamas River channel for this portion of the project. Natural thermal potential in this reach exceeds the 16° cold water rearing criterion during much of the summer, and the 13° spawning criterion for part of the spring and fall spawning periods. Under current operations, water temperatures in the Faraday Diversion reach occasionally exceed NTP or the applicable numeric criterion.

PGE proposes to increase summer time base flow in the Faraday Diversion reach to 270 cfs, and if fish passage is sufficiently improved, this base flow may be decreased to 250 cfs. The water quality model shows improved temperatures with both flow levels . Predicted temperatures follow the Natural thermal potential temperature well, and are considered to be in compliance with the standard.

Faraday Lake: Travel time through Faraday Lake is rapid, so under existing conditions, there is minimal stratification in Faraday Lake. The upper layer of the lake, to a depth less than 5 m, can be as much as 3° C warmer than water at depth. The shallow water layer remains less than 18°, and the bulk of the water column temperature remains unchanged, at 15-16° C throughout the summer months. As described later in the description for River Mill Dam to mouth, the minor heating in the surface of Faraday Lake contributes some heat to the Clackamas downstream of River Mill Dam. Thus, PGE is proposing to either lower the elevation in Faraday Lake, or to construct a channel that will reduce retention time in Faraday Lake even further. The water quality model was used to show how these changes will affect Faraday Lake. Model results show that the summer time heating in the surface water will disappear, removing the minor stratification in the lake. The entire water column will remain cold, at 15-16° throughout the summer. While the water temperature criteria is already met in Faraday Lake, this action will improve temperature conditions in the lake as well as downstream of River Mill Dam.

Estacada Lake: This lake is much smaller than North Fork Lake, and has a retention time of about 2 days. The lake is well mixed, showing no signs of stratification. Unlike North Fork Dam where water deep in the lake is delivered downstream, Estacada Lake water is released from a 60 foot-wide structure 11 feet high, that delivers water from mid-depth in Estacada Lake. This large port draws water from a wide area, and discourages stratification in the lake. Tailrace temperatures are indicative of lake water temperatures in the lake. The water quality model indicates that tailrace temperatures are generally at or below the numeric or Natural Thermal Potential criterion. Thus water temperatures in Estacada Lake are considered to be in compliance with the temperature standard.

River Mill Dam Tailrace to mouth of Clackamas: Daily maximum water temperatures in the River Mill Tailrace are cooler than the natural thermal potential temperatures, and thus being colder than the applicable standard are considered to be in compliance with the temperature standard. This condition might be expected to cool the lower river. However, the daily minimum and mean temperatures are higher than those predicted as the natural thermal potential minimum and mean temperatures. As a result, daily maximum water temperatures downstream from the project are considerably warmer than the natural thermal potential temperatures for that reach. PGE's Clackamas project contributes to both an increase in daily average temperatures, and a lack of daily variability in temperature at the River Mill Dam. These two characteristics result in higher daily maximum temperatures downstream of River Mill Dam, and do violate the temperature standard in the lower river (Figure 7). This heating is explained in detail in the Willamette Basin TMDL (Willamette TMDL, 2006, pp 4-48—4-51).

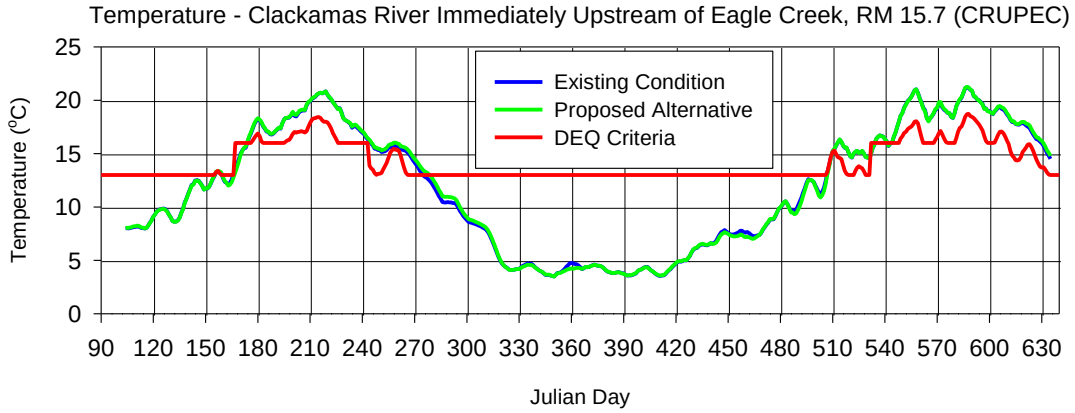

Figure 7. Predicted temperature in the Clackamas River system – Existing vs. SA Alternative, Clackamas River Immediately Upstream of Eagle Creek, RM 15.7 (CRUPEC).(Excerpted from PGE June 2008 § 401 Application, Figure 7.2-85.)

When natural thermal potential temperatures exceed the numeric criteria, no more than 0.3° C of heating for all sources combined is allowed at the point of maximum heating. In the lower Clackamas this location is about 8 river miles below the dam, near the confluence of Eagle Creek and the Clackamas River. PGE's project contributes as much as 1.8 ° C of heating at this location. Further downstream near the mouth of the Clackamas, the project contributes cooler daily maximum temperatures as often as it increases daily maximum temperatures. When heating occurs here the magnitude is much smaller, at about 0.3° C. The Willamette Basin TMDL provided PGE with an allocation of 0.15° C. This allows PGE to contribute up to half of the allowable heating in the lower Clackamas River (Willamette TMDL, 2006 p. 4-75).

PGE's heat contribution to the lower river was recognized during the concurrent FERC relicensing and DEQ TMDL processes. During the fall of 2005, DEQ held a public scoping effort to solicit ideas from the public that might assist in project cooling. PGE also worked with the participants of the collaborative relicensing team and several consultants to identify potential solutions for the Clackamas Project heating. Few solutions were identified by the time of the 2006 Settlement Agreement, so efforts continued into 2008. PGE has worked extensively with consultants to investigate several different approaches intended to lower the magnitude of project heating on the lower Clackamas River. These included:

- selective-depth withdrawal of water at North Fork Reservoir;
- the use of chillers to cool river water; below ground cooling;
- removal of various project dams and reservoirs including River Mill Dam, and North Fork Dam;
- piping water from North Fork Reservoir to River Mill Dam with a seasonal bypass of Faraday Lake;
- creating diurnal variation in water temperature by selectively withdrawing water from Faraday Lake or North Fork Lake;
- bypassing Faraday Lake on a seasonal basis;
- releasing higher flow from River Mill Dam during summer time daylight hours;
- modifying the configuration of Faraday Lake.

These alternatives and their potential for cooling water temperatures are described in more detail in Chapter 9 and Appendix 2 of PGE's § 401 Application (2008).

Several of the approaches investigated provide incremental cooling for the lower river. However, none of the approaches cooled the lower river sufficiently to meet PGE's thermal allocation of 0.15° C. In addition, PGE investigated the proposed ideas to quantify their cooling ability before fully examining the practicality of implementing the options. Some of the alternatives examined were either not technically or practically feasible. For example:

- Using coolers or chillers to cool river water directly requires more energy during the summer than is generated by the project, and requires a huge infrastructure that would significantly heat the air surrounding Estacada.

- Below ground cooling for river water may provide some cooling, but eventually below ground cooling would become ineffective as the subsurface environment heated up from river water. Extensive excavation would be required to route river water underground. Significant river flow would be diverted from the mainstem of the river, greatly altering flow and habitat in the river.

- Restoring daily variability to the temperature of water released from the dam should offset some of the project heating. Selectively withdrawing water from different depths to influence water temperature is a common approach to correct thermal impacts from reservoirs. However this approach is not mechanically possible here. Faraday Lake and Estacada Lakes are not stratified and thus do not provide a source of cold water for this approach. Cold water storage in North

Fork Reservoir is small, so cooling could only be provided for about 6 days during the critical season. Downstream heating is a problem for over 100 days a year.

Alternatives involving PGE operations that were found to be technically feasible include releasing variable flow at River Mill Dam, and changing operations at Faraday Lake to decrease heating at that site.

The water quality model was used to look at the thermal impacts of releasing twice as much flow during the day as at night from River Mill Dam. This alternative could provide up to 0.5° of cooling measured as the daily maximum temperature in the Clackamas near Eagle Creek. However, under this alternative, daily flows would modulate significantly, causing a large impact on aquatic habitat. These effects were considered to be at least as severe as high temperatures for the sensitive anadromous fish present and were discontinued from further consideration as an alternative. This alternative may provide some cooling, but would not meet the water quality standard for biocriteria (OAR 340-041-0011) and thus would not be acceptable for § 401 approval.

The water quality model showed that bypassing Faraday Lake and diverting all water to the Faraday Diversion reach on a seasonal basis could lower the amount of heat added to the system. Seven-day averages of the daily maximum temperatures near Eagle Creek could be lowered by about 0.23° C. When investigated further, modeling results showed that simply lowering the lake elevation would decrease the residence time in Faraday Lake and contribute to measurable cooling downstream. The amount of cooling predicted at the Eagle Creek site depended on how low the lake was lowered. Lowering the lake by 13' provided 0.18° C of cooling, 0.08° C more cooling than lowering the lake by 9'. Additional studies need to be completed to determine how far PGE can lower the lake elevation during the summer without endangering the banks of Faraday Lake. In addition, PGE will investigate the construction of an in-lake channel that would contribute the same magnitude of cooling, but allow full power generation at the site, and minimize water level disturbances in the lake. This study will be completed within six months of the new FERC license

In the Settlement Agreement (2006), PGE committed to implement a gravel augmentation program that will introduce coarse sediment to the Clackamas River downstream of River Mill Dam. Studies conducted during the relicensing effort have shown that project dams have decreased the amount of sediment reaching the lower Clackamas River. Rivers that are rich in gravel and sediment tend to have a smaller variation in daily temperatures, and thus tend to have lower daily maximum temperatures. PGE's proposed program is expected to lower daily maximum temperatures in the lower river, although it is difficult to predict how much cooling may be observed. PGE funded studies in the lower Clackamas River to quantify the thermal benefit from gravel deposits. Results from that work were used to estimate the potential thermal benefits from the Settlement Agreement Gravel Augmentation Program. This modeling showed that cooling of as much as .0.07° C may occur. The estimate was based on a presumed doubling of the number of gravel bars of a particular size in the river system. No one knows how the coarse sediment will be distributed in the river, so it is nearly impossible to predict the amount of cooling that the gravel may contribute. The results of the study and the modeling show that this program will tend to moderate the thermal impacts in the lower river. Other work has shown that the program will also enhance physical habitat in the system. While the thermal benefit to the system will likely be small, the coarse sediment augmentation program is expected to provide significant improvements in physical habitat for fish and other aquatic life.

PGE has submitted a Temperature TMDL Implementation Plan to show how PGE's proposed measures will address the TMDL allocation provided for the Clackamas Hydroelectric Project in the Willamette TMDL. The TMDL Implementation Plan outlines the following measures that PGE will implement to address its thermal allocation:

- PGE will lower the surface water elevation at Faraday Lake by 13' or as much as feasible during the summer months. Within the first 6 months of the new license, PGE may identify an alternative, such as constructing a channel in the lake that will provide the same level of cooling to the system.

- PGE will implement the coarse sediment augmentation plan that was included in the Settlement Agreement (2006). This effort will primarily improve habitat in the lower river, but is also expected to help moderate maximum temperature values. The coarse sediment augmentation program and changes in Faraday Lake operations combined are estimated to lower river temperature by 0.24° C, addressing 15 % of PGE's excess heat load.

- PGE will implement a planting program to add 30 miles of riparian shade to the lower Clackamas Basin. Native tree species will be used to plant buffer areas 50' wide. Diverse and site-appropriate species will be planted, and revisited annually for three years following planting. This effort will decrease solar radiation and will thus contribute to cooler river temperatures; this level of shade will address another15% of PGE's excess heat load.

These measures will lower water temperatures in the Clackamas River. In addition, gravel augmentation and shade will improve habitat conditions in the aquatic and riparian areas, which will also improve conditions in general and thus support the beneficial uses in the system.

PGE proposes an additional measure to address the thermal impacts from the Clackamas Project:

- PGE will enhance the habitat in existing or abandoned side channels located along the lower Clackamas River. PGE has successfully restored a channel downstream from the Barton Bridge. Water temperatures in the channel are 2-4° C cooler than in the mainstem of the river. However, the volume of water is small compared to river flow, and does not contribute significant cooling in the mainstem river. The channel does provide high quality cold water habitat for anadromous fish. For the TMDL Implementation Plan, PGE proposes to rehabilitate 3 additional channels totaling 3700 m in length. These are expected to provide habitat for additional "model population units" of 8 Coho, 104 steelhead and 21 Spring Chinook (PGE § 401 Application, Appendix 6). The increase in cold water habitat will not measurably lower the mainstem water temperatures, but will provide improved habitat for the species most affected by the Clackamas Project heating.

DEQ Findings

Under existing operations, PGE's Clackamas hydroelectric project contributes heat to the Clackamas River. This heating is related to two main project characteristics; the construction of reservoirs and the diversion of flow from stream reaches. Both of these project elements alter the hydrology of the river system, which in turn is contributing heat to the system.

PGE diverts water or significantly alters the flow regime downstream of Timothy and Harriet Lakes, and in the Faraday Diversion Reach. Under the new license, PGE has proposed new flow regimes for three affected reaches. Flow manipulations downstream of Timothy Lake do not currently and are not predicted to contribute to violations of the temperature standard, so the instream flow regime is not included as a condition of the 401 to meet the temperature standard. The new flow regime proposed for this reach will improve habitat conditions, and is included as a condition for Biological Criteria (condition 8).

Significantly more flow will be released downstream of Harriet Lake and in the Faraday Diversion Reach under the new license. The water quality model predicts that these instream flows will allow PGE's operations to come into compliance with the temperature standard. Therefore the 401 Certificate includes conditions (condition 6b.-6c.) that require these flows as noted below.

Reservoir impacts have been observed in Timothy Lake, North Fork Reservoir, and in the Clackamas River downstream of River Mill Dam. North Fork Reservoir is weakly stratified with water temperatures that comply with the natural thermal potential temperatures. Timothy Lake exhibits strong seasonal stratification where the surface of the lake is warmer than water at depth. The surface layer, or epilimnion, is often warmer than the standard. However colder water is present at depth. The water quality standards for temperature, pH, and dissolved oxygen are met in the middle layer, or metalimnion, of Timothy Lake. Model predictions suggest that pH may occasionally approach the pH criterion in this layer under the new license. This potential impact is discussed in the pH section (5.2.2) and the proposed §

401 Certificate Condition 3 will require PGE to implement the Blue-Green monitoring Plan as described in the WQMMP. Provided that this condition will be implemented, and considering DEQ's finding that the volume of the lake is sufficient to support beneficial uses within the lake, DEQ is reasonably assured that Timothy Lake will meet the water quality standard for temperature.

The three mainstem project reservoirs are wider than the natural river, and detain water, which allows increased exposure to solar radiation. As water flows through the reservoirs it becomes relatively well mixed, with similar temperature throughout the water column. North Fork Reservoir is weakly stratified, but Faraday and Estacada Lakes are not. Thus the reservoirs supply water downstream that has a similar temperature for days and weeks at a time. The Clackamas River without the project dams would be characterized by daily variation in temperature of a few degrees Celsius. This loss in variation translates to warmer maximum temperatures downstream. Lowering the elevation of Faraday Lake during July, August and September decreases temperatures in Faraday Lake and tailrace, which translates to cooler temperatures downstream. As noted below, this operation is included as a § 401 condition (condition 8.l). Some of this cooling is transferred downstream to the lower Clackamas River.

In sum, the § 401 Conditions to meet temperature are included under number 6 of the proposed § 401 Certification and are summarized here:

- PGE will construct a flow control structure at Harriett Lake that can direct instream flows to the Oak Grove Fork downstream of Harriett Lake, Proposed License Article 7.

- PGE will meet the instream flow schedule for the Oak Grove Fork downstream of Harriett Lake that is outlined in the 2006 Settlement Agreement, Proposed License Article 8.

- PGE will establish a flow gage in the Lower Oak Grove Fork as described in the Settlement Agreement's Proposed License Article 2 to ensure that instream flows are attained in the reach.

- PGE will provide instream flows in the Faraday Diversion Reach as described in the Settlement Agreement's Proposed License Article 13.

Provided these § 401 Conditions are implemented, DEQ finds there is reasonable assurance that operations and facilities of the Project as proposed to be relicensed will comply with the Temperature standard in waters located above River Mill Dam.

For waters located below River Mill Dam, DEQ recommends, in lieu of 401 Certification, that the Project's Load Allocation for temperature be addressed through a TMDL implementation plan, consistent with OAR 340-042-0080. On December 15, 2008, PGE submitted a draft TMDL Implementation Plan to address the Project's heat contribution to the lower river through the following measures:

- Lowering the elevation of Faraday Lake by 13' from July 1 through September 30, or propose a measure that provides at least as much cooling in the first six months of the new license.

- Implementing the Gravel Augmentation Program described in the Settlement Agreement, Proposed License Article 46.

- Implementing a riparian shading program in tributaries.

- Restoring side channels through two habitat enhancement projects.

Together, these measures are predicted to reduce the Project's current 1.8° C thermal contribution by 0.5° C. Further, the habitat enhancement projects will increase the amount of cold water habitat available to salmonids in the lower river.

The TMDL implementation plan will be administered and enforced through a TMDL Implementation Order, which, among other things, will require periodic review and revision as appropriate to incorporate

any new or modified management strategies to achieve the Project's Load Allocation. The Faraday Lake and gravel measures also will be enforceable as § 401 Conditions attached to the new FERC license since those measures are included in PGE's license application and located within the Project boundary. These measures are included as § 401 Conditions for TMDL compliance below River Mill Dam, not for temperature compliance above River Mill Dam. See attached proposed § 401 Certification Condition 8 "Other Appropriate State Laws".

Provided these measures are implemented, DEQ believes that PGE will employ all practical management strategies to achieve the Project's temperature Load Allocation downstream of River Mill Dam. DEQ intends that its use of a TMDL implementation plan in lieu of § 401 certification should constitute a "failure or refusal to act" within the meaning of 33 U.S.C. § 1341(a)(1) regarding certification of the Project's impacts to temperature in waters below River Mill Dam. This approach, in tandem with DEQ's certification of water quality above River Mill Dam, should enable FERC to license the Project and commence implementation of the Settlement Agreement's Protection Mitigation and Enhancement (PM&E) measures.

DEQ recommends this approach, not only to enable implementation of the Settlement Agreement and fulfillment of the state's resource objectives addressed by the settlement, but in recognition of the unique circumstances presented by the Clackamas Project: (a) the Project is not a new source, but a facility in existence since 1907; (b) unlike other hydroelectric projects, no technically feasible means have been identified, despite extensive and collaborative efforts among stakeholders, to fully remove the Project's downstream temperature impacts; and (c) PGE would be committed to employ all practical management strategies to achieve the Project's temperature Load Allocation downstream of River Mill Dam, and to undertake habitat projects addressing remaining impacts to beneficial uses due to temperature.

5.2.6 Biocriteria

Water Quality Standard

The biocriteria standard is intended to complement the other parameter-specific criteria in the following manner. The parameter-specific criteria are designed to give full protection to the most sensitive beneficial use, with the implicit assumption that if the most sensitive beneficial use is protected, then all uses will be protected. However, the application of these criteria is very limited in considering multiple stressors and cumulative effects. By contrast, the biological criteria enable the assessment of total impact to the community in situ. The applicable State standard for Biological Criteria is as follows:

OAR 340-041-0011

Biocriteria

Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.

Several definitions are applicable to the biocriteria standard:

OAR 340-04l-0002

Definitions

Definitions applicable to all basins unless context requires otherwise:
(5) "Appropriate Reference Site or Region" means a site on the same water body, or within the same basin or ecoregion that has similar habitat conditions, and represents the water quality and biological community attainable within the areas of concern.
(6) "Aquatic Species" means any plants or animals that live at least part of their life cycle in waters of the State.
(17) "Designated Beneficial Use" means the purpose or benefit to be derived from a water body, as designated by the Water Resources Department or the Commission.
(19) "Ecological Integrity" means the summation of chemical, physical and biological integrity capable of supporting and maintaining a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of the natural habitat of the region.

(44) "Resident Biological Community" means aquatic life expected to exist in a particular habitat when water quality standards for a specific ecoregion, basin, or water body are met. This must be established by accepted biomonitoring techniques.
(67) "Without Detrimental Changes in the Resident Biological Community" means no loss of ecological integrity when compared to natural conditions at an appropriate reference site or region.

Current Conditions and Proposed Measures:

The Biocriteria standard largely addresses aquatic habitat, be that of a physical or chemical nature. The standard can be used to guard against cumulative effects of stressful water quality conditions that otherwise meet individual criteria. These are rare, and are not known to occur in the Clackamas Basin. The standard also ensures that physical habitat is of sufficient quality to support the existing and designated uses.

Hydroelectric projects have profound influences on flow magnitude and regimes. Flow characteristics may directly impair habitat, or they may affect other processes that in turn impair habitat, such as interrupting the transport of sediment and woody debris.

There are many different approaches to assess habitat impacts. One approach used for this project included sampling and identifying benthic macroinvertebrates. These small organisms were sampled from above Timothy Lake down to the mouth of the Oak Grove Fork, and from upstream along the Clackamas River above the Oak Grove Fork down to the mouth of the river. The results from this kind of study can be used to calculate several different metrics. The metrics in turn can be used to show how populations and communities of organisms change. Metrics that show Clackamas project impacts by demonstrating changes in communities associated with project features include the following:

- Total Abundance: a measure of the population size
- Total taxa richness: a measure of the population diversity
- EPT taxa richness: a measure of the occurrence of *Ephemeroptera, Plecoptera and Trichoptera*
- three aquatic insect orders that are generally indicative of high water quality because they are less tolerant to adverse conditions
- Tolerant taxa abundance: a measure of the population size of tolerant species
- Per cent of collector-filterers; a measure of filter-feeding taxa, and
- Per cent of collector gatherers: a measure of the abundance of taxa that collect and scrape food as opposed to filtering the water column

Instream Flow studies were used to assess physical fish habitat. Surveys of side channels and low-flow riparian area were also used to evaluate fish habitat in various locations of the watershed.

Project impacts, results from the applicable habitat studies and a brief description of the measures proposed to address project impacts are presented in this section, organized by location from the upper watershed and Timothy Lake, downstream to River Mill Dam. Some impacts occur across the project; these and their associated mitigation measures follow the project location-specific measures.

Timothy Lake: The size of open water wetlands located along the North Arm of Timothy Lake changes with Timothy Lake elevation. During spring, these small ponds support breeding for 7 species of amphibians, 3 of which are classified as either state sensitive species or federal species of concern. PGE sponsored a preliminary study to determine when amphibians use the flooded wetland, and to evaluate the relationship between surface area and depth of the ponds with Timothy Lake elevation (Tressler, 2004). This investigation showed that flooded areas in the wetland disappear at lake elevations as low as 3189.5 feet above sea level, and are largely flooded at 3191.9 feet above sea level. The study also demonstrated that most Red-legged and Cascade tree frogs leave the ponds as juveniles by late July, but most remain within 50 meters of the ponds. These sensitive species could be affected by project operations due to decreasing habitat quality or to losses in habitat. Maintaining the water elevation of Timothy Lake during the summer months should support these amphibian populations. Minimum summer-time lake elevations were adopted in the Settlement Agreement. The Settlement Agreement

also includes a commitment for PGE to continue monitoring amphibian populations in the North Arm of Timothy Lake. If the proposed summer lake elevations are found to impact amphibian populations, future project operations will be modified.

The creation and ongoing and operation of Timothy Lake impacts the cutthroat trout population in the lake. Habitat in the lake changes throughout the year with changing water levels. Water quality within the lake is affected by the project operation, with warm surface waters in the lake. Passage within the Oak Grove Fork is limited by the Timothy Lake Dam. All these factors have altered the water quality and habitat conditions for cutthroat trout population in and upstream of Timothy Lake. Improvements to habitat in Dinger Creek provide access to and improved habitat in one of the four tributaries to Timothy Lake. Under the Settlement Agreement, PGE has agreed to remove culverts at two road crossings that create passage barriers in Dinger Creek, and to design and install large wood habitat structures in Dinger Creek to improve habitat within the Creek. These will increase the habitat available for cutthroat trout spawning and juvenile rearing, and thus support the native trout population.

Timothy Lake Tailrace: Macroinvertebrate sampling in the Oak Grove Fork demonstrated a somewhat different community in the Timothy Lake Tailrace than those observed upstream or downstream of PGE's Timothy Lake Dam. While this site exhibited similar abundance of invertebrates, it had lower total taxa richness, lower EPT taxa richness, and higher scores for more tolerant species. The abundance of insects that gather food by scraping is higher in the tailrace, reflective of the somewhat higher abundance of attached algae. This sampling suggests that the PGE Timothy Lake Dam has an impact on macroinvertebrates in this reach, but the magnitude of these differences was lower at this site than those observed in the mainstem project tailraces.

Instream flow analysis was used to evaluate cutthroat trout habitat in and downstream of the Timothy Lake Dam. These studies showed that flow modifications from the PGE project had an impact on cutthroat habitat in this reach. The instream flow analysis demonstrated that the maximum useable width for adults occurred at 175 cfs, and for juvenile fish at 75 cfs. However, water velocity was found to limit habitat availability more than water depth. Thus more habitat improvement can be accomplished with habitat enhancement projects that provide eddies and areas of lower velocity within the reach.

Abrupt changes in flow, either daily or seasonally can also impact aquatic habitat. Timothy Lake has historically been managed for summer recreation, and for fall water storage. Thus lake levels have been lowered very quickly in early September. The sudden change from low to high flow in the Oak Grove Fork reach downstream of the dam has impacted habitat.

To address these issues, the Settlement Agreement included different instream flow levels for the Oak Grove Fork during summer, new flow restrictions in the Oak Grove Fork in the fall that will slow the rate that the lake is lowered, and ramping rates that will moderate the rate at which flow changes can be made. As part of the Settlement Agreement PGE also agreed to develop and implement a habitat improvement plan for this reach. These improvements will be largely targeted at providing velocity shelters within the river. This will increase habitat availability for fish and provide increased habitat diversity for macroinvertebrates as well.

Oak Grove Fork Downstream of Harriett Lake: Harriett Lake is a diversion dam that diverts flow from the Oak Grove Fork to Frog Lake almost all of the time. Understandably, the macroinvertebrate data show impaired conditions in the reach downstream of Harriett Lake. Total taxa richness downstream of Lake Harriet was less than half of that observed immediately above Lake Harriet. Invertebrate abundance below Lake Harriet was 10 percent of that above the lake. However, the lower Oak Grove Fork benthic macroinvertebrate community, with the exception of some tolerant species, showed recovery with increasing distance downstream to moderate levels near the mouth of the Oak Grove Fork. The invertebrate fauna below Lake Harriet does not indicate water quality impairment, but is the result of reduced water quantity. Fish habitat in the tailrace is also minimal, and limited flow in this reach has modified habitat conditions throughout the reach. Many side channels that historically provided winter fish habitat no longer fill with water due to the decreased flow in the channel. Harriett Lake Dam has also withheld sediment and large woody debris, which has reduced habitat complexity in this reach.

Under the Settlement Agreement, PGE committed to four different measures to address these issues. First, PGE will construct a flow control structure in Harriett Lake and will provide year-round instream flows to Oak Grove reach. The schedule for flows in this reach is designed to mimic seasonal flow in the reach, and is therefore complex. Base flow levels change by date, and also with water year; less flow will be delivered to the reach in dry years than wet years. In addition, high flows will be released downstream to mimic high water events, restoring some of the high flow channel forming events to the system. Additional details about the flow regime and its various components can found in the Settlement Agreement.

PGE has also committed to restore 40,000 square feet of side channel Coho habitat along the lower Oak Grove Fork downstream of the barrier falls. Under the new license PGE will develop a habitat enhancement plan, and restore these habitat areas within 5 years of the new license. The habitat areas will be monitored regularly and after high flow events throughout the life of the license.

The third measure addressing habitat in the lower Oak Grove Fork provides for both physical fish habitat improvement and gravel augmentation to restore coarse sediment delivery in the Lower Oak Grove Fork. A detailed plan for these actions will be completed by the third year of a new license, and implemented throughout the life of the new license. As in the upper Oak Grove Fork, the addition of physical structure designed to improve fish habitat is also expected to improve habitat for macroinvertebrates by affecting flow velocities as well as adding variety to habitat structure and food sources. Gravel augmentation in other areas has been shown to increase macroinvertebrate populations (Merz & Ochikubo Chan, 2005). PGE's sampling has demonstrated that macroinvertebrate populations in the lower reach are in reasonably good shape, so the combination of adding flow and increasing overall habitat condition with side channels, physical structures and gravel augmentation are expected to boost the population size significantly as well as add taxa richness to the reach.

Finally, PGE will transport large woody debris trapped in Harriett Lake around the Dam and place it back into the Oak Grove Fork at the nearest possible location. This will help to restore habitat in the lower Oak Grove reach, and should help to trap added gravels creating more complex habitat structures.

Clackamas River near the Oak Grove Powerhouse: Macroinvertebrate sampling conducted above and below the Oak Grove Powerhouse tailrace in 2001 showed that total invertebrate abundance, total taxa richness and EPT abundance drop off downstream of the Oak Grove Powerhouse, and do not recover to upstream levels downstream of this site. Macroinvertebrate populations change along river systems, and are not expected to show the same abundance, diversity or species composition as downstream sites (Vannote, 1980). Some of the indices calculated from the macroinvertebrate study suggest that changes in the macroinvertebrate population begin to occur near the Oak Grove powerhouse and continue downstream. This location may be a reach where the Clackamas River begins to change character because mainstem Clackamas and Oak Grove Fork have similar summer baseflows. At the confluence of the two, the base flow of the river is roughly doubled in size, so changes in biological communities can also be expected to occur naturally here.

The Oak Grove Powerhouse is operated in a peaking mode during times of the year when sufficient water is available to operate in this mode and electric demand is high enough to warrant peak production. During low summer flows when Oak Grove Powerhouse discharges provide the largest influence on flow in the river, peaking mode operation is uncommon because there is not sufficient flow to refill Frog Lake to continue peak flow operations. However, flow through the Oak Grove powerhouse is adjusted and fluctuates at some level on a daily basis. Changes in flow can have affects on downstream habitat. The total area and location of low-velocity channel edge habitat changes with flow, as do velocity profiles. These characteristics can impact aquatic species by causing undue stress for organisms that must continually move while seeking habitat with the appropriate depth, velocity or food sources.

Analysis conducted by Doughty and Blum (2004a) in the reach between the Oak Grove Powerhouse and North Fork Reservoir indicated that the proportion of the varial zone affected by a maximum peaking

event is about 0.6 percent of the total shoreline habitat. This finding indicates that potential for effects of powerhouse operations on macroinvertebrate communities in this reach are small.

However, impacts from the Oak Grove Powerhouse have been observed in the results from the macroinvertebrate study. Total Invertebrate abundance, EPT taxa richness, and Filterer abundance drop in the Oak Grove Tailrace sample, and indices for tolerant taxa increase in the tailrace data. Similar results were noted for tailrace samples throughout the project area.

In addition to macroinvertebrates, the waters of the Project support a wide variety of fish species that may also be affected by flow and water elevation changes. Of most concern in this reach are spring Chinook salmon, winter steelhead, and Coho salmon. Both the spring Chinook and winter steelhead are federally listed as Threatened and the Coho salmon is listed as Threatened by the State of Oregon. Juvenile fish prefer the shallow edges of the river reach where velocities are lower, and food sources may be higher. When depth and water velocity change quickly, these small fish may not be able to swim fast enough to stay in deep water. Along shorelines with a shallow gradient, these aquatic organisms may become stranded in small pockets of water, or left totally high and dry. Even if they manage to remain in the moving water column, they may experience undue stress from the energy expenditure of constantly relocating. Doughty (2004a) identified and measured varial habitat in this reach that has the potential for stranding juvenile fish. These measurements quantified the vulnerable surface area and identified river elevations and related flow levels that most affected these habitats. This information informed the flow levels used to bracket the application of the different ramping rates adopted under the Settlement Agreement.

The Settlement Agreement for the new license outlines ramping rates for the Oak Grove Powerhouse. These rates change with date and flow to assure that a slower rate of change occurs at low flows when the impact is greater. The Settlement Agreement also requires monitoring within the affected reach to determine whether juvenile fish are being stranded in the reach. If stranding is demonstrated to occur, the ramp rate will be adjusted.

Faraday Diversion Reach: The Faraday Diversion Reach is impacted by controlled flow from the Faraday Diversion Dam. Here, flow is diverted to Faraday Lake and the Faraday Powerhouse. Under the current license, PGE must supply an instream flow of 75 cfs in this reach although current practices provide an average flow closer of 120 cfs. This flow is insufficient to maintain cold water temperatures in the reach. The Settlement Agreement includes an instream flow requirement of 270 cfs. This instream flow is included as a § 401 condition to support water temperature (condition 8.b(3)) This increase in flow will also boost aquatic habitat for both fish and macroinvertebrates in this reach.

Another feature impacted in this reach is the entrance to the North Fork upstream fish ladder. The Settlement Working Group expressed concern that despite higher instream flow, flow and water quality near the ladder entrance may not be ideal, and may hinder fish in their efforts to travel upstream. The Settlement Agreement includes a requirement to examine the feasibility of altering flows in the reach and the fish ladder entrance to improve fish passage.

The impact of water quality on fish passage is a concern at three specific zones in or adjacent to the Faraday Reach; between the Faraday Powerhouse tailrace and the reach just upstream of the tailrace, between the Faraday Diversion Reach and the North Fork Fish Ladder, and in the North Fork Fish Ladder. Another zone of interest surrounds the Oak Grove Powerhouse Tailrace. The Settlement Agreement includes a commitment to monitor water quality in these reaches specifically to identify conditions that may impair the passage of fish through the reaches. For example, even if water temperatures meet the applicable standard, an abrupt change in water temperature may cause fish to avoid the fish ladder entrance, or to refuse to continue upstream travel and instead seek an alternate route. If monitoring shows that water quality is responsible for delays in fish migration, PGE will develop a plan to improve conditions and remove passage impairment.

Estacada Lake and River Mill Dam: Estacada Lake acts in part as a re-regulating facility for power generation at North Fork and Faraday Powerhouses. Flow levels in the lake are managed to minimize

project impacts on flow in the mainstem Clackamas River. Under current operations, inflows to North Fork Reservoir are released from River Mill Dam to the extent feasible. This management strategy was adopted in the Settlement Agreement for the new license. PGE will install a new control system within 12 months of license issuance to ensure that this measure can be implemented accurately. The inflow-outlfow restrictions will also address changes in flow that are usually addressed by ramping rates. Thus a ramping rate has been adopted only for times when PGE is altering the elevation of Estacada Lake. These measures ensure that the flow regime downstream of River Mill Dam mimics the natural Clackamas River Flows to the maximum extent possible.

Changes in Estacada Lake levels at some times of the year can result in dewatering areas in the upper lake that have been used for salmonid spawning. The Settlement Agreement includes lake level restrictions that are targeted at protecting spawning habitat. In addition, if spawning is shown to occur outside of the time periods targeted by these restrictions, PGE will work with the Fish Committee to adjust the dates for the lake level restrictions.

Like other dams, the North Fork-Faraday- River Mill Dam complex influences the amounts of sediment and large woody debris that are transported downstream. This decrease in material can impair downstream habitat. The Settlement Agreement requires PGE to manage large woody debris according to the Fish Passage and Protection Plan included in the Settlement Agreement. The Settlement Agreement also includes a significant gravel augmentation program to restore coarse sediment to the lower river. This measure is expected to improve both downstream habitat, and decrease water temperatures in the downstream reaches. Because of the temperature benefits, this measure is included in the § 401 Certificate associated with the temperature standard.

Project-Wide Concerns: In addition to the specific concerns addressed by the previous habitat measures and other specific water quality concerns, some project-wide impacts remain. PGE has altered flow regimes throughout the project area. In addition to the large scale impacts, these alterations may affect localized hydrology that in turn can affect the ability of native species to prevail and of native habitats such as riparian zone wetlands to persist. Changes in hydrology can destroy or degrade small riparian wetland habitat, and alter ground water flow regimes as well, that in turn affect hyporheic flow and aquatic conditions. Habitat for aquatic life, including fish, invertebrates and plants, can all be affected by changing flow regimes. Through the Settlement process, these additional impacts were addressed by the following measures.

Vegetation Management: PGE's Clackamas project includes or affects seven impoundments and many miles of streams and river. One major environmental pressure is the modification of natural flow regimes. Under FERC regulation, the Project must also offer recreational opportunities, and project waterways are popular for boating and fishing. The transport of invasive aquatic species can be accelerated by boating and fishing, in modified flow conditions, or a combination. Currently there are no serious issues concerning invasive aquatic plants within the project area. However, a potential for problematic populations exists. Invasive species are able to out-compete native species, and thus have the potential to create mono-species cultures. These can grow prolifically, resulting in water quality violations due to the accumulation and decay of biomass. In addition to water quality problems, the prolific growth can degrade and replace physical habitat for other native species, impairing the entire aquatic community. The Settlement Agreement addressed the potential for aquatic and riparian invasive plants along with more terrestrial species in the Vegetation Management Plan.

Wetland Mitigation and Management: Under the new license PGE proposes to increase the water level at Harriett Lake. This inundation will impact wetlands located along the lake margin. Through the Settlement Agreement, PGE has proposed to mitigate for this wetland loss through measures outlined in the Wetland Management Plan. These include enhancing and restoring wetland habitat in two project locations, Davis Ranch and Promontory Park. No other suitable wetland projects were identified, so the Settlement Work Group agreed that the remaining mitigation requirement should be met by acquiring a property located in the Sandy River Basin known as the North Mountain parcel. Although this wetland is not located in the area affected by Clackamas Project, or in the Clackamas Basin, the wetland is located

at an elevation similar to Harriett Lake, and has many characteristics similar to those lost with the Harriett Lake inundation.

Mitigation Fund: There are many measures included in PGE's FERC license proposal and the related Settlement Agreement that address project impacts to the aquatic environment. However, the Settlement acknowledged that not all impacts to native anadromous and resident fish could be addressed by specific license conditions. The Settlement parties agreed that additional projects that provide riparian and riverine protection, habitat restoration and land acquisition throughout the project area will provide opportunities to increase the natural production of native fish in the basin that will in turn address some of the remaining project impacts. The parties agreed to establish a mitigation fund for habitat mitigation and enhancement projects. The fund amount totals $8 million; $7.5 million to address anadromous fish habitat, and $500,000 for native resident fish. The fund is to be used for projects; funds may only be used for research, studies or monitoring if they are specifically included and approved as part of a resource project. The types of projects that may be funded include land acquisition or lease of riparian areas and wetlands, instream habitat projects, riparian corridor and wetland restoration and enhancement, water quality, water conservation, land conservation easements, fish passage facilities and passage barriers, and water right acquisitions. The fund is scheduled for use across 18 years of the new license, and fund use will be determined by a Mitigation Fund Committee, with membership as defined in the Settlement Agreement.

DEQ Evaluation and Findings:

PGE's Clackamas project has significant impacts on aquatic habitat characteristics necessary to fully support Oregon's water quality standard for Biocriteria. Most of the impacts are related to the flow modifications caused by the Project. Not all of these impacts can be easily addressed by restricting flow modifications however. Some habitat restoration projects are necessary.

The Settlement Agreement addressed these impacts with a series of operational restrictions that control flow rates throughout the project. The Settlement Agreement also identified habitat restoration projects, coarse sediment augmentation programs, and management plans for large woody debris, wetland protection and vegetation management. In addition, the Settlement Agreement calls for a Mitigation Fund to be used for habitat-related projects throughout the Clackamas Project area and Basin.

DEQ was a signatory to the Settlement Agreement, and participated actively on the Settlement Work Group. The flow regimes and Management Plans were reviewed by DEQ as they were developed, both for potential conflict and compliance with the water quality standards. The various Management Plans include Agency representation for review and if necessary approval of management changes that are included as adaptive management strategies. With the inclusion of § 401 Condition 8 that require the flow regimes and management plans identified above, DEQ finds that the Clackamas Project will comply with the biocriteria water quality standard.

5.2.7 Statewide Narrative Criteria

Water Quality Standard

These standards provide protection for humans, wildlife and aquatic life from adverse effects resulting from the presence of toxic substances above natural levels, either alone or in combination with other chemicals or substances. Where needed, DEQ can consider additional studies reported in the scientific literature to review applicability of numeric criteria, or to set guidance values. Bioassays can be used to determine effects of site-specific effluents or chemical substances on aquatic life. The applicable standards are included below.

OAR 340-041-0007

Highest and Best Practical Treatment
Statewide Narrative Criteria

(1) Notwithstanding the water quality standards contained in this Division, the highest and best practicable treatment and/or control of wastes, activities, and flows must in every case be provided so as to maintain dissolved oxygen and overall water quality at the highest possible levels and water temperatures, coliform bacteria concentrations, dissolved chemical substances, toxic materials, radioactivity, turbidities, color, odor, and other deleterious factors at the lowest possible levels.

Current Water Quality Status

Most reaches of the Clackamas River, including the Oak Grove Fork, currently meet water quality standards. Exceptions that are attributable to PGE's project include "dewatered reaches" or reaches from which PGE has diverted water in order to generate electricity. These are located downstream of Timothy Lake Dam, downstream of Harriett Dam, and downstream of the Faraday Diversion Dam. Impacts in these reaches include one or more of the following: elevated water temperature, occasional low dissolved oxygen levels, or impaired biotic communities (See sections 5.2.5, 5.2.1 and 5.2.6). Nuisance algae species can proliferate in project reservoirs, and may sometimes cause taste and odor problems for downstream drinking water providers (see relevant section below).

DEQ Evaluation

In the Settlement Agreement (2006), PGE has proposed to increase flows in diversion reaches downstream of all of its project dams; Timothy Lake, Harriett Lake, and the Faraday Diversion Dam. Water quality models predict that increased flows are expected to lower water temperatures, and may increase dissolved oxygen concentrations in these reaches. No models have been used to predict changes in biotic communities, but there is no dispute that increased flows will improve both water quality conditions and habitat for aquatic biota.

PGE has proposed a monitoring program to assess when and how blue-green algae blooms form in the project reservoirs. As described in the Settlement Agreement, the Blue-Green Team, a committee composed of PGE, DEQ and agency personnel with an interest in the blue-green bloom formation and management will convene to design a monitoring plan, review monitoring results, and propose management strategies to deter future bloom formation in project reservoirs. This plan also includes a communication strategy to advise downstream water users when blooms have occurred.

PGE's reservoir complex on the mainstem of the Clackamas River contributes heating to the Clackamas River downstream of the project facilities. PGE, DEQ and the Settlement Work Group have identified all feasible measures to address heating in this reach of the Clackamas River. Identified measures include altering the elevation of Faraday Lake, restoring riparian shade to 30 river or creek miles in the lower Clackamas River system, implementing the gravel augmentation program downstream of River Mill Dam, and restoring two side channels in the lower river. These measures are either incorporated into the § 401 Certificate as conditions, or into PGE's TMDL Implementation Plan for Temperature. For additional details see Section 5.2.5.

DEQ Findings

ODEQ views the proposed instream flows and the adaptive-management monitoring plan for blue-green algae blooms in project waters as consistent with highest and best treatment for temperature, dissolved oxygen, pH, and nuisance phytoplankton growth. Increased instream flows will improve existing water quality in three affected reaches. Multiple measures have been adopted to address project heating in the lower reaches of the Clackamas River. While these are not expected to provide sufficient cooling to meet the temperature criterion, they do represent the highest and best practicable measures available.

Provided that PGE implements the Settlement Agreement articles, the conditions of this § 401 certificate, and the TMDL Implementation Plan for Temperature, ODEQ is reasonably assured that operation of the Project will comply with the highest and best practicable treatment rule.

OAR 340-041-0007

Oily Sheens
Statewide Narrative Criteria

(14) Objectionable discoloration, scum, oily sheens, or floating solids, or coating of aquatic life with oil films may not be allowed;

Current Water Quality Status

PGE has not provided a description of the current conditions regarding objectionable discoloration, scum, oily sheens, floating solids of oil films in the reaches of the Clackamas affected by the project. However, there is no record of oil spills or oily sheens in the river, especially related to project activities.

DEQ Evaluation

Hydroelectric facilities do not release oil through turbines as a common practice. If oil was regularly introduced as water traveled through a hydroelectric facility, DEQ would require the facility to obtain a National Pollution Discharge Elimination System (NPDES) Permit for this activity. With no intentional discharge oil into the waters of the state, the project would only introduce oil to the river by spills and other accidents. PGE maintains both an "Oil Spill Prevention Control and Countermeasure Plan" and a "Hazardous Materials Emergency Response Plan" for the project. These plans are posted at project facilities, are updated regularly, and PGE maintains a training program so that staff members are aware of and will follow the plans when needed.

DEQ Findings

Discharges of oil are not common at hydroelectric facilities, and indeed if regular or ongoing discharges occurred, hydroelectric facilities would be subject to discharge permits. PGE has a Spill Prevention Plan in place so that any accidental releases will be promptly addressed, and any ensuing environmental impacts will be minimized. DEQ has included condition 8n in the § 401 Certificate to ensure that this level of protection is continued throughout the life of the new license.

5.2.8 Toxic Substances

Water Quality Standard

This standard provides protection for humans, wildlife and aquatic life from adverse effects resulting from the presence of toxic substances above natural levels, either alone or in combination with other chemicals or substances. Where needed, DEQ can consider additional studies reported in the scientific literature to review applicability of numeric criteria, or to set guidance values. Bioassays can be used to determine effects of site-specific effluents or chemical substances on aquatic life. The applicable standard is included below.

OAR 340-041-0033

Toxic Substances

(1) Toxic substances may not be introduced above natural background levels in the waters of the State in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety or welfare, aquatic life, wildlife, or other designated beneficial uses;

(2) Levels of toxic substances may not exceed the criteria listed in Table 20 which were based on criteria established by EPA and published in Quality Criteria for Water (1986), unless otherwise noted;

(3) The criteria in section (2) of this rule must apply unless data from scientifically valid studies demonstrate that the most sensitive designated beneficial uses will not be adversely affected by exceeding a criterion, or that a more restrictive criterion is warranted to protect beneficial uses, as accepted by the Department on a site specific basis. Where no published EPA criteria exist for a toxic substance, public health advisories and other published scientific literature may be considered and used, if appropriate, to set guidance values;

(4) If the Department determines that it is necessary to monitor the toxicity of complex effluents, other suspected discharges or chemical substances without numeric criteria to aquatic life, then bio-assessment studies may be conducted. Laboratory bioassays or in-stream measurements of indigenous biological communities, properly conducted in accordance with standards testing procedures, may be considered as scientifically valid data for the purposes of section (3) of this rule. If toxicity occurs, the

Department will evaluate and implement necessary measures to reduce or eliminate the toxicity on a case-by-case basis.

Current Water Quality Status

Hydroelectric projects do not discharge pollutants to waters that flow through their facilities. Projects with constructed dams and bypassed channels do alter natural river hydrology. Changes in hydrology can alter water quality and chemistry, and create conditions that violate water quality standards or increase the toxicity or availability of toxic chemicals.

PGE and DEQ worked together to identify toxic chemicals that might be present in project waters and influenced by project operations. Pesticides used in the upper watershed were not considered likely to accumulate or bio-accumulate in the project reservoirs, based on samples collected just downstream of River Mill Dam (Carpenter, 2004). However, mercury and PCBs were toxic chemicals identified for further investigation. Historically electric generating facilities commonly used very toxic poly-chlorinated biphenyls (PCBs) to insulate electric transformers. Transformers are often located near waterways at hydroelectric plants. The use of PCBs in transformers has been phased out, but PCBs released to the environment may persist for years. DEQ wanted assurance that PCBs from previous activity or accidental releases were not present in project waters.

Reservoirs have also been observed to increase the biological availability of mercury to aquatic life, as well as bioaccumulation (Gilmour, C.C. 1995). Oregon is rich in naturally occurring mercury deposits. Indeed, a site on the Oak Grove Fork was home to three different mercury mines between 1923 and 1943. The refinery for two of these mines was located right along the Oak Grove Fork. Tailings from these operations were located very close to the water's edge, and flooding carried some portion of them into the river. PGE did not influence or control the mines in any way. However, if PGE's reservoirs made mercury from tailings or mercury-laden sediment more available to aquatic life in the reservoirs, PGE would be responsible for minimizing the availability of this toxic chemical in project waters.

PCBs and mercury both have low solubility in water, but can be accumulated and concentrated into biological tissue. Tissue samples from aquatic organisms accumulate the contaminants over time and thus were considered to be more informative than one-time water samples. Therefore fish tissue was sampled as a preliminary screen for these toxic chemicals. To determine whether PCBs or mercury occurred at toxic or problematic levels in Project reservoirs, PGE sampled fish tissue for PCB congeners and mercury. Mercury levels in fish would be compared to those found in other lakes in mercury-rich regions, and compared to mercury levels that trigger health advisories. PCB contamination is widespread and far-reaching. For assurance that there are no near-field sources of PCBs, PCB levels in fish from Project areas would be compared to other PCB studies in the Portland Metro area. This screening was intended to identify whether local hot spots of PCBs were present.

Mercury tends to accumulate in muscle tissue in fish, and carnivorous species tend to concentrate mercury at faster rates than do fish that feed lower on the food chain. PCBs accumulate in fat tissue, so leaner fish species have lower body burdens than fish with higher lipid content. Because fish tend to accumulate these toxins in tissue, older, larger fish tend to have higher contaminant burdens than younger fish of the same species.

Brook Trout and rainbow trout were collected from Timothy Lake and North Fork Reservoir during March and September of 2001 for mercury analysis. Muscle tissue from the fillets was analyzed for total mercury. Mercury concentrations in the Timothy Lake brook trout ranged from 8.7 to 120.5 µg/Kg in fish ranging in length from 235 to 385 mm. Mercury concentrations in North Fork Reservoir rainbow trout ranged from 23.7 to 66.9 µg/Kg in fish ranging in length from 210 to 250 mm.

Large-scale suckers have a wide distribution, and are prone to accumulating organic toxicants. To determine whether there was evidence for a source of PCB contamination from historic use at Project generating facilities, large-scale suckers were collected from North Fork Reservoir, Faraday Lake and Estacada Lake. Whole fish were analyzed for Aroclors and specific PCB congeners. Of the 7 Aroclors tested, only Aroclor 1254 and 1260 were found above the detection limit (< 5 µg/Kg). Total Aroclors were

less than 37.2 μg/Kg and the most toxic congeners (126 and 169) were not detected in any of the samples.

Potential Impact of New License

Project operations will be altered somewhat at several project facilities under the new license. Higher instream flows will be implemented downstream of Timothy Dam, Harriett Dam, and the North Fork Diversion Dam. Target elevations for Project reservoirs will have more narrow ranges than occur under current operations, but for the most part proposed lake elevations are the same as current operations. Two exceptions to this occur. Fall drawdown at Timothy Lake will occur more slowly than it does now. Harriett Lake elevation will increase approximately 1 foot in height; this will help to accommodate the instream flows for the lower Oak Grove Fork under the new license. Higher instream flows in the Oak Grove Fork will greatly improve fish habitat in this reach.

How these changes may affect mercury in the system is unclear. Reservoirs can affect the rate that mercury is modified into methyl mercury, the form most readily taken up by aquatic biota. Changes in reservoir management may affect the transformation to methyl mercury and its uptake by fish in these systems.

Minimum flows in the Oak Grove Fork may deliver more mercury to project reservoirs than currently occurs. However, these minimum flows are significantly lower than the storm flows that have occurred since Harriett Dam was constructed. These minimum flows will not alter the level and frequency of high flow levels that occur under the existing license operations. A vein of cinnabar, a mercury sulfide mineral, runs through the Oak Grove Fork river channel. Higher base flows in the channel could increase erosion of this naturally occurring material.

PGE no longer uses PCBs in its transformers, and has been phasing out equipment that is contaminated with PCBs. Changes to operations that are proposed under the new license are not expected to release PCBs to the aquatic environment, nor will they potentially relocate toxic material into the aquatic environment. If PCBs are already present in the aquatic environment, it is not clear how the proposed changes in project operations might affect the availability of PCBs.

DEQ Evaluation

Mercury: DEQ does not have water quality standards for mercury in tissue levels of aquatic organisms. The Oregon Health Department posts advisories to limit human consumption of fish when average tissue levels are 350 µg/Kg or higher. The federal Food and Drug Administration restricts interstate commerce for fish tissue levels of mercury exceeding 1000 µg/Kg. Values observed in PGE Clackamas reservoirs ranged from 8.7-120.5 µg/Kg. These values are less than half of the action level that triggers an evaluation for a health advisory.

The State of Oregon has issued advisories that suggest limiting the consumption of mercury-laden fish for ten Oregon lakes, most of which are located downstream of historic mercury or gold mines. Various fish species have been sampled for mercury levels. At sites where data for rainbow trout and other species are available, rainbow trout tend to have lower mercury levels than do other fish (Newell *et al.*, 1996). However, no other sport fishing species were available from North Fork Reservoir. The rainbow trout fishery in both Timothy Lake and North Fork Reservoir result from hatchery stocked fish, not fish that reproduced naturally in these lakes. Fish sampling in this system indicates that stocked fish are caught the same year that they are released. Therefore, they do not spend much time in the lakes, and are not exposed to mercury for much of their life cycle. Largemouth bass tend to have the highest mercury body-burdens, but are not native fish to Oregon, and thrive in waters that are warmer than the Clackamas. Based on these results, the consumption of Clackamas River rainbow and brook trout do not pose a known human health risk for mercury.

No guidelines are available to ensure the protection of other fish or wildlife that consume fish with mercury body burdens. However, these fish tissue levels are relatively low compared to other Oregon lakes sampled by DEQ. Data from other lakes in Oregon range from < 25 µg/Kg to 2540 µg/Kg in lakes clearly affected by mercury mining.

There is no documented risk to humans for mercury exposure by consuming fish in project reservoirs. No known risk is posed to wildlife in the region. Future operations for the project lakes are not expected to change significantly, so any risks regarding mercury are expected to remain low under future operations.

PCBs: There is no record of PCB spills or other environmental accidents including PCBs at PGE's Clackamas Project. DEQ's main concern regarding PCBs for this Project was to demonstrate that no historic undocumented PCB spills had occurred. PGE collected fish at project lakes that are downstream of powerhouses to investigate whether a legacy PCB problem existed. The results of PCB concentrations in large-scale suckers showed low body burdens of PCBs. Of six Aroclors analyzed, only two Aroclors had any samples with detectible values. These were both less than 10 ppb. Eight different PCBs were analyzed. Three of these were below detection and the results from the remaining analyses were each less than 1.2 ppb each. EPA's action limit for total PCBs is 10 ppb. However, PCB contamination is widespread in the environment, so it is rare to find results with total PCBs less than 10 ppb (µg/Kg). Ken Kauffman of Oregon's Department of Human Services suggested that values of total PCB less than 100 ppb would be acceptable (personal communication, March, 2001). This level was also identified as a guidance level by Newell *et al.* 1987 for the Niagara River. Of greater importance to this study is the comparison of Clackamas values to other data in the region. Average concentrations of PCBs in Clackamas River large-scale suckers were an order of magnitude less than PCB concentrations found in Willamette River large-scale suckers, specifically for Aroclor 1254 and 1260, and congeners 115 and 118 (EVS 2000). Comparison to concentrations of Aroclors in large-scale suckers in Washington State lakes indicates that PCBs in fish from the Clackamas River are comparable to those found throughout the region, and are not indicative of waters with direct PCB contamination (Johnson 2001). These data confirm that there is no hidden contamination in the Clackamas Project Reservoirs.

DEQ Findings

Mercury: Fish tissue data collected during the relicensing studies shows mercury concentrations in fish tissue to be low. Levels were not high enough to post human health advisories regarding fish consumption. Fish tissue values are low compared to many other Oregon Lakes. Future project operations are not expected to alter the lake environment in a way that would increase mercury uptake. Increased flows in the Oak Grove Fork will not exceed historic high flows, so that erosion is not expected to increase the delivery of mercury downstream. No § 401 conditions are required for this parameter.

PCBs: Data collected for PCB concentrations in large-scale suckers demonstrated that there is no evidence of historic PCB contamination by the PGE project. These data provide reasonable assurance that there is no legacy contamination of PCBs attributable to the PGE Project. No changes in operations under the new license are likely to negatively influence existing conditions. No § 401 Certification conditions are required for this parameter.

The above analysis provides reasonable assurance that PGE's Clackamas Project is in compliance with the Toxic Substances standard.

5.2.9 Turbidity

Water Quality Standard

Turbidity in water results from inorganic and organic particulate matter being held in suspension. The standard is designed to minimize the addition of soil particles or any other suspended substances that would cause significant increases in the river's normal, seasonal turbidity pattern.

OAR 340-041-0036
Turbidity

Turbidity (Nephelometric Turbidity Units, NTU): No more than a ten percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity. However, limited duration activities necessary to address an emergency or to accommodate essential dredging, construction or other legitimate activities and which cause the standard

to be exceeded may be authorized provided all practicable turbidity control techniques have been applied and one of the following has been granted:
(a) Emergency activities: Approval coordinated by the Department with the Oregon Department of Fish and Wildlife under conditions they may prescribe to accommodate response to emergencies or to protect public health and welfare;
(b) Dredging, Construction or other Legitimate Activities: Permit or certification authorized under terms of section 401 or 404 (Permits and Licenses, Federal Water Pollution Control Act) or OAR 14I-085-0100 et seq. (Removal and Fill Permits, Division of State Lands), with limitations and conditions governing the activity set forth in the permit or certificate.

Current Water Quality Status

No turbidity data were collected by PGE. Through its' ambient monitoring program, DEQ has collected turbidity and/or total suspended solids data at two sites just downstream of River Mill Dam, PGE's lowest project facility. Samples were collected approximately monthly or bimonthly between July, 1995 and April 2007. The ambient monitoring site downstream of River Mill Dam was moved a mile or so downstream to McIver Park in October 1997. Total suspended solids were collected throughout the period of record, while turbidity has been collected since April 1997. Total suspended solids and turbidity tend to track each other so that when total suspended sediments are high, turbidity is likely to be high also. Thus, examining total suspended solids data can provide a rough estimate for turbidity.

DEQ's ambient program monitoring data showed very low levels for both total suspended solids and turbidity. One sample date had a high value for total suspended solids at 110 mg/L The applicable water quality criteria for the Willamette Basin is 100 mg/l (OAR 340-41-0345 (2)). This sample was collected on November 29, 1995, one day after the ninth highest river level ever measured at the nearby Estacada gauge. The river crested at 23.4' on November 28, 1995. Flood level occurs at 20', and major flood level occurs at 25'. The high value for this sample was likely due to the flood condition. Turbidity was not measured on that date. Of the remaining data for total dissolved solids, three values of were between 10 and 20 mg/L, and all other values were <6 mg/l; all are low values for this parameter. Turbidity was added to the monitoring program in 1997. In all, 66 turbidity samples were collected, four at the River Mill Dam site, and the remainder at the downstream McIver Park site. These values were all < 20 NTU, reflecting very low turbidity values.

Potential Impact of New License

Hydroelectric projects generally do not create a waste stream with added pollutants and thus will not contribute to increased turbidity in this way. However, turbidity is a documented problem at hydroelectric projects where project operations result in near- or instream-erosion, when maintenance activities flush accumulated sediments into waterbodies, or where project operations result in the formation of algae blooms that in turn increase the turbidity of water.

None of the ordinary operations at PGE's Clackamas Project contribute to erosion. For the mainstem facilities, this is reflected in the low values observed for turbidity and total suspended solids. Regular maintenance activities at PGE's Clackamas Project do not include removal of any accumulated sediments, so no increases in turbidity due to suspension of sediment has been observed or is anticipated from current or proposed project operations.

Proposed changes under the new license will alter the hydrology of some of the project lakes and reservoirs. The water quality model was used to estimate water quality under the proposed alternative for project operations.

The Settlement Agreement includes a higher summertime lake elevation for Timothy Lake, if hydrologic conditions allow. Timothy Lake has historically been lowered very quickly in the fall. The Settlement Agreement provides for higher instream flows downstream of Timothy Lake during summer months, and lower instream flows downstream of Timothy Lake in September and October, and again in March, April and May than under the current operating plan. The lower flows in spring and fall will result in a slower lowering of lake level during these time periods.

The water quality model predicts some small increases in surface water chlorophyll *a* and pH for Timothy Lake during summer months under the proposed operating conditions. The model predicts a similar, small increase in chlorophyll *a* in Harriett Lake, but here there is no concurrent predicted change in pH. The model predicts that conditions in Frog Lake will be essentially identical to those in Lake Harriett.

In North Fork Reservoir, the water quality model predicts an increase in chlorophyll *a* at about 10 m depth, with a concurrent increase in pH at the same depth in the modeled data for August 2001. This translates to a small increase in chlorophyll *a* in the North Fork Tailrace, and downstream. A much smaller increase in chlorophyll *a* was observed in Estacada Lake in August 2001, with no concurrent change in pH.

The Settlement Agreement includes various construction projects and habitat projects located throughout the Project area. Construction of these projects may lead to erosion and sediment disturbance that can contribute to instream turbidity.

DEQ Evaluation

PGE's § 401 Application classified turbidity as a standard not affected by the Project. DEQ has nonetheless evaluated the Project's impact on turbidity, based on the occurrence of turbidity problems at other hydroelectric facilities. This evaluation is based mainly on the potential for the Clackamas Project to affect turbidity, supplemented with bimonthly DEQ monitoring data from a just downstream of the Project.

Day to day project operations are not expected to contribute turbidity causing material to enter the aquatic system. Available data for turbidity and total suspended solids are generally low values, corroborating that there are no ongoing problems with turbidity. These data confirm that there is no evidence that day to day project operations contribute turbidity to the Clackamas. Project monitoring will not be required to confirm any affect that ongoing operations may have on turbidity.

The water quality model predicts some increases in algal blooms in Timothy Lake and in North Fork Reservoir. Both of these project facilities discharge water from deep within these reservoirs. Algal blooms are surface water events, and will likely not be discharged at these facilities. The water quality model does predict some changes to algal populations under the proposed operations in each of the project lakes and reservoirs. These changes will be monitored primarily by monitoring algae and chlorophyll *a* levels. The plan for monitoring these parameters is included in the Water Quality Monitoring and Management Plan, and discussed here in Section 5.2.4.

The Settlement Agreement does include measures that will require major construction at several points throughout the project. Some examples are the proposed reconnection of side channels in the lower Oak Grove Fork, and the new fish passage facilities for both the North Fork Reservoir and Estacada Lake. Construction activities may disturb river sediments and lead to temporary increases in river turbidity. For any construction activities that require state or federal dredge and fill permits, PGE will be required to obtain necessary permits and to follow the conditions of those permits, including in-water work periods and implementation of erosion control practices that will minimize increases in sedimentation and turbidity and potential related impacts on fish and aquatic life. Conditions would include further water quality measures identified by DEQ during § 401 review associated with any federal permits.

DEQ Findings

The above evaluation provides DEQ with reasonable assurance that PGE's Clackamas Project does not contribute to increased turbidity levels in the Oak Grove Fork or Clackamas River. There is a potential for the construction activities proposed under the new license to result in short term turbidity increases. § 401 Condition 7 requires PGE to implement best management practices and condition 9b to obtain all necessary federal and state permits for future activities. At the time any federal permit is sought for the construction activity, DEQ will have another opportunity to review the proposed activity's compliance with water quality standards and to prescribe further water quality measures as conditions to the federal permit. These § 401 conditions provide assurance that future construction will not cause Project-related turbidity violations.

5.2.10 Antidegradation

Water Quality Standard

Water quality standards have three main elements; the beneficial uses that are protected by the standard, numeric and narrative criteria that are protective of those uses and an antidegradation policy that governs how and when existing water quality may be lowered. When the Department considers issuing a permit or a water quality certification that would allow the existing water quality to be diminished in some way, the Department action must comply with the antidegradation provisions of the water quality standards. Portions of the antidegradation language that might be applied to this water quality certification are included below. The rule can be found in its entirety at OAR 340-41-0004.

OAR 340-04l-0004

Antidegradation

(1) Purpose. The purpose of the Antidegradation Policy is to guide decisions that affect water quality such that unnecessary further degradation from new or increased point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses. The standards and policies set forth in OAR 340- 041-0007 through 340-041-0350 are intended to supplement the Antidegradation Policy.

(2) Growth Policy. In order to maintain the quality of waters in the State of Oregon, it is the general policy of the Commission to require that growth and development be accommodated by increased efficiency and effectiveness of waste treatment and control such that measurable future discharged waste loads from existing sources do not exceed presently allowed discharged loads except as provided in section (3) through (9) of this rule.

(3) Nondegradation Discharges. The following new or increased discharges are subject to this Division. However, because they are not considered degradation of water quality, they are not required to undergo an antidegradation review under this rule:

(a-b, not applicable)

(c) Temperature. Insignificant temperature increases authorized under OAR 340-041-0028(11) and (12) are not considered a reduction in water quality.

(d) Dissolved Oxygen. Up to a 0.1 mg/l decrease in dissolved oxygen from the upstream end of a stream reach to the downstream end of the reach is not considered a reduction in water quality so long as it has no adverse effects on threatened and endangered species.

(4-6 are not applicable)

(7) Water Quality Limited Waters Policy: Water quality limited waters may not be further degraded except in accordance with section (9)(a)(B), (C) and (D) of this rule.

(8 is not applicable)

(9) Exceptions. The Commission or Department may grant exceptions to this rule so long as the following procedures are met:

(a) In allowing new or increased discharged loads, the Commission or Department must make the following findings:

(A) The new or increased discharged load will not cause water quality standards to be violated;

(B) The action is necessary and benefits of the lowered water quality outweigh the environmental costs of the reduced water quality. This evaluation will be conducted in accordance with DEQ's "Antidegradation Policy Implementation Internal Management Directive for NPDES Permits and section 401 water quality certifications," pages 27, and 33-39 (March 2001) incorporated herein by reference; and

(C) The new or increased discharged load will not unacceptably threaten or impair any recognized beneficial uses or adversely affect threatened or endangered species. In making this determination, the Commission or Department may rely upon the presumption that if the numeric criteria established to protect specific uses are met the beneficial uses they were designed to protect are protected. In making this determination the Commission or Department may also evaluate other State and federal agency data that would provide information on potential impacts to beneficial uses for which the numeric criteria have not been set;

(D) The new or increased discharged load may not be granted if the receiving stream is classified as being water quality limited under OAR 340-041-0002(62)(a), unless:

(i) The pollutant parameters associated with the proposed discharge are unrelated either directly or indirectly to the parameter(s) causing the receiving stream to violate water quality standards and being designated water quality limited; (the remaining language in (9) is not applicable.)

Current Water Quality Status

The Clackamas River from River Mill Dam to the mouth at the Willamette River has been designated as water quality limited for temperature, bacteria and mercury. TMDLs have been approved for all three pollutants. PGE has an allocation for temperature that allows PGE to contribute 0.15° C of warming to the system. PGE has no allocation for bacteria or mercury.

Current conditions for each parameter that may be affected by PGE's operations at the Clackamas Project are described in the applicable sections of Chapter 5. Oregon's antidegradation policy does not apply to current conditions, instead it protects against degradation of existing water quality as described below in this section.

Potential Impact of New License

Actions under a new license are not allowed to cause violations of water quality standards. The antidegradation policy guards against a lowering of water quality. Such lowering of water quality is only allowed under specified conditions, such as when the lowered quality of one parameter nonetheless results in improved overall conditions for a beneficial use, or when no other alternatives exist, and the lowered water quality will not result in violations.

PGE's proposed operations may result in lowered water quality for two parameters. These are discussed in more detail under the evaluation for the respective parameters; both pH and total dissolved gas (TDG) may increase under conditions proposed for the new license. Beneficial uses are protected under a range of pH conditions, so it is difficult to conclude whether an increase should be considered a lowering of water quality; however on some occasions pH values approach the upper limit, so additional increases in pH values may be considered a degradation of quality.

Changes to instream flow and lake elevations at Timothy Lake and North Fork Reservoir may result in somewhat higher pH levels in the surface water of these two reservoirs. The increases in pH are expected to be small. The increases would result from changes in algal populations. The level of confidence surrounding the water quality model predictions for algal populations is lower than the ability of the model to predict any other water quality conditions, so it is not clear that the model predictions for higher pH will actually occur. In addition, the changes are restricted to a portion of the surface water in the reservoirs. The model predicts that water quality at other depth will remain unchanged.

As a term of the Settlement Agreement to protect fish passage, under specified conditions PGE will route water over the spillway at North Fork Dam. Routing water over the spillway may result in increases in total dissolved gas, which is considered a lowering of water quality.

DEQ Evaluation

During a § 401 evaluation, an antidegradation review is triggered when new license conditions are likely to increase any impact that the project has on water quality parameters; not when existing impacts remain the same or are lessened. Application of the antidegradation rule depends on the findings about the Project impact on individual water quality standards.

For waters that are listed as water quality limited, such as the Clackamas River downstream of River Mill Dam for temperature, the policy generally prohibits further degradation due to new or increased discharged loads. The new license will not entail new or increased discharges below River Mill, except for gravel augmentation which will not degrade temperature conditions. The Project's impacts on temperature are otherwise discussed in section 5.5 of this report regarding TMDL implementation.

DEQ Findings

The § 401 Evaluation identified a potential need for an antidegradation analysis. The antidegradation analysis has demonstrated that potential degradation of water quality by PGE's operations are expected to be minor, and result from actions taken that will provide a net benefit by improving overall conditions for aquatic life. The § 401 Certification includes conditions to ensure that pH (condition 3) and TDG (condition 4) will not violate water quality standards. With the inclusion of these conditions in the § 401 Certification, DEQ is reasonably assured that the antidegradation policy will be supported by the proposed changes in PGE's operations at the Clackamas hydroelectric facility.

5.2.11 Three Basin Rule

Water Quality Standard

The intent of the Three Basin Rule (OAR-340-041-0350 is to preserve or improve the existing quality water for the Clackamas River, the North Santiam River and the McKenzie River. Municipal water supplies, recreation, and preservation of aquatic life are specifically protected from new or increased waste discharges, except as provided by this rule. New activities allowed by this rule are considered if they contribute no or insignificant pollution inputs to these waters. Portions of the Three Basin Rule language that might be applied to this water quality certification are included below. The rule can be found in its entirety at OAR 340-41-0350.

340-041-0350

The Three Basin Rule: Clackamas, McKenzie (above RM 15) & the North Santiam
[Excerpts of this rule are provided here, the full text can be found in OAR 340-041-0350]
(1) In order to preserve or improve the existing high quality water for municipal water supplies, recreation, and preservation of aquatic life, new or increased waste discharges must be prohibited, except as provided by this rule, to the waters of:
(a) The Clackamas River Subbasin; …

(6) The Director or a designee may issue the following General Permits or Certifications subject to the conditions of the Permit or Certification: …

(g) Federal Clean Water Act Section 401 water quality certifications.

Potential Impact of New License

The antidegradation policy guards against a lowering of water quality, but allows a lowering of water quality under some conditions and when the lower quality will still meet water quality standards. The Three Basin rule provides additional limitations for new sources to prohibit a lowering of water quality in three targeted basins that provide municipal drinking water.

PGE's proposed operations will generally improve water quality throughout the project. Increases in instream flows will improve water temperatures, and maintain dissolved oxygen in reaches downstream of project dams. While changes in PGE's operations will improve water quality overall, water quality models suggest that some reaches may degrade slightly.

DEQ Evaluation

For the purposes of the § 401 evaluation, the three basin rule allows existing projects to continue as long as additional pollutant loads are not added to the river. For most of the Clackamas Project, PGE's proposed activities will either enhance or maintain water quality. In some reaches, the water quality modeling suggests that some degradation of water quality may occur. However, these impacts are predicted to be small, and may not occur. DEQ has included § 401 conditions that require monitoring for changes in water quality, and that also require PGE to develop a plan of action to stop project-related degradation of water quality, if changes in their operations do cause problems.

DEQ Findings

The relationship between the Three Basin Rule and the § 401 Certification was evaluated for this project because it is located in the Clackamas Basin, one of the three basins protected by the Three Basin Rule. DEQ has determined that a § 401 Certification will be issued for this project for operations upstream of and including River Mill Dam. PGE's project is an existing project, and not a new source of pollution. PGE's actions under the new license are expected to maintain or improve water quality, and not increase contributions of any pollutants to the Clackamas. For these reasons, the project was found to meet the goals of the Three Basin Rule. No § 401 conditions were added related to the Three Basin Rule.

6. EVALUATION OF COMPLIANCE WITH SECTIONS 301, 302, 303, 306 AND 307 OF THE FEDERAL CLEAN WATER ACT

In order to certify a project pursuant to § 401 of the federal Clean Water Act, DEQ must find that the project complies with applicable provisions of Sections 301, 302, 303, 306 and 307 of the Act and state regulations adopted to implement these sections. Sections 301, 302, 306 and 307 of the federal Clean Water Act deal with effluent limitations, water quality related effluent limitations, national standards of performance for new sources and toxic and pretreatment standards

Section 303 of the Act relates to Water Quality Standards and Implementation Plans. The federal Environmental Protection Agency (EPA) has adopted regulations to implement Section 303 of the Act. The EQC has adopted water quality standards consistent with the requirements of Section 303 and the applicable EPA rules. The EQC standards are codified in Oregon Administrative Rules Chapter 340, Division 41. The Environmental Protection Agency has approved the Oregon standards pursuant to the requirements of Section 303 of the Act. Therefore, the Project must comply with Oregon Water Quality Standards to qualify for certification.

The lower Clackamas River from the mouth to river mile 22.9 at the River Mill Dam has been included on the state's list of impaired waters; a list required under § 303(d) of the Clean Water Act. Pursuant to the Clean Water Act, Oregon has completed, and EPA has approved a Total Maximum Daily Load to address these water quality impairments (Willamette TMDL, 2006). PGE's Clackamas Project affects the impaired reach of the Clackamas, and the project was given a load allocation for temperature in the Willamette TMDL. PGE's TMDL Implementation Plan, summarized and referenced in section 5.2.5 above, and attached to this document as Exhibit A, meets Oregon's TMDL Implementation Plan requirements of 340-042- 0080(3).

7. EVALUATION OF OTHER APPROPRIATE REQUIREMENTS OF STATE LAW

Once a Project is determined to qualify for § 401 certification, additional determinations may be made to identify additional conditions that are appropriate in a certification to assure compliance with other appropriate requirements of state law, pursuant to § 401(d) of the Clean Water Act. Such requirements are "appropriate" if they have any relation to water quality, *Arnold Irrigation Dist. v. DEQ*, 79 Or.App. 136 (1986), and may include requirements as to water quantity if necessary to protect a beneficial use. *PUD No.1 of Jefferson Co. v. Washington Dept. of Ecology*, 511 U.S. 700 (1994).

7.1 Department of State Lands

ORS 196.810 requires that permits be obtained from the Oregon Department of State Lands (DSL) prior to any fill and removal of material from the bed or banks of any stream. Such permits, when issued, may be expected to contain conditions to assure protection of water quality so as to protect fish and aquatic habitat. The proposed new license includes some construction activities that may require a removal-fill

permit from DSL which is administratively coordinated with issuance of a dredge and fill permit by the U.S. Army Corps of Engineers under § 404 of the Clean Water Act. The § 401 Certification includes a condition requiring PGE to obtain all necessary permits, to ensure compliance with the appropriate state permit programs (condition 8m).

7.2 Department of Fish and Wildlife

The state laws summarized below are administered by the Department of Fish and Wildlife and pertain to providing and maintaining passage around artificial obstructions, protecting aquatic habitat and protecting and restoring native fish stocks.

- **ORS 541.405** Oregon Plan for Salmon and Watersheds
  Restore native fish populations and the aquatic systems that support them, to productive and sustainable levels that will provide environmental, cultural and economic benefits.

- **ORS 496.435** Policy to Restore Native Stocks
  Restore native stocks of salmon and trout to historic levels of abundance.

- **ORS 509.580 - 509.645** ODFW's Fish Passage Law
  Provide upstream and downstream passage at all artificial obstructions in Oregon waters where migratory native fish are currently or have historically been present.

- **OAR 635-007-0510** General Fish Management Goals
  Manage fish to take full advantage of the productive capacity of natural habitats and address losses in fish productivity due to habitat degradation through habitat restoration.

- **OAR 635-007-0521-0524** Natural Production Policy
  Protect and promote natural production of indigenous fishes.

- **OAR 635-007-0525-0529** Wild Fish Management Policy
  Protect genetic resources of wild fish.

- **OAR 635-007-0536-0538** Wild Fish Gene Resource Conservation Policy
  Manage wild fish to maintain their adaptiveness and genetic diversity.

- **OAR 635-500-0100-0120 Trout Management**
  Maintain the genetic diversity and integrity of wild trout stocks; and protect, restore and enhance trout habitat.

- **OAR 635-415-0000-0030** Fish and Wildlife Habitat Mitigation Policy
  Require or recommend mitigation for losses of fish and wildlife habitat.

Applying these state laws, ODFW, in its recommendations to FERC under Section 10(j) of the Federal Power Act, identified certain measures as necessary for the protection, mitigation and enhancement of fish resources. ODFW and DEQ, with other parties, agreed to inclusion of the same measures in the new FERC license through the Settlement Agreement. Of these measures, the following are related to water quality – either directly or by protection of a beneficial use through water quantity measures regarding flow volumes, velocities and for fish passage. These measures are included in the § 401 Certification as certification conditions and will be developed and implemented in consultation with the Fish Committee including ODFW and DEQ, and with approval of Fish Agencies including ODFW, as specified in the Settlement Agreement and Proposed License Articles.

Many of the protection, mitigation and enhancement measures included in the Settlement Agreement provide reasonable assurance that DEQ's water quality Biocriteria standard (OAR 340-004-0011) will be met. These are discussed in more detail in Section 5.2.7. In addition to measures that support the Biocriteria standard, several measures provide support for the beneficial uses by assuring fish passage

and protection. These actions are included as conditions in the § 401 Certification to support the beneficial aquatic uses, as allowed under the Clean Water Act § 401(d):

- Culvert replacement at Dinger Creek will restore access to 1.7 miles of habitat in Dinger Creek, providing additional habitat for native cutthroat trout. This measure will comply with Oregon rules for Trout management, Wild Fish Management, and General Fish Management and Oregon statutes requiring Fish Passage and Restoration of Native Stocks (citations listed above). The measure is described in the Settlement Agreement in Exhibit D, and proposed license article 42.

- PGE will install bar racks at the Timothy Lake outfall to protect fish from the outfall structure. This measure will protect native cutthroat trout in Timothy Lake and is described in Exhibit D of the Settlement Agreement and included as a proposed license article 39.

- The Settlement Agreement includes an extensive plan for improving upstream and downstream fish passage through the Clackamas project facilities. These are described in Exhibit D of the Settlement Agreement and included in Proposed License Articles 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, and 41. These measures include a number of improvements to downstream passage through the North Fork development, changes to the fish ladder to North Fork Reservoir, improvements to the fish sorting facility in the North Fork ladder, various effectiveness studies, and upstream and downstream passage for Pacific Lamprey. Implementation of these measures will comply with ODFW rules and statutes requiring fish passage. Fish passage measures also support fish and aquatic life, a designated use under Oregon's water quality rules throughout the Clackamas PGE project area.

The § 401 Certification includes condition 8 that requires these measures for Protection of Biocriteria; Support for Beneficial Uses; and Other Appropriate Requirements of State Law.

7.4 Department of Environmental Quality

On-site disposal of sewage is governed by ORS 454.705 et. seq. and OAR Chapter 340, Divisions 71 and 73. The purpose of these rules is to prevent health hazards and protect the quality of surface water and groundwater. Onsite sewage disposal systems are present at some project facilities, are regulated by the local government, and are in compliance with local and state law. No § 401 certification condition is necessary in relation to ORS 454.705 et seq.

ORS 466.605 et. seq. and ORS 468.780-815 establish requirements for reporting and cleanup of spills of petroleum products and hazardous materials. ORS 468.742 requires submittal of plans and specifications for water pollution control facilities to DEQ for review and approval prior to construction. One of the purposes of these statutes and rules promulgated pursuant thereto is to prevent contamination of surface or groundwater. PGE maintains an "Oil Spill Prevention Control and Countermeasure Plan" and a "Hazardous Materials Emergency Response Plan" at its facilities. These plans are regularly updated, and efforts are made to ensure that all project personnel are familiar with the plan requirements. Development, proper implementation and regular revision of these plans show that PGE is in compliance with these state laws.

Oregon rule (OAR 340-045-0015) requires facilities that discharge to water to secure National Pollution Discharge Elimination System permits for discharges of pollutants to surface water. At each of the four powerhouses in the Clackamas Project, Oak Grove Fork, North Fork, Faraday and River Mill, PGE withdraws river water, uses it to cool project turbines, and discharges the water back into the river. This common practice of cooling turbines uses a small amount of water, and is usually addressed by DEQ with a general permit that provides conditions that cover many similar sources. General permits address deminimus impacts; impacts that are too small to be measured. PGE does not currently hold NPDES permits for these facilities, but applied for the appropriate permits on May 28, 2009.

7.5 Department of Water Resources

ORS 468B.040(2) requires DEQ to determine whether § 401 certification is consistent with standards established in ORS 543A.025(2) to (4). Applicable standards under 543A.025(2)-(4) include (a) mitigation, restoration or rehabilitation of impacts to fish and wildlife resources, (b) non-endangerment of public health and safety, (c) protection, maintenance, or enhancement of wetland resources and (d) protection, maintenance, or enhancement of other resources.

Water Resources has prepared a draft proposed final water right for this project, which is made available for public comment at the same time as the proposed § 401 Certification. Based on the contents of the draft proposed final water right, and the State of Oregon's support of the Settlement Agreement for the Clackamas Hydroelectric Project and for this § 401 Certification, DEQ finds that certification is consistent with the standards set forth under ORS 543A.025.

7.6 Department of Land Conservation and Development

ORS Chapter 197 contains provisions of state law requiring the development and acknowledgement of comprehensive land use plans. This chapter also requires state agency actions to be consistent with acknowledged local land use plans and implementing ordinances.

The § 401 Application for the Clackamas Project included an approved Land Use form from the Clackamas County Planning office dated August 4, 2004. This review was based on the same operations that were approved in the Settlement Agreement. Most of these proposed actions have not changed in the June 2008 § 401 Application. However, PGE now proposes to operate Faraday Lake differently, but either drawing the lake level down in the summer, or constructing a channel to alter the residence time in Faraday Lake. In addition, PGE has proposed several measures for the lower river to improve habitat for salmonid species, including adding riparian shade to 30 stream miles in the lower basin, and to construct or enhance side channel habitat along the mainstem river. A separate Land Use Compatibility Statement was completed and approved for these activities on October 1, 2008. Based on the two completed Land Use Compatibility Statements, DEQ finds the PGE Clackamas Project to be in compliance with comprehensive land use planning requirements at the state and local level. No § 401 certification condition is necessary in relation to ORS Chapter 197.

8. PUBLIC COMMENT

8.1 Issuance of Public Notice, Opportunity to Comment

Public Notice of the Clackamas Project § 401 Application and proposed § 401 certification documents were distributed February 20, 2009. DEQ distributed this notice to the Agency's mailing list, including known interested persons and agencies, to adjacent landowners and to the FERC mailing list for the Clackamas Project. 2009. A Public Hearing was held on April 16, 2009 at 6:00 p.m. at DEQ's Northwest Region, 2020 SW 4th Avenue, Portland, Oregon. A short summary of the project and § 401 conditions was presented, including an opportunity for questions. An opportunity to supply oral testimony for DEQ's record followed. Written comments were accepted through April 23, 2009.

8.2 Public Comment Received

Eight people attended the Public Hearing on April 16, 2009. Ryan Johnson, representing Friends of the Clackamas, a nonprofit organization, was the only person to testify at the hearing. In his testimony, Mr. Johnson stated that Friends of the Clackamas were in opposition to the § 401 certifications, and requested an extension to the public comment period beyond April 23, 2009. On April17, 2009, DEQ responded to the Friends of the Clackamas that the public comment period would not be extended.

On April 23, 2009, DEQ received written comments from 4 parties; Carol Witbeck, Ryan Johnson as President of Friends of the Clackamas River, Scott Forrester, and Michael Rysavy as Executive Director of the Northwest Forest Conservancy. The comments are summarized or paraphrased in Table 14 and in Section 8.2. This section includes DEQ's response to each comment point. The complete text of comments received is included in Appendix A of this document.

DEQ also made two changes to the Evaluation Document. The Public comment version of the Evaluation Document made reference to the Stratified Water Rule, (OAR 340-041-0061(15)). This rule was disapproved by EPA on February 20, 2009, so DEQ has removed references to this rule in Sections 5.2.2 about pH, and Section 5.2.5, Temperature.

While the documents were available for comment, DEQ also determined that it was more appropriate to issue a TMDL order, in place of contractual agreement with PGE. Section 5.2.5, Temperature, was edited to reflect this change.

Table 14. DEQ's Response to Comments Received regarding DEQ's Proposed § 401 Certification to Accompany a New FERC license for PGE's Clackamas Hydroelectric Project

Summary of Comment	Commenter	Where to find DEQ's Response
1. Extension of Comment Period beyond 60 days	Friends of Clackamas River	Section 8.2
2. Include specified State and Federal Law as part of Hearing Process	Ms. Witbeck & Friends of Clackamas River, comments 1-4	Section 8.2; refer to Section 2, Section 6 and Section 7
3. Include several references regarding formation of trihalomethane formation and toxicity in drinking water	Ms. Witbeck & Friends of Clackamas River, comments 5-11	Section 8.2
4. Applicability of "Three Basin Rule"	Ms. Witbeck & Friends of Clackamas River, comment A.	Section 8.2 and refer to Section 5.11 added to the final version of this document
5. Fish passage, and Eutrophication and Turnover in Timothy Lake	Ms. Witbeck & Friends of Clackamas River, comment B.	Section 8.2; refer to Sections 3.2.2, 5.2.1, 5.2.2, 5.2.4, and § 401 Conditions 2b, 3 and 5
6. Project heating, temperature standard, 303(d) list, and all practical measures to reduce heating	Ms. Witbeck & Friends of Clackamas River, comments C,D, L, T	Section 8.2 and Section 5.2.5
7. Upstream transport of Blue-green algae species	Ms. Witbeck & Friends of Clackamas River, comment C	Section 8.2
8. Dam Safety Concerns	Ms. Witbeck & Friends of Clackamas River, comments E,F, G	Section 8.2, www.ferc.gov/industries/hydropower
9. Contaminants in sediments behind dams	Ms. Witbeck & Friends of Clackamas River, comment H	Section 8.2 and refer to Section 5.2.8

10. Howell Bunger Valve at Timothy Lake Tailrace	Ms. Witbeck & Friends of Clackamas River, comment I	Section 8.2, refer to Section 5.2.1, § 401 Condition 2c
11. Measures used in the past and future to address eutrophication in Project Reservoirs	Ms. Witbeck & Friends of Clackamas River, comments J, K	Section 8.2, refer to Sections 5.2.1, 5.2.2, 5.2.4, § 401 Condition 2, 3, 5, and 6
12. Gravel Management Plan	Ms. Witbeck & Friends of Clackamas River, comment L	Section 8.2, refer to Sections 5.2.6, § 401 Condition 8i, and Settlement Agreement (2005) Exhibit D Sections VIII and IX
13. Laboratory used for samples	Ms. Witbeck & Friends of Clackamas River, comment M	Section 8.2
14. Herbicides and bioaccumulation, and Herbicide use on Public Lands	Ms. Witbeck & Friends of Clackamas River, comment N	Section 8.2, and USGS citation added to document Reference list (Carpenter, 2004)
15. Trihalomethanes and human health, Clackamas Drinking Water Provider participation in process, and notification for Clackamas River drinking water consumers	Ms. Witbeck & Friends of Clackamas River, comments O,P, last S	Section 8.2
16. Liquefied Natural Gas Pipeline Impacts	Ms. Witbeck & Friends of Clackamas River, comment Q	Section 8.2
17. Water quality monitoring under new license	Ms. Witbeck & Friends of Clackamas River, comments R,S, W	Section 8.2, refer to Sections 5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, 5.2.7, and § 401 Conditions 2b(3), 3d, 4b, 5b
18. Impoundments and fish food web	Ms. Witbeck & Friends of Clackamas River, comment U	Section 8.2, refer to Section 5.2.6, and see Wissman & Doughty, (2004)
19. Identify habitat enhancement approaches	Ms. Witbeck & Friends of Clackamas River, comment V	Section 8.2, refer to Settlement Agreement (2005)
20. Global warming and greenhouse gas impacts	Scott Forrester, all comments	Section 8.2, and § 401 Condition 9a
21. Proposed ‘temperature trade’ to lower downstream temperatures with PGE funded management changes at Austin Hot Springs	Northwest Forest Conservancy, all comments	Section 8.2

Comments and Responses:

1. **Comment:** Friends of the Clackamas River requested an extension of Comment Period beyond April 23, 2009.
   Response: After discussion with Friends of the Clackamas, DEQ denied this request. ORS 543A.105(2) required DEQ to provide a 60 day comment period for this Proposed § 401 Certification. DEQ considers the complexity of projects, materials for review and the complexity of anticipated comments to determine whether an extension is warranted. In this case, the 63 day comment period provided similar comment time as other complex water quality projects, including proposed Total Maximum Daily Loads.

2. **Comment**: Both Ms. Witbeck and the Friends of the Clackamas River requested DEQ to include specified State and Federal Laws as part of the hearing Process.
   Response: DEQ's authority to issue § 401 Certifications ultimately results from the Clean Water Act. Oregon's water quality standards are adopted to ensure compliance with the Clean Water Act, the Safe Drinking Water Act and the Federal Endangered Species Act. The § 401 Certification also addresses any state law related to water quality. §401 Conditions included under this authority are identified in Section 7 of this document. These state and federal rules are included by reference in this document or by inference under DEQ's legal authority to implement the § 401 Certification Program. Section 2 identifies the legal authorities under which DEQ implements the § 401 Certification Program. Sections 6 and 7 describe how DEQ has determined that the project will meet federal and state law related to water quality. Section 5 outlines how DEQ determined that the project meets state water quality standards. Where the text of these rules helps the reader to understand DEQ's action, portions of the rule have been included. Otherwise, only references to rule and statute are included for brevity.

3. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River requested DEQ to include specified references concerning the formation and toxicity of trihalomethanes in drinking water.
   Response: DEQ is addressing the questions about trihalomethanes, drinking water safety and nexus to the project under comment number 19, below. As can be seen in that response, DEQ did not find it necessary to add these references to the Evaluation Document. DEQ has added a USGS report on pesticides (Carpenter, 2004) to the discussion in Section 8.2, comment 14.

4. **Comment**: Both Ms. Witbeck and the Friends of the Clackamas River requested DEQ to describe how the "Three Basin Rule" applies to this project.
   Response: The Three Basin Rule is included in Oregon's water quality standards (OAR-340-041-0350). It's intent is to 'preserve or improve the existing high quality water for municipal water supplies, recreation, and preservation of aquatic life, new or increased waste discharges must be prohibited, except as provided by this rule, to the waters of: (a)The Clackamas River Subbasin; (b) The McKenzie River Subbasin above the Hayden Bridge; (c) the North Santiam River Subbasin.' DEQ did examine and evaluate the applicability of this rule to PGE's Project but failed to include that consideration in the Evaluation Document. DEQ has added an evaluation for this rule to Section 5.11.

   In summary, the Three Basin Rule specifically allows DEQ to issue § 401 Water Quality Certifications, subject to the conditions of the certification. Thus, if DEQ determines it may otherwise issue a § 401 Certification, the Three Basin Rule does not preclude DEQ from doing so. The Three Basin Rule is intended to restrict additional pollutants in those basins. In this case, PGE's Project pre-dated adoption of the Three Basin Rule, and is therefore not a new source of pollution. In addition, the terms of the proposed FERC license will contribute to improved water quality and improved habitat, addressing the intent of the Three Basin Rule to 'preserve and improve' the existing high quality Clackamas River water.

5. **Comment**: Both Ms. Witbeck and the Friends of the Clackamas River ask DEQ to elaborate on fish passage at Timothy Lake and eutrophication and turnover in PGE's Clackamas reservoirs.
   Response: DEQ does not have authority over fish passage in Oregon waters. Oregon Department of Fish and Wildlife, and the National Marine Fisheries Service and U.S. Fish and Wildlife Service all have some level of authority regarding fish passage at hydroelectric facilities. Fish passage and

related mitigation at all project facilities was negotiated as part of the Settlement Agreement. DEQ's § 401 Certification supports both Oregon's Department of Fish and Wildlife authority and the Settlement Agreement by including the fish passage measures as mandatory conditions in the § 401 Certification.

Regarding the need for fish passage to protect passage for threatened and endangered salmonid species, there are no threatened and endangered fish species present at Timothy Lake. Habitat for anadromous threatened species exists only in the Clackamas River and in the lower 3 to 4 miles of the Oak Grove Fork, downstream of a natural waterfall.

PGE replaced the aging and outdated fish ladder at River Mill Dam in advance of this relicensing effort, so it already meets the modern standards for fish passage. The fish ladder at North Fork Dam does not require replacement. Under the new license, several other measures will be completed at that site to improve both downstream and upstream passage.

The commenter's ask about 'turnover cycles' at Project reservoirs in relation to eutrophication. In general, eutrophication is enhanced during the time period when lakes are stratified. During that time, the surface layer receives more sunlight, water temperatures are generally warmer and the surface layer may support greater algal growth. In contrast, turnover occurs when water temperatures, and thus water density, is the same throughout the water column, and wind causes the entire lake to mix. In this respect, Timothy Lake is the only reservoir within the project that exhibits significant stratification during the summer. Timothy Lake has been described as a mesotrophic system (see Section 3.2.2, Timothy Lake). The impacts of the Timothy Lake and both in-lake and downstream water quality are described in the following sections of this document; Section 5.2.1, Dissolved Oxygen and Timothy Lake, Section 5.2.2, Hydrogen Ion Concentration (pH) and Timothy Lake, and Section 5.2.4, Nuisance Algae and Timothy Lake. Timothy Lake is not considered to be a eutrophic system. However, it is a somewhat productive system that does stratify during the summer, and does support algal growth during the summer months. DEQ used water quality models to predict water quality conditions under the operations proposed for the new license. Because of the results from the water quality model, DEQ is requiring PGE to monitor dissolved oxygen, pH, temperature and algae growth in Timothy Lake under the new license. If eutrophication does occur under the new license, PGE will be required to identify management measures to reverse this affect. Conditions 2b, 3 and 5 of the § 401 Certificate direct PGE to monitor for these parameters, and to develop an action plan if water quality standards are not met.

6. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River ask DEQ to explain how the PGE impoundments add heat to the river, and ask why DEQ would allow this heating. The commenter's also inquire whether the PGE Clackamas Project meets the water quality standard for temperature, and ask what measures are considered practical.
   Response: DEQ describes the temperature standard, the thermal impacts contributed by PGE's project, and the measures that were investigated to address heating in the Clackamas River in Section 5.2.5, Temperature.

7. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River ask DEQ to explain how Anabaena travels upstream to infest a superheated stream corridor.
   Response: DEQ is not aware of any scientific studies demonstrating migration of blue-green algae upstream. Some species of blue-green algae are able to modify their buoyancy, and thus migrate to various depths within the water column.

8. **Comment:** In three different comments, both Ms. Witbeck and the Friends of the Clackamas River ask DEQ to deny the § 401 certification because the dams are old and may fail.
   Response: DEQ does not have authority over dam safety, and dam safety is not directly related to water quality, so the § 401 Certification and Evaluation Report are silent on this topic. However, dam safety is extremely important. The Federal Energy Regulatory Commission has authority over the safety of dams at hydroelectric projects that hold a FERC license. More information on FERC's dam safety program can be found at http://www.ferc.gov/industries/hydropower.asp. This program includes a rigorous inspection schedule, and implementation of emergency action plans that address the concerns voiced by the commenters.

9. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River ask DEQ whether sediments behind the dams have been tested for contaminant levels.
Response: Sediment behind the project dams has not been tested for contaminants. The proposed license does not include any activities that would cause the sediments to be disturbed or released downstream, so there are no requirements to sample the sediments for contaminants.

   DEQ agrees with the concern of the Commenters that PCBs have been used historically at hydroelectric facilities, and was concerned that prior use of these persistent contaminants may have accumulated in biota at the project sites. PGE did test fish tissue as a biological indicator to determine whether PCB contamination was an issue at the Clackamas Project. These results showed that PCB levels are not elevated in fish tissue. This is described in detail in Section 5.2.8, Toxic Substances.

10. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River ask DEQ to explain the sense of water spraying out of the bottom of the dam at Timothy Lake.
Response: The valve that sprays water at the bottom of Timothy Lake Dam is called a Howell Bunger Valve. This type of valve is designed to minimize the potential for erosion downstream of Timothy Dam. Water is released from depth at Timothy Lake. If this water was released from a pipe or a gate, there is significant energy transferred downstream, which could result in large-scale erosion of the river bank. By spraying water into the air, the energy is dispersed, and the erosion potential is minimal. This method does not result in significant heating of the Oak Grove Fork. Water released from Timothy Dam comes from deep within the lake, where temperatures are cold. In addition, there is a significant supply of groundwater to the Oak Grove Fork just downstream of Timothy Lake, so that no heating of the Oak Grove Fork downstream of Timothy Lake has been shown to occur.

    As described in Section 5.2.1, water quality is improved by spraying water through the Howell Bunger Valve. The water deep in Timothy Lake can have low dissolved oxygen at times during the summer. The Howell Bunger Valve aerates this water, improving the dissolved oxygen level. DEQ has included § 401 Condition 2c requiring PGE to use this valve for a sufficient portion of the water released from Timothy Lake to ensure that water in the Upper Oak Grove Fork will meet the applicable standards for dissolved oxygen.

11. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River inquire about what kinds of eutrophication control measures have been used in the past, and what might be used in the future at the PGE Clackamas reservoirs.
Response: PGE has not attempted to control eutrophication at any of its project reservoirs. During the late 1990's and early in the 21st century, the USFS replaced all of the aging toilets Timothy Lake with newer vault toilets. Both old and new toilets were pumped regularly, but the steel casings of the older toilets were suspected of contributing bacterial and possible nutrients to the lake. No testing was completed prior to or after the toilet upgrade.

    The § 401 Certification includes conditions 2c, 3b, 6a and 5a that require PGE to monitor Timothy Lake for dissolved oxygen, pH and temperature, and both Timothy Lake and North Fork Reservoir for the presence of blue-green algae blooms. If pH becomes higher, or dissolved oxygen lower than the applicable water quality standards in Timothy Lake, PGE will develop a plan to address this water quality problem (see § 401 Conditions 2b(4), 3d, 6a(4) and 5b. Blue-green algae blooms have not occurred in project reservoirs in the past few years. If blooms occur again, monitoring required under the § 401 Certification will help PGE identify how to reverse the intensity or frequency of bloom formation. It is not clear what actions might be taken without the future data. Some ideas that may be explored include another look at near-shore sources of nutrients, changes in the amount of time that water is retained in project reservoirs, using some type of bubbler to discourage algal growth, and investigating new methods for nutrient control that may not be known to us at this time, but become apparent in the future.

12. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River ask questions about the gravel management plans that will be implemented under the new license.

Response: As directed in § 401 Conditions 8i (see Section 5.2.6 for discussion), and agreed to in the Settlement Agreement (2005), PGE will add gravel to two different reaches of the Clackamas system. Gravel additions to the Oak Grove Fork and the mainstem Clackamas will be made near the base of Harriett Dam and River Mill Dam, respectively. In both cases, the river will carry gravel downstream, and it will be deposited and distributed in the same way gravel would distribute if it were not retained behind the dams. These efforts will be monitored and modified according to their respective gravel management plans. Additional detail for the gravel plans are presented in the Settlement Agreement (2005; Lower Oak Grove Fork in Section VIII.3.b of Exhibit D, and the mainstem Clackamas in Section IX of Exhibit D).

13. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River inquired which laboratory PGE used to process their water quality samples.
Response: Field parameters were analyzed using field equipment. PGE used North Creek Analytical Lab to analyze samples for nutrients. Fish tissue analysis for mercury was performed by Cebam Analytical Lab in Seattle, and Columbia Analytical Services in Kelso performed the analysis for PCB in fish tissue. All samples were collected, stored and analyzed according to a Quality Assurance Plan completed by PGE and approved by DEQ prior to sampling. Sampling and analytical methods were those specified by EPA for water quality analysis.

14. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River inquire about the use of pesticides on public lands, and the potential for bioaccumulation in the project reservoirs.
Response: DEQ does not regulate the use of pesticides on public or private land. In Oregon pesticide use is regulated by the Oregon Department of Agriculture. The § 401 Certification may only be used to regulate PGE's actions under the new FERC license, not those of public agencies or other public or private landowners. PGE must follow the rules set out by the Oregon Department of Agriculture for pesticide use on PGE project lands.

    The U.S. Geological Survey issued a report on pesticides in the Clackamas Basin from samples collected in 2000 and 2001 (Carpenter, 2004). This report showed non-detectable to extremely low concentrations of pesticides in the Clackamas downstream of River Mill Dam. Pesticide levels were higher downstream in the Clackamas and higher still in the tributaries to the lower Clackamas. These data indicated that the sources of pesticide in the Clackamas Basin are downstream of PGE's facilities. Thus there is no data suggesting that PGE's Reservoirs are a likely source for significant bioaccumulation of pesticides.

15. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River inquire about the relationship between PGE's project and trihalomethane formation in drinking water.
Response: Trihalomethanes can form when water that contains organic carbon is chlorinated. Drinking water treatment plants commonly use chlorination to disinfect drinking water to control the occurrence of pathogens in water. The commenters question whether the PGE project increases the load of organic material to the lower river, and thus increases the risk of trihalomethane formation in downstream drinking water. Data for organic carbon levels in the Clackamas are very low; less than 2 mg/L. Organic carbon comes from many sources in a watershed, including fallen leaves. Any impact that PGE contributes through eutrophication in Project reservoirs is very low, owing to both the low chlorophyll levels in the reservoirs, and overall low concentration of organic matter in the Clackamas system. There is no established relationship between PGE's activities and an increase in trihalomethanes in drinking water from the Clackamas River.

    The formation of trihalomethanes can be decreased by altering water treatment. Each of the drinking water providers in the Clackamas Basin uses different treatment strategies. Information on concerning the concentrations of trihalomethanes in finished water is available from the individual providers. However, all six of the drinking water providers report trihalomethane formation at values less than half of the maximum contaminants levels (MCL) allowable under the Safe Drinking Water Act.

    The commenters also question whether the drinking water purveyors testified on DEQ's proposed § 401 Certification and whether they support DEQ's action. All six of the Clackamas Basin drinking water purveyors were signatories to the Settlement Agreement (2005) for PGE's Clackamas Project.

The proposed § 401 Certification is consistent with that Agreement, and no comments were received by the drinking water purveyors. They are aware and in support of the proposed § 401 Certification for PGE's project.

The commenters also question whether everyone who consumes Clackamas River water was notified of the opportunity to comment on the proposed § 401 Certification. DEQ directly notified all parties who are involved in the FERC relicensing process, the Settlement Agreement for this FERC license, landowners who own property adjacent to the PGE project, and everyone who has asked DEQ to be notified regarding § 401 Certifications. In addition, DEQ posted the comment period notice on our webpage, and issued a news release about the public hearing. This § 401 Certification does not primarily concern drinking water in the Clackamas, and no significant project impact was identified that prompted DEQ to notify drinking water customers directly. All of the drinking water providers were involved in both the collaborative relicensing effort hosted by PGE and the Settlement Agreement for this license. They did not identify a need to notify every customer directly about the opportunity to comment on this proposed § 401 certification.

16. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River question whether impacts from the proposed pipeline for liquefied natural gas were considered in the proposed § 401 for PGE's Clackamas Project.
Response: The § 401 Certification review is restricted to the proposed actions for a federal permit or license that may impact water quality. The project to construct a liquefied natural gas pipeline in Oregon is not part of PGE's proposed action for a new FERC license. Thus DEQ has not considered any impacts from the proposed pipeline in the § 401 Certification analysis for PGE's Clackamas Hydroelectric project.

17. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River suggest a schedule for water quality monitoring under the new license, and suggest that monitoring alone will not solve water quality problems.
Response: The Water Quality Monitoring and Management Plan that is included as an attachment to the proposed § 401 Certification includes monitoring requirements specific to various water quality questions and concerns under the new license. The timing for sampling is directed at addressing those particular questions. The Monitoring Plan can also be altered in the future, if the future data collection is insufficient to address each particular issue. For additional information on each parameter, look at Sections 5.2.1, 5.2.2, 5.2.3, 5.2.4, 5.2.5, 5.2.6, and 5.2.7 of this document, and § 401 Conditions 1, 2, 3, 4, 5, 6, and 8. DEQ concurs that monitoring alone will not address water quality problems. The proposed § 401 certification directs PGE to monitor water quality for the purposes of better describing water quality status, and identifying solutions for water quality problems. When PGE does adopt new approaches to address water quality, monitoring will continue to confirm that water quality improvements have been achieved.

18. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River inquire whether PGE's impoundments have impaired the macroinvertebrate population and the food web in the reaches of the Clackamas Basin affected by the project.
Response: As part of the relicensing effort, PGE funded an extensive study of the macroinvertebrate population along both the mainstem Clackamas River and the Oak Grove Fork. This study found different species and smaller populations in tailraces of the dams. The study showed that these affected areas were small in size, and that the Clackamas Basin in general has a robust population of species that thrive in cold, clear water. The study is described to some extent in Section 5.2.6. Additional information can be found in the study report by Wissman and Doughty, (2004).

19. **Comment:** Both Ms. Witbeck and the Friends of the Clackamas River request that methods for habitat enhancement be described. The commenters also inquire how diluting, flushing and dredging the impoundments would affect the project.
Response: PGE will implement habitat projects in three main areas of the Project; Timothy Lake, the Lower Oak Grove, and downstream of River Mill Dam. The Settlement Agreement (2005) describes the habitat projects that will be constructed in the Timothy Lake area and the Lower Oak Grove. A

committee that includes state and federal agencies, tribes, and non-governmental organizations will work with PGE as the projects are implemented to address details that were not included in the Settlement Agreement, and to evaluate the projects once they are installed. The habitat projects downstream of River Mill Dam are described in PGE's Clackamas River Project Total Maximum Daily Load Implementation Plan. Projects are outlined in some detail in that plan, and will be implemented using the same Fish Technical Committee as the upstream projects.

There are no plans to dilute, flush or dredge the project reservoirs in the proposed actions for this project. Any future plans to dredge the project would be subject to a future § 401 Certification review to accompany a § 404 Permit from the Army Corps of Engineers.

20. **Comment:** Mr. Forrester commented that the effects of global warming were not evaluated as part of the § 401 Certification.
Response: DEQ did not evaluate potential impacts from global warming for this § 401 Certification. Some projections do suggest that global warming may affect water quality, and according to some climate models, could do so within the life of the FERC license. If global warming does have widespread impacts to water quality that alter the impacts made by PGE's Clackamas project, DEQ may find it necessary to revise this Certification. Condition 9a allows DEQ to reconsider this Certification should the PGE Project contribute to adverse conditions that do not currently exist and are not reasonably apparent, or if changes in TMDLs or water quality standards make changes to this Certification necessary.

21. **Comment:** The Northwest Forest Conservancy invites PGE to sponsor their purchase of the Austin Hot Springs property, providing PGE with an opportunity to decrease heating in the Clackamas River by diverting hot springs water from the upper Clackamas River. PGE is also invited to assist in sponsoring recreational activities at the site.
Response: PGE and DEQ have evaluated several options to decrease PGE's thermal load downstream of River Mill Dam. DEQ has encouraged PGE to pursue opportunities to decrease Clackamas River water temperatures. However, there are some limitations on the kinds and locations for these projects. In this case, PGE would have to demonstrate that heat diverted from the River high in the watershed would indeed result in cooling downstream of River Mill Dam in the vicinity of PGE's heating.

    The § 401 Certification addresses water quality, and not recreational issues. DEQ has forwarded these comments to PGE, in order to make PGE aware of the opportunity to cooperate with any of the proposed recreational activities.

9. CONCLUSIONS AND RECOMMENDATION FOR CERTIFICATION

DEQ has evaluated PGE's Clackamas Project proposal and has determined that, subject to compliance with the conditions that accompany the § 401 Certification, there is reasonable assurance that operations and facilities of the project as proposed to be relicensed will comply with the applicable provisions of Sections 301, 302, 303, 306 and 307 of the Clean Water Act, Oregon Administrative Rules, Chapter 340, Division 41, and other appropriate requirements of state law for waters located above River Mill Dam.

Based on the preceding analysis and findings, it is recommended that pursuant to § 401 of the Federal Clean Water Act and ORS 468B.040, the Director conditionally approve the § 401 Certification with Conditions for the Clackamas Hydroelectric Project, consistent with the findings of this document.

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Appendix 1. Comment Received During Public Comment Period

A1.Oral Testimony: The only testimony presented at the Public Hearing on April 16, 2009 was presented by Ryan Johnson, representing the Friends of the Clackamas River.

Transcript of testimony presented Ryan Johnson, Friends of Clackamas River:

'I am actually speaking on behalf of the non-profit Friends of the Clackamas River. The mission of Friends of the Clackamas River is to educate, promote, coordinate, and facilitate opportunities for habitat restoration projects and other forms of stewardship of natural resources within the Clackamas River Basin. Our comments are short, we're going to be filing additional comments but for now I just wanted to on behalf of the Friends of the Clackamas River to state our opposition to the 401 Certifications and also to request an extension of the comment period past April 23. And that's all.'

A2. Written Comment: Written comments were submitted by private citizens Carol Witbeck, and Scott Forrester. Executives for two different nonprofits provided comment; Ryan Johnson, President of Friends of the Clackamas River, and Michael Rysavy, Executive Director of Northwest Forest Conservancy. The full text of each document is included here.

Submitted by Carol Witbeck, Damascus, Or:

How appropriate it is that this hearing ends the day after Earth Day,

April 23, 2009

To: Department of Environmental Quality
Attention: Avis Newell
Phone: (503)229-6018 or Toll free in Oregon (800) 452-4011
Mailing address: DEQ, Attention: Avis Newell, 2020 SW 4th Avenue, Suite 400, Portland, OR 97201
Fax: 503-229-6018
E-mail: Newell.Avis@deq.state.or.us
From: Carol Witbeck, 15031 S. E. Royer Rd., Damascus, Oregon, 97089

Please enter this e-mail and any attachment as testimony into the hearing process for the 401 Certification and NPDES permit processes for PGE dams on the Clackamas River.

Please make the following documents part of this hearing process:
1. The Clean Water Act
2. The Clean Drinking Water Act
3. The Endangered Species Act
4. All Oregon Administrative Rules and Revised Statutes for Natural Resources, Fisheries and Water Resources, including the Three Basin Rule

5. The World Health Organization study on animal and human tri-halomethane exposure, at http://www.who.int/water_sanitation_health/dwq/chemicals/en/trihalomethanes.pdf

6. The study, Nephrotoxicity and Hepatotoxicity Induced by Inhaled Bromodichloromethane in Mice, Toxicological Sciences 64, 269-280 (2001) at http://toxsci.oxfordjournals.org/cgi/content/full/64/2/269

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8. The study, Bromoform and Dibromochloromethane Relevance to Public Health at http://www.atsdr.cdc.gov/toxprofiles/tp130-c2.pdf

9. The study, Chloroform: Developomental/Reproductive Toxicity Data Summary at http://www.oehha.ca.gov/prop65/CRNR_notices/state_listing/data_callin/pdf/CHLORdatasum.pdf

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11. The study, Organic Compounds in Clackamas River Water Used for Public Supply near Portland, Oregon, 2003-05 at http://pubs.usgs.gov/fs/2009/3030/

12. All tri-halomethane testing results and reports from all water purveyors of drinking water from the Clackamas River for annual comparison of increase

13. The Impacts of Climate Change on Portland's Water Supply: An Investigation of Potential Hydrologic and Management Impacts on the Bull Run System at http://www.tag.washington.edu/papers/papers/PortlandClimateReportFinal.pdf

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A. It is interesting to read of the historical attempts to prevent the degradation of rivers and waters of the state of Oregon with the Oregon State Sanitary Authority in 1938. DEQ tells us "outraged citizens overwhelmingly supported the Water Purification and Prevention of Pollution Bill." This bill was declared a state policy in order to prevent the pollution of the waters of the state. In 1969, the Authority changed its name to the Department of Environmental Quality. You were once part of the health division. Please explain how the Three Basin Rule with its intent to implement the anti-degradation policy does not apply here.

B. The DEQ has its charge…….to protect the waters of the state from pollution. Because it is the duty of DEQ to prevent the pollution of the waters of the state and protect endangered and/or threatened salmonid species and their habitat, it is the DEQ's responsibility to deny this certification and NPDES permit and facilitate the organized dismantling of any dam without 10 foot x 10 foot-pool fish ladders and any water impoundment suffering eutrophication. How long of a eutrophication and turn over cycle does Timothy Lake experience? What other water impoundments in the project experience eutrophication and turn over and how often?

C. DEQ knows full well about how PGE water impoundments cause the gross superheating of Clackamas River water. DEQ knows full well about how the superheating of river water promotes the growth of algae in impoundments and throughout this watershed. DEQ knows anabaena……a variety of algae that when treated with chlorine creates disinfection byproducts…..tri-halomethanes…..in a form highly toxic to the human body, proven toxic to the liver and kidneys and nervous system and fetuses and quite likely the pancreas. Anabaena even travels and grows upstream to infest any superheated stream corridor. Can DEQ explain how this happens?

D. So the mystery continues. Why would a state agency created to prevent the pollution of the waters of the state, facilitate a private corporation's dumping of superheated river water into streams and rivers used for public drinking water supply?

E. These certification and NPDES permit applications should be denied, for another simple reason being, these dams are old. Common sense would dictate that a 45 year extension of operation approval of an already 55 year old dam presents problems. Simply Google 'dam collapses.' Inspections are imperfect. Portland Water Bureau white papers on global climate change advise that the region could/likely experience increases in precipitation volume in shorter periods of time. Has this weather scenario been considered? Has global warming driven climate change been considered at all? What if a "pineapple express" had blown through on top of the 18 inches of snow we received this winter in elevations above

500 feet and as much 4-12 inches snow all over town? Are these aged dams and their earthly foundations strong enough for retaining these “events” today.....or 45 years from now?

F. Are there maps available showing the full impact area in the event of dam failures occurring during a rain on snow event like the region experienced in February of 1996? Where are those maps? Have new impacted property owners been advised of their situation?

G. How often are these aging dams to be re-inspected? How often are downstream embankments, spillways and other conduits inspected for seepage, erosion, boils and piping? How often are dam and impoundments inspected for deteriorated concrete, inoperable gates and corroded outlet pipes? What if structural problems arise? Who will determine if the dam needs to be removed for safety purposes, or will government regulators simply allow the dam to continue operation until it fails? Has the probability of failure of these Clackamas River dams been assessed……or are we still only considering the physical impacts of failure? Will state of the art technology be used to determine earth, dam, channel movement and to alert property owners who could be affected? Without this condition, this 401 Certification and NPDES application should be denied. And what about reparations for property damage as a result of dam collapse? Or will FEMA offer a dime on the dollar to property owners? Why do we continue to allow the little people to pay the price for risky business? We realize disaster compensation is not DEQ’s purview, but someone has to ask.

H. Have studies been done on sediments behind the existing dams to determine if there are any chemical pollutants present? Have PCB’s been identified in water quality testing downstream from dams? What chemicals does the dam operator store at dam and reservoir sites? Historically, joint compounds have commonly been manufactured using PCB’s. Do dam operators use joint compounds in any dam or water conveyance surfaces coming in contact with river water? These studies are needed to assess water quality threats. If they have not been done, this 401 Certification and NPDES permit application should be denied.

I. Will DEQ please explain the sense of the water spraying out of the bottom of the dam at Timothy Lake? What possible reason could this be good for water quality? In the summer, that spray is almost vaporized. What water isn’t vaporized is superheated by the sun. This dam outflow method must stop. Without a plan in place to replace that outflow, this 401 Certification and NPDES application should be denied.

J. Why are we so enamored of PGE that we would allow them to continue to pollute our drinking watershed and contribute to our ill health. What kinds of eutrophication control measures have been attempted in the past? K. What kinds of eutrophication control measures will be required in the future, and when? Have alternatives to dams been considered? Have individual solar or wind installations on all homes been considered? How much has your PGE bill gone up in the past year? Have the right questions been asked? Since you have not given the public adequate notice or time to review the piles and piles of files on this dam issue, the public doesn’t know if the right questions have been asked. Why doesn’t DEQ put an article in the Oregonian relating how DEQ will continue to allow PGE superheated water impoundments to grow organic material that is drawn into drinking water intakes where it is chlorinated and results in the formation of tri-halomethanes that will eventually negatively affect everyone’s health? Let’s do that. Let’s have a regional discussion about this poison in our drinking water. These applications should be denied until such time as appropriate studies have been done showing that these tri-halomethanes are good to breathe and absorb and drink. And then we should have single payer health care before any other re-consideration of these projects to compensate for anabaena/trihalomethane induced health impacts.

L. Does the Clackamas River meet water quality standards for temperature as set forth by the State of Oregon under the Clean Water Act? Is the Clackamas River still on the 303D list for temperature? The plan PGE is offering is unusual…….replacing stream bed gravels. Are there pictures of the sites where this is being considered? Where are the pictures online? How deep is the stream where gravels are proposed to be spread? What size of gravels are they talking about? What is the condition of the areas

proposed for gravels enhancement? Are the proposed gravel enhancement sites areas where gravel mining or erosion from logging has occurred?

M. Was Coffee Labs used for any of the water quality analysis supporting continuing dam operation? Coffee Labs accreditation status has been revoked. Inquire of Dr. Ronning, Laboratory Certification Program, Drinking water Program, Oregon Department of Human Services. We need studies by accredited labs when making 45 year decisions about water quality. Our Health is at stake.

N. The forest service allows commercial timber harvesters to use herbicides on logged lands in preparation for replanting or supposed watershed enhancement projects. What kind of bioaccumulation occurs in the impoundments and in fish and wildlife that are exposed to these chemicals? We know long lasting and extremely toxic chemicals are used in this watershed to eliminate knot weed and Scotch broom. What chemicals will continue to be allowed on public lands in this watershed that could submerge in underwater plumes, or bio-accumulate in the impoundments in question, or in fish and wildlife that live in or might drink impoundment water?

O. What considerations have been made about health issues factoring in what we know about tri-halomethanes and pesticides in the watershed? Has any chemical synergy been observed in drinking water quality studies involving tri-halomethanes and pesticides in combination as we see in Clackamas River water? If studies have not been done, this 401 Certification and NPDES applications should be denied.

P. Did all municipal drinking water purveyors testify on how damming rivers and impounding the water helps water quality? Did they testify on how damming rivers and impounding water harms water quality? If they did not testify, we again request that these applications be denied. Will drinking water purveyors be compensated for expenses incurred in the process of assessing, planning, new equipment purchases or new installations in order to be able to solve the tri-halomethane problem caused by impoundments? Will they be compensated for all the measures necessary today to filter organic material from source water and control slime growth in delivery systems resulting from the anabaena in the water? If these kinds of plans and arrangements have not been made, this 401 Certification and NPDES permit application should be denied.

Q. What consideration has been given to the risks to humans, dams, fisheries, water quality and the risks to the liquefied natural gas pipeline being sought/proposed/heavily financed/promoted through the Clackamas River watershed? How are the watershed, the fisheries, the dams, the impoundments and this interstate liquefied natural gas distribution line and hunting policy going to interact? Could a gas line explosion take out a dam? If no risk assessment for the dams, impoundments, fisheries and this liquefied natural gas line has been done, this 401 Certification and NPDES application should be denied.

R. Water monitoring profiles and schedules need to be based on the evaluation of data collected each August or September after the first heavy rains of fall. Water conditions will most likely degrade over time as a result of climate and land use changes. Why base what is essentially an emergency plan on 40 year old data collected prior to and early in the FERC license period. If annual water monitoring for algae and organic matter in source water and tri-halomethanes in finished drinking water is not a condition of approval, and if this monitoring isn't required in August or September after the first heavy rains of the season, this 401 Certification and NPDES application should be denied.

S. All water collection for water quality monitoring should be done each fall after the first heavy rains of the season. To not monitor at these times is derelict and seems to be an attempt to hide the truth.

T. As per DEQ, "the 401 Certification includes conditions to increase stream flows downstream of project dams, to monitor and control total dissolved gas production at project spillways, to monitor for algal blooms in project reservoirs and to improve fish passage and fish habitat conditions throughout the project. Further, through a separate water quality management implementation plan known as a temperature total daily maximum load, PGE will perform all practical measures to reduce heating in the Clackamas River below River Mill Dam and to support anadromous fish including salmon and trout that

spend all or part of their adult life in salt water and return to freshwater streams and rivers to spawn." Exactly what are "all practical measures?" Do practical measures even exist? These applications should be denied because there is no possibility that the Clackamas Hydroelectric Project under 401 conditions will be consistent with water quality standards.

U. Impoundments, with their high concentrations of phytoplankton, high turbidity and low dissolved oxygen, are not good habitat for macro invertebrates, an integral part of the salmonid food web. Impoundments destroy riverine plants and completely alter the fish food web. Without conditions imposed on the applicant to restore the part of the salmonid food web destroyed by impoundments, this 401 Certification and NPDES application should be denied.

V. Methods of restoring riverine habitat need to be specified. This can't be left up to the whim of the corporate entity. How would diluting and flushing the impoundments effect anabaena growth? How would dredging the organic material out of the impoundments help or hinder?

W. Here it is again. DEQ's own words "What are DEQ's responsibilities? The Oregon Department of Environmental Quality (DEQ) is the regulatory agency that helps protect and preserve Oregon's environment. DEQ is responsible for protecting and enhancing Oregon's water and air quality…….One way DEQ does this is by providing water quality certification for certain activities…...The proposed 401 Certification is consistent with the Clackamas Settlement Agreement dated March, 2006. The conditions relate to water quality monitoring and operation of the hydropower developments. DEQ has concluded, subject to consideration of public comment, that there is reasonable assurance that continued operation of the Clackamas Hydroelectric Project under the 401 conditions will be consistent with water quality standards and other state laws for waters upstream of River Mill Dam." Remarkable statement. These applications should be denied because there is no possibility that the Clackamas Hydroelectric Project under 401 conditions will be consistent with water quality standards. Timothy Lake will continue to spew anabaena laced hot water out over the river corridor. This does not meet federal or state laws for the upper watershed and further degrades water quality in the lower river continuing the spread of anabaena algae. Monitoring will not solve the anabaena problem and only provides a record of the problem. Is DEQ succumbing to weakening water quality standards as the applicant fails to measure up? Is this what you have been reduced to as an agency? We need solutions…..not just monitoring. Without plans to eliminate the anabaena problem, this 401 Certification and NPDES application should be denied.

S. DEQ's own words once again….."Who is affected? People who fish or boat on the Clackamas River and property owners and residents in the vicinity and downstream of the project facilities may be affected." These applications should be denied because DEQ has failed to notify everyone drinking Clackamas River water, that their water will continue to be polluted with tri-halomethanes as long as superheated water impoundments exist.

For the Clackamas River
Carol Witbeck, 15031 S. E. Royer Rd. Damascus

Submitted by Friends of the Clackamas River:

From: Ryan Johnson, *President*
Friends of the Clackamas River
PO Box 1022
Clackamas, OR 97015

To: Department of Environmental Quality
Attention: Avis Newell
Phone: (503)229-6018 or Toll free in Oregon (800) 452-4011
Mailing address: DEQ, Attention: Avis Newell, 2020 SW 4th Avenue, Suite 400, Portland, OR 97201
Fax: 503-229-6018
E-mail: Newell.Avis@deq.state.or.us

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been considered? Have individual solar or wind installations on all homes been considered? Have the right questions been asked? Since you have not given the public adequate notice or time to review the piles and piles of files on this dam issue, the public doesn't know if the right questions have been asked. Why doesn't DEQ put an article in the Oregonian relating how DEQ will continue to allow PGE superheated water impoundments to grow organic material that is drawn into drinking water intakes where it is chlorinated and results in the formation of tri-halomethanes that will eventually negatively affect everyone's health? Let's do that. Let's have a regional discussion about this poison in our drinking water. These applications should be denied until such time as appropriate studies have been done showing that these tri-halomethanes are good to breathe and absorb and drink.

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N. The forest service allows commercial timber harvesters to use herbicides on logged lands in preparation for replanting or supposed watershed enhancement projects. What kind of bioaccumulation occurs in the impoundments and in fish and wildlife that are exposed to these chemicals? We know long lasting and extremely toxic chemicals are used in this watershed to eliminate knot weed and Scotch broom. What chemicals will continue to be allowed on public lands in this watershed that could submerge in underwater plumes, or bio-accumulate in the impoundments in question, or in fish and wildlife that live in or might drink impoundment water?

O. Knowing what we do about tri-halomethanes and pesticides in the watershed, has any chemical synergy been observed in drinking water quality studies involving tri-halomethanes and pesticides in combination as we see in Clackamas River water? If studies have not been done, this 401 Certification and NPDES applications should be denied.

P. Did all municipal drinking water purveyors testify on how damming rivers and impounding the water helps water quality? Did they testify on how damming rivers and impounding water harms water quality? If they did not testify, we again request that these applications be denied. Will drinking water purveyors be compensated for expenses incurred in the process of assessing, planning, new equipment purchases or new installations in order to be able to solve the tri-halomethane problem caused by impoundments? Will they be compensated for all the measures necessary today to filter organic material from source water and control slime growth in delivery systems resulting from the anabaena in the water? If these kinds of plans and arrangements have not been made, this 401 Certification and NPDES permit application should be denied.

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old data collected prior to and early in the FERC license period. If annual water monitoring for algae and organic matter in source water and tri-halomethanes in finished drinking water is not a condition of approval, and if this monitoring isn't required in August or September after the first heavy rains of the season, this 401 Certification and NPDES application should be denied.

S. Friends of the Clackamas River believes that all water collection for water quality monitoring should be done each fall after the first heavy rains of the season. To not monitor at these times is derelict and seems to be an attempt to hide the truth.

T. As per DEQ, "the 401 Certification includes conditions to increase stream flows downstream of project dams, to monitor and control total dissolved gas production at project spillways, to monitor for algal blooms in project reservoirs and to improve fish passage and fish habitat conditions throughout the project. Further, through a separate water quality management implementation plan known as a temperature total daily maximum load, PGE will perform all practical measures to reduce heating in the Clackamas River below River Mill Dam and to support anadromous fish including salmon and trout that spend all or part of their adult life in salt water and return to freshwater streams and rivers to spawn." Exactly what are "all practical measures?" Do practical measures even exist? These applications should be denied because there is no possibility that the Clackamas Hydroelectric Project under 401 conditions will be consistent with water quality standards.

U. Impoundments, with their high concentrations of phytoplankton, high turbidity and low dissolved oxygen, are not good habitat for macro invertebrates, an integral part of the salmonid food web. Impoundments destroy riverine plants and completely alter the fish food web. Without conditions imposed on the applicant to restore the part of the salmonid food web destroyed by impoundments, this 401 Certification and NPDES application should be denied.

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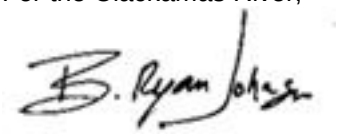
S. These applications should be denied because DEQ has failed to notify everyone drinking Clackamas River water that their water will continue to be polluted with tri-halomethanes as long as superheated water impoundments exist.

Friends of the Clackamas River is made up of citizen volunteers who have given their time in the interest of protecting the Clackamas River Watershed. We requested an extension in time to file our public comments in order to more effectively participate and also allow other members of

public that opportunity. We regret that DEQ denied our request, especially in the light of the length of the license renewal (45 year) and the impacts it will have on our environment.

For the Clackamas River,



Ryan Johnson, *President*
Friends of the Clackamas River
PO Box 1022
Clackamas, OR 97015

Submitted by Scott Forrester:

Ms. Newell,

It appears that there is no information on the impacts of global warming or the effects of Greenhouse Gases within this 401 Cert. process. The effects can be any combination of:
--- higher summer temperatures
--- lower annual precipitation
--- higher wet period precipitation with lower dry period precipitation and potential related increased water temperature and decreased flow
--- change in snowpack and related spring/summer snowmelt change in quantity and timing
--- increased "rain on snow events," like that of the flood on 1996
--- increased heat on inpervious surfaces with higher runoff temperatures
--- increased algae blooms with increased tixins and decreased oxygen for ESA fish and other aquatic life
--- increased incidence of forest fires and resultant water quality impacts
--- increased water demand (withdrawls) from annually projected increase in Metro population that relies on the Clackamas for potable water

Thank you,
Scott Forrester

Submitted by Northwest Forest Conservancy:

4/23/2009

Hi Avis,

On behalf of Northwest Forest Conservancy, I wanted to write about a unique feature of the Upper Clackamas River, Austin Hot Springs. This amazing location sits on 152 acres of private property, straddling the Clackamas River, and surrounded by the Mt Hood National Forest.

Currently the property is closed, but thousands of people trespass on an annual basis and leave behind a significant impact, mainly due to the lack on management. Our organization hosts 2 cleanups per year to collect the nearly 4 tons of trash left behind and helps mitigate the soil compaction and abuse the property receives.

Our partner group, Austin Preservation, has negotiated a purchase agreement to acquire the property for $700,000. We have until the end of the year to conduct our fundraising.

We at Northwest Forest Conservancy feel that the hydro-relicensing process is the perfect opportunity to address the significant needs of this stretch of river. It provides a great opportunity for mitigation and the potential to help lower stream temperatures using & cooling some of the water for recreational use. We

also are proposing using the site as a river access point for white water recreationalists. It would provide safe parking, river access, restrooms, and warm water for soaking and perhaps showers.

I hope that the Austin Property can receive some benefits from the hydro-relicensing process.

Please contact me if you have any questions.

Thank you!

--
Michael Rysavy
Executive Director
Northwest Forest Conservancy
www.nwforests.org
503-860-4705 direct

Help Save Austin Hot Springs!
www.austinhotsprings.org
Restoration, Recreation, Economic Development, & Sustainable Management

Exhibit A. PGE's Clackamas Total Maximum Daily Load Implementation Plan