Water Quality Certifications for Existing Hydropower Dams

Guidance Manual

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Prepared by an inter-program work group chaired by the Watershed Management Section
Water Quality Program
Washington State Department of Ecology
Water Quality Program

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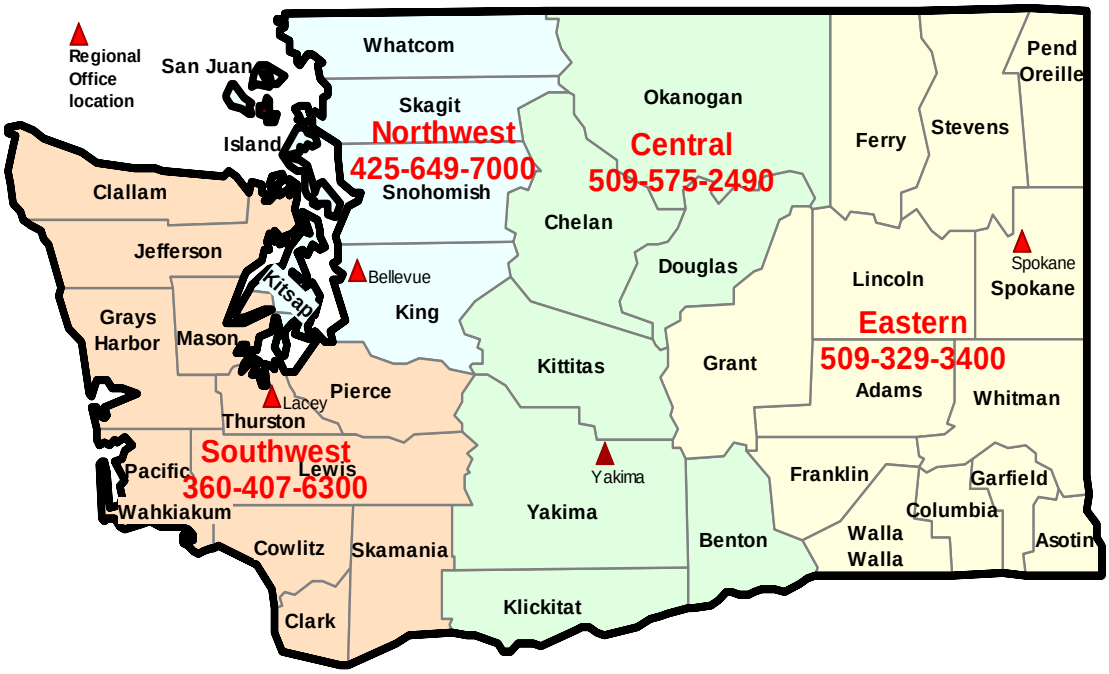

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How to Use This Document

This guidance is intended to help Federal Energy Regulation Commission (FERC) license applicants, tribes, and the public understand and participate in the Department of Ecology's (Ecology) review of hydropower projects. As guidance, it is not intended to limit or restrict agency action or interpretations of law or policy and should not be used or relied upon for that purpose. This guidance is intended to be revised and updated from time to time as need may arise. Chapters and appendices of the guidance are outlined below. This guidance outlines general expectations for writing, issuing, and overseeing Section 401 water quality certifications for existing FERC licenses.

The guidance is designed to use on line so there are a number of web address and links if the reader wants additional information. Ecology expects to update the document as major revisions become necessary.

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Chapter 1
Introduction

Purpose and Overview

The purpose of this guidance is to assist utilities, resource agencies, tribes, other stakeholders, and the public to understand Ecology's roles and responsibilities in the licensing of existing hydroelectric projects. The decision whether to license a project is made by the Federal Energy Regulatory Commission (FERC). However, FERC cannot issue a license until Ecology either waives its authority through inaction or certifies under Section I of the Clean Water Act (401 water quality certification) that the project will meet applicable water quality requirements.

In addition, in the 15 Washington State coastal counties, Ecology has the responsibility to determine that the project will be consistent with the state's federally-approved Coastal Zone Management Program (CZMP). FERC is required to include as license articles any condition that the state carries in its 401 water quality certification or consistency statement.

During re-licensing, the applicant must address many different types of concerns, including natural resources. Concerns about recreation, cultural and historical resources, fish and wildlife resources and many other issues are often dealt with through the FERC licensing process. This process can include negotiation with all parties, direct requests to FERC, or requirements from FERC for additional information. When water quality certification conditions are given to FERC, they automatically become conditions in the new license. Because of this, the process of arriving at water quality certification conditions is necessarily tied to the negotiated FERC licensing process. Nevertheless, Ecology often participates in formal negotiated licensing agreements because water quality is closely related to other issues.

The purpose of a 401 water quality certification is to protect water quality and the beneficial uses of the state's waters as defined under the federal Clean Water Act (CWA) and state water quality standards. The purpose of the Coastal Zone Management Program is to protect the state's coastal zone resources.

As stated above, Ecology's certification conditions become conditions of the federal license. These conditions can be developed apart from FERC's traditional, alternative, or integrated licensing process. Understanding how Ecology makes 401 water quality certification decisions requires understanding: (1) the environmental issues associated with structural modifications and operations of dams, (2) the timing and quality of information needed by Ecology to make informed decisions, and (3) the process by which the agency exercises its authority. This guidance seeks to provide that understanding.

What is Ecology's role in FERC licenses?

Ecology is charged with determining whether federally-licensed hydroelectric projects and their activities will meet applicable water quality and coastal

zone requirements. The conditions in the 401 water quality certification automatically become conditions of the FERC license. The FERC licensing process is designed to ensure that FERC has the information it needs to decide if issuing a license with certain conditions is the best use of the waterway, and if so, what conditions to include in a license. Licenses issued by FERC may be valid for 30 to 50 years. In addition to the conditions for new licenses, 401 water quality certification conditions are used for amendments to licenses for major modifications such as certain construction projects, raising reservoir levels, and adding power generation capabilities.

The water quality certification decisions and coastal zone management consistency determinations can be made mostly outside the FERC licensing process. However, an applicant is required to submit its request for a 401 water quality certification to Ecology no later than 60 days after the FERC issues its ready-for-environmental analysis notice. In practice however, utilities, Ecology, other state, tribal, federal and local resource agencies can benefit from participating in the licensing process. Participation in the licensing process, though time intensive, produces license conditions that are better understood, coordinated, and agreed on by all parties.

If an applicant objects to a 401 water quality certification, resolution is at the state Pollution Control Hearings Board (PCHB) (and subsequently to higher state courts), not FERC. If the applicant disagrees with Ecology's CZM consistency determination, relief may be sought from the Secretary of the Unites States Department of Commerce.

At least one year before the FERC process begins, utilities should meet with Ecology to discuss expectations and begin planning. This allows the environmental issues of concern to be identified. Preliminary meetings also can begin to identify studies that will be used to evaluate whether the project will be meeting water quality standards. Many water quality studies require multiple years of monitoring or measurements during a wide range of hydrologic and climatic conditions.

Enabling the licensing and the 401 water quality certification processes to proceed simultaneously requires both the applicant and Ecology to develop a realistic timeline in coordination with other parties. FERC's regulations require that the applicant submit its 401 water quality certification application no later than 60 days after the FERC issues its Ready for Environmental Analysis notice.
Water quality certifications for FERC hydropower projects generally are issued by Ecology's water quality program following consultation with other Ecology programs and other state agencies to ensure compliance with both the numeric and the narrative criteria of the water quality standards is achieved.

Ecology has several different water programs. Depending on the environmental issues associated with each project, the agency will decide which of these programs will take the lead, coordinate between the programs, and sign the 401 water quality certification.

- The Water Quality Program is responsible for numeric water quality standards and many narrative criteria. It is most often the lead for 401 water quality certifications for hydropower dams.
- The Water Resources Program is responsible for the narrative water quality criterion of flow.
- The Shorelands and Environmental Assistance Program (SEA) is responsible for Shorelands and wetlands issues. This program has the lead responsibility for coastal zone management decisions.
- The Environmental Assessment Program assists other programs in data gathering, technical assessments, engineer review, and modeling.

Ecology's 401 water quality certification decisions are issued under the authority of the Clean Water Act and as administrative orders under RCW 90.48, Washington's Pollution Control Act.

What are Ecology's authorities and legal obligations?
Below is an overview of the *major* statutes that define Ecology's responsibilities in the licensing of hydroelectric projects. Additional laws pertain to specific parameters in Chapter 3, Section 2, such as the Oil and Hazardous Substance Spill Prevention and Response law (RCW 90.56).

To issue a federal license, FERC must comply with the National Environmental Protection Act (NEPA). Ecology will have an opportunity to comment under NEPA, which brings in environmental issues beyond water quality — for instance, air pollution during construction.

The federal **Clean Water Act's** (CWA) major objective is "to restore and maintain the chemical, physical, and biological integrity of the nation's waters." In partial fulfillment of this objective, section 401 of the CWA requires that applicants for a federal permit or license that involves any discharge to the nation's waters request a certification (401 water quality certification) from the state where the discharge originates that the proposed activity will meet applicable state water quality standards and other appropriate requirements of state law. States may use their certification authority to approve or deny the request. Approvals of such requests are nearly always conditional. States may also waive the authority to require a certification although in doing so, they also lose their authority to affect the operation and construction of the project.

In order for a 401 water quality certification to be required two conditions must be met:

- A federal permit or license is required for the activity, and
- The activity involves discharges into navigable waterways.

Pollution at hydroelectric projects include the discharges of water through a power plant, fish passage systems, and the discharge of sediments and other materials to the waterway during construction. This also includes non-point pollution such as changes to water flow and related habitat alterations.

Once a section 401 certification is triggered due to a discharge, the scope of the 401 certification applies to all activities of the project that may affect state water quality standards or any other appropriate requirements of state law. Conditions found in 401 water quality certifications are written to ensure that all numeric and narrative water quality criteria continue to be met throughout the life of the FERC license. Section 401 certifications regularly contain conditions for narrative water quality criteria such as flow conditions to provide suitable habitat for fish.

Washington State's Water Pollution Control Act, 90.48 RCW, gives powers, duties, and functions to administer water pollution control activities within the state. It defines Ecology's water quality protection and enforcement authorities, including the development of water quality standards rules. The goal of the act is to "maintain the highest possible standards to insure the purity of all waters of the state consistent with public health and public enjoyment, the propagation and protection of wild life, birds, game, fish and other aquatic life, and the industrial development of the state. And to that end requires the use of all known available and reasonable methods by industries and others to prevent and control the pollution of the waters of the state of Washington."Section 401 certifications are issued as enforceable orders under RCW 90.48.

Washington State's Water Quality Standards Chapter 173-201A WAC consists of existing and designated uses that must be protected and supported in a particular water body, the numeric and narrative criteria necessary to support such uses, and an antidegradation policy necessary to avoid harm to existing uses. The criterion for each particular water quality parameter associated with hydropower projects is described in Chapter 3, Section 2 of this guidance. Narrative criteria are further specified site by site to protect beneficial uses.

The state is required to update periodically the water quality standards and give them to the Environmental Protection Agency (EPA) for approval. The last updated version was codified in July 2003. However, as of August 2004, the EPA is still reviewing the standards and has not approved them. Until they are approved, 401 certifications and other water quality permitting programs will rely on the earlier 1997 water quality standards, although actual certification conditions will attempt to incorporate both sets of water quality standards. Differences between the two versions of the water quality standards will be noted for each parameter, these are mostly related to the temperature portion of Chapter 3, Section 2.

New language was also added to clarify that a compliance schedule can be used to issue water quality certifications for re-licensing existing dams. In the compliance schedule, dams need to endeavor to meet standards. If standards cannot be met, dams may pursue a site-specific standard or use-attainability analysis (UAA). This language is found under WAC 173A-201A-510:

> Means of implementation

(5) Compliance schedules for dams:

(a) All dams in the state of Washington must comply with the provisions of this chapter.

(b) For dams that cause or contribute to a violation of the water quality standards, the dam owner must develop a water quality attainment plan that provides a detailed strategy for achieving compliance. The plan must include:

(i) A compliance schedule that does not exceed ten years;

(ii) Identification of all reasonable and feasible improvements that could be used to meet standards, or if meeting the standards is not attainable, then to achieve the highest attainable level of improvement;

(iii) Any department-approved gas abatement plan as described in WAC 173-201A-200 (1)(f)(ii);

(iv) Analytical methods that will be used to evaluate all reasonable and feasible improvements;

(v) Water quality monitoring, which will be used by the department to track the progress in achieving compliance with the state water quality standards; and

(vi) Benchmarks and reporting sufficient for the department to track the applicant's progress toward implementing the plan within the designated time period.

(c) The plan must ensure compliance with all applicable water quality criteria, as well as any other requirements established by the department (such as through a total maximum daily load, or TMDL, analysis).

(d) If the department is acting on an application for a water quality certification, the approved water quality attainment plan may be used by the department in its determination that there is reasonable assurance that the dam will not cause or contribute to a violation of the water quality standards.

(e) When evaluating compliance with the plan, the department will allow the use of models and engineering estimates to approximate design success in meeting the standards.

(f) If reasonable progress toward implementing the plan is not occurring in accordance with the designated time frame, the department may declare the project in violation of the water quality standards and any associated water quality certification.

(g) If an applicable water quality standard is not met by the end of the time provided in the attainment plan, or after completion of all reasonable and feasible improvements, the owner must take the following steps:

(i) Evaluate any new reasonable and feasible technologies that have been developed (such as new operational or structural modifications) to achieve compliance with the standards, and develop a new compliance schedule to evaluate and incorporate the new technology;

(ii) After this evaluation, if no new reasonable and feasible improvements have been identified, then propose an alternative to achieve compliance with the standards, such as site specific criteria (WAC 173-201A-430), a use attainability analysis (WAC 173-201A-

440), or a water quality offset (WAC 173-201A-450).

(h) New dams, and any modifications to existing facilities that do not comply with a gas abatement or other pollution control plan established to meet criteria for the water body, must comply with the water quality standards at the time of project completion.

(i) Structural changes made as a part of a department approved gas abatement plan to aid fish passage, described in WAC 173-201A-200 (1)(f)(ii), may result in system performance limitations in meeting water quality criteria for that parameter at other times of the year.

A new section has been added to the rule identifying and providing more detail on tools that can be used for applying criteria and uses. The ones that might pertain to existing hydropower facilities include:

- Site-specific criteria;
- Use-attainability analysis (UAA); and
- Variances
- Water quality offsets.

These tools are briefly described in the appendix and Ecology has a decision tree for selecting water quality standards exception tools.

Site-specific criteria revise the criteria for a pollutant. Site-specific criteria must demonstrate that the local biota are less sensitive to a pollutant then the biota used to establish the national or state criteria. The EPA has general guidance for developing site-specific water quality standards (CH 3.7) that was published in the federal register. This guidance details three methods for developing site-specific criteria. Site-specific criteria must be adopted into state water quality standards. From the time they are adopted, they will remain in effect indefinitely.
Ecology is creating a Use Attainability Guidance to assist Ecology and the public to meet the requirements of this tool. The Use Attainability Guidance provides guidance to persons or groups interested in evaluating the uses of water bodies that are to be protected under Washington's surface water quality standards regulation. An evaluation of uses is termed a "use attainability analysis" (UAA). A UAA is a structured scientific assessment of the factors affecting the attainment of uses designated for protection in the water quality standards. It may include an assessment of physical, chemical, biologic, and economic factors as described in the federal regulations at 40 CFR 131 10(g).

Variances are described in section 420 of the water quality standards.

Water quality offsets are described in the 2003 standards. To date, no one has attempted to qualify for a water quality offset.

The Washington Coastal Zone Management Program

Congress passed the federal Coastal Zone Management Act (CZMA) in 1972 to encourage the appropriate development and protection of the nation's coastal and shoreline resources. The Coastal Zone Management Act gives states the primary role in managing these areas. To assume this role, the state prepares a Coastal Zone Management Program (CZMP) document that describes the state's coastal resources and how these resources are managed.

Hydropower activities and developments affecting coastal resources are evaluated through a process called "federal consistency" with the Coastal Zone Management Program. This process provides the public, local governments, tribes, and state agencies with an opportunity to influence federal actions likely to affect Washington's coastal resources or uses.

A water quality certification is a part of a determination that a project is consistent with the Coastal Zone Management Program and therefore water quality laws. Other activities affecting any land-use, water-use, or natural resource of the coastal zone must also comply with these laws: the State Environmental Policy Act (SEPA), Clean Air Act, and the Shoreline Management Act.

Washington's Coastal Zone Management Program defines the state's coastal zone to include the 15 counties with marine shorelines: Clallam, Grays Harbor, Island, Jefferson, King, Kitsap, Mason, Pacific, Pierce, San Juan, Skagit, Snohomish, Thurston, Wahkiakum, and Whatcom counties. The Coastal Zone Management Program also applies to activities outside these counties that may impact Washington's coastal resources.

Washington Water Code 90.03 RCW

Anyone who wishes to divert or store surface waters must get a water right permit from the state. This is true for hydroelectric projects, even though they don't "consume" water like irrigation or drinking water. Typically, hydroelectric projects return the water to the river after generating with it or only consume the water for a limited stretch of river.

The permit system is based on the doctrine of prior appropriation — or "first in time, first in right." FERC projects may not impair the senior rights held by others.

The need to protect proprietary rights is important to Washington State's stream flow regulations. These regulations are considered water rights for instream flow purposes that are owned by the state. However, if the hydroelectric project has a water right that is senior to the instream flow right, the senior hydropower right is not affected by the regulation (it may be regulated, however, under other authorities like the Clean Water Act and Coastal Zone Management Act).

Water rights information in Washington State can be found at: http://www.ecy.wa.gov/programs/wr/rights/water-right-home.html.

State Environmental Policy Act (SEPA) 43.21C RCW

The State Environmental Policy Act requires all state and local governments within the state to give appropriate decision-making consideration to environmental benefits and values along with economic and technical considerations. In many respects, SEPA is analogous to the National Environmental Policy Act (NEPA).

If a project has a certification only under Section 401 of the Clean Water Act, it does not need SEPA review. However, if any other permit for the project requires compliance with SEPA, such as a shoreline permit, then SEPA must be completed prior to Ecology making a 401 water quality certification decision.

State regulations also specify that when an action requires a permit that is subject to SEPA (e.g., a water right or shoreline permit), then all permits required for that proposal, even those that alone would be exempt, become subject to SEPA. SEPA rules allow the SEPA lead agency to adopt documents prepared as part of a NEPA effort to satisfy the requirements of SEPA (WAC 197-11-610). This may eliminate the need for Ecology or the appropriate lead agency to prepare additional documents or duplicate the efforts of the NEPA preparers, assuming the NEPA documents satisfactorily meet SEPA needs. More information regarding adoption of NEPA or other documents is available in the SEPA Handbook.

The Three FERC Licensing Processes

FERC has three licensing processes: traditional, alternative, or integrated. After July 23, 2005, the integrated process will be the default. Applicants can petition FERC to use one of the other two. As of (2005) most of the new licenses are being pursued under the alternative process. Even the traditional processes are using alternative process steps such as early involvement of interested parties.

Charts and descriptions of the three licensing processes can be found at the FERC hydropower website. The charts are also found in appendix 4 of this document. No matter which process is used, Ecology's interaction with the applicants on 401 water quality certifications needs to contain the same elements:

- Early communication about expectations at least one year prior to Notice of Applicant's Intent to File with FERC for a new license.
- Mutual understanding about resource limitations.
- Clarity of purpose, timing, and quality of data collection and studies.

The FERC licensing schedule for all Washington State dams can be found on Ecology's 401 hydropower web site.

Chapter 2
The 401 Water Quality Certification Application Process for Dam Applicantss and What to Expect from Ecology

Water quality 401 certification conditions become mandatory for the 30 to 50 year life of the FERC licenses. Prior to the formal FERC process, applicants should work with Ecology to determine the scope of Ecology's involvement in their licensing process. Dam applicantss may enter into formal negotiated agreements with a number of parties before, during, and after a water quality certification in the FERC hydro dam re-licensing process. These agreements can have provisions and requirements that relate to water quality certification. Although there are many factors in both the agreements and the certifications, it is important to acknowledge the need for consistency between the agreements and the 401s. It is also important to make sure 401 conditions are consistent with negotiated agreements. Even if Ecology does participate in the negotiation, it will reserve authority to order additional or modified conditions if necessary to comply with state water quality standards or other applicable requirements of state law. If Ecology is not a party to the negotiation process, it will be important for those engaged in the negotiated agreement process to clearly understand how the process will or will not impact 401 conditions. It will also be important to communicate those assumptions to Ecology. Ecology and the Washington Department of Fish and Wildlife will work together after this guidance manual is finished to resolve procedural conflicts between negotiated agreements and 401 water quality certifications. The results will be reflected in an update to this guidance.

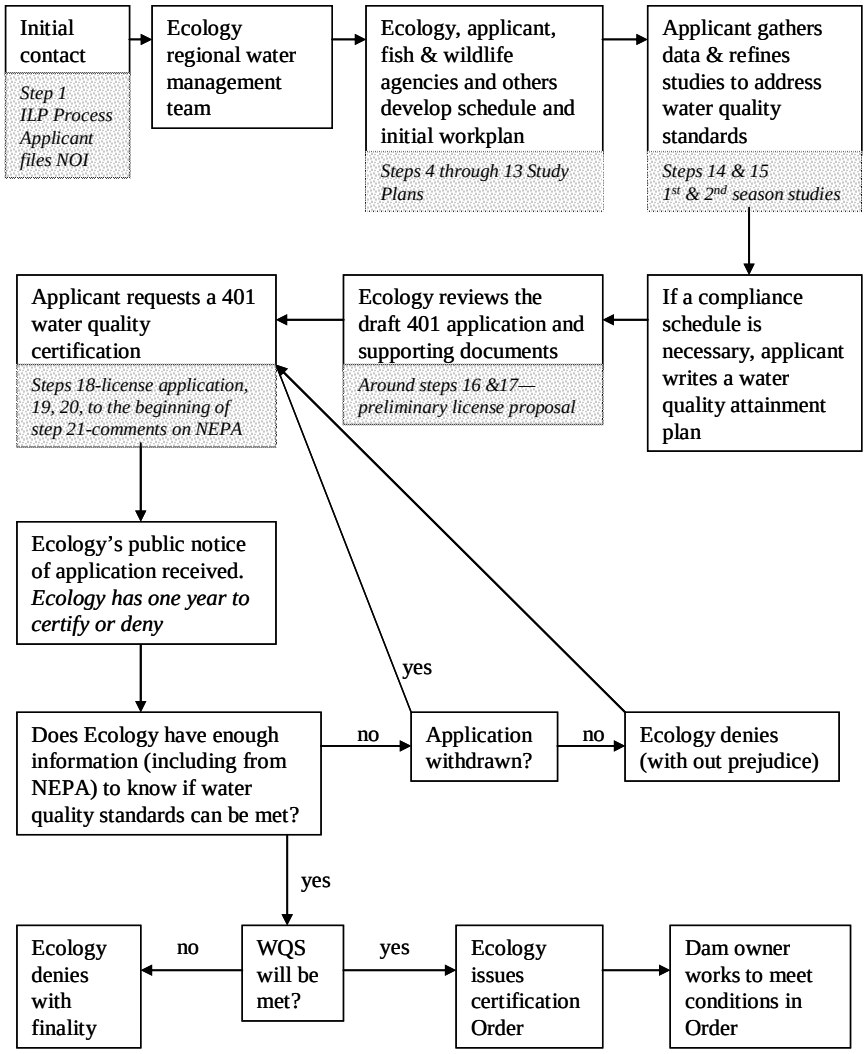
Regardless of which licensing process is undertaken, there is a defined pathway toward assessing hydropower facility's abilities to meet water quality standards. This pathway ensures that Ecology has sufficient and timely quality information, so the agency can make informed and defensible determinations of the applicant's ability to meet water quality standards. These decisions span at least a 30-50 year time frame and have the potential for future significant effects on water quality and beneficial uses protected by Washington's Water Quality Standards. It is typically necessary to obtain federal NEPA review prior to issuing a 401 certification decision. Making a 401 certification decision following receipt of NEPA documents will improve the quality of the certification and improve its defensibility.

There is a high probability that Ecology will not be able to issue a certification during the first year of their certification request. Under federal 401 certification regulations, the state has one year to make 401 decisions once it receives an application. Since these hydropower projects are large and complex, and since Ecology may need the NEPA analysis prior to final issuance of the certification, this may mean Ecology will ask the dam operator to withdraw and reapply. For some dams this can result in withdrawing and reapplying a number of times, depending on the issues and the timing of the NEPA analysis.

When this information is given to Ecology, it becomes available to the public limited to the Public Disclosure Act exemptions (RCW 42.17.310).

Water Quality Certification for Hydropower Facilities: Ecology's Process

FERC's ILP Process



Ecology's 401 water quality certification development and management process:

1. Initial consultation phase
2. Formal consultation phase
3. Submitting the 401 water quality certification application and supporting documents
4. What to expect in a 401 water quality certification
5. After receiving a 401 water quality certification

1. Initial consultation phase

Regional directors can help applicants identify the appropriate staff contact who will be working on their certification. Prior to formal licensing activities, Ecology's regional water management teams will evaluate their region's schedule of dams coming up for re-licensing requiring 401 water quality certification. They will have developed a proposed work plan, assuming existing program resources, for how the region and the agency will manage each of the relicensing processes identified on the schedule. Allocation of resources will need to take into account the following factors:

- Expectations for Ecology to participate in settlement negotiations. If Ecology can not participate, then a discussion regarding the relationship of the settlement agreement to the 401 certification needs to occur.
- Types and complexities of water issues expected.
- Usefulness and quality of existing data.
- Known environmental issues and associated legal, policy, and technical decisions likely to be needed.
- How the parties will address the relationship of negotiated agreements and 401 water quality certification conditions.

Based on the issues, an Ecology team will be identified to manage the work. The team will include a principal decision maker and responsible official to sign the 401 water quality certification. Ecology estimates will be based on its capacity to manage the workload within existing resources. These estimates will include staffing for post-licensing follow-up.

When an applicant provides Ecology with a copy of the Notice of Intent (NOI) and *either* a Pre-Application Document (PAD) or an Initial Information Package (IIP), Water Quality Program's 401 Hydropower Certification Coordinator will notify the appropriate Ecology regional director that the licensing proceeding is underway (or about to begin, whichever the case may be).

However, there is nothing that prohibits applicants from beginning consultation earlier than required by FERC. In practice, Ecology encourages applicants to make their initial contact prior to filing a notice of intent. Once an applicant files its notice of intent, then the applicant must adhere to FERC consultation requirements.

Due to resource limitations, Ecology and utilities should work together to establish efficient meeting locations and times. They should also discuss steps that could allow Ecology staff to participate more actively.

Permits issued by Ecology usually have a funding mechanism to pay for state time and resources. The fees are paid by the applicant. Water quality certifications for hydropower in Washington State do not have a fee mechanism. If staff resources are lacking for Ecology's participation in the water quality certification or licensing process, the applicant can explore funding Ecology staff through interagency agreements (RCW 39.34) or cost reimbursement agreements for personal services contracts (RCW 39.29).

The applicant should develop a draft initial work plan in consultation with Ecology for 401 water quality certification issues. This initial work plan should incorporate:

- Ecology's timing needs for information and studies
- Type and quality of information expected—reports
- Scope of studies
- Reassessment opportunities of the data gathering strategy

The initial consultation phase provides Ecology an opportunity to articulate its expectations, roles, and responsibilities with the applicant.

2. Formal consultation phase

The integrated process is FERC's default process (as of July 23, 2005). The applicant is required to use this process unless the applicant requests use of the traditional or alternative licensing process. Both the traditional and alternative licensing processes are optional and contingent upon approval by FERC. FERC will seek comments on the applicant's request to use either a traditional or alternative process from all parties, including Ecology. When commenting on the applicant's request to use the alternative or traditional process, Ecology needs to consider whether it has the staff resources to collaborate effectively.

Detailed information and diagrams about all three FERC licensing processes can be found at FERC's website. Information gathering tasks are detailed more thoroughly in Chapter 3, Section 2, but at a minimum, these tasks need to be done prior to requesting 401 water quality certification:

- Create a detailed schedule for gathering data.
- Create initial study objectives for each water quality parameter.
- Create initial study objectives for all existing and designated uses.
- Create quality assurance plans for each study.
- Study the project's water quality impact of structures, operations, and activities associated with the project.

- Develop a water quality attainment plan and a compliance schedule for those water quality parameters that don't meet water quality standards.
- Make commitments to assess new information to improve water quality.
- Send to Ecology for review all the materials (401 certification studies, analyses, reports, etc.,) that will be used to back up any assertions that water quality standards will be met.

Coastal Zone Management Activities (CZMA)

An applicant for a FERC license whose project is within one or more of the 15 coastal zone counties must submit to Ecology a Coastal Zone Management Program (CZMP) consistency determination statement. The applicant may choose to do this when requesting a water quality certification along with a statement that the utility believes water quality standards are being met.

With a request for a determination, the applicant must provide specific information: a detailed description of the proposed activity and its associated facilities that assesses the probable effects and employs maps, diagrams, and data when appropriate; and a brief appraisal of the probable effects of the proposal with a short set of findings indicating that the project, its associated facilities and their effects are all consistent with the state coastal management program's enforceable policies.

It also must contain: an application for a 401 water quality certification (or an approved water quality certification), shoreline permit (if needed), variance, or exemption (if needed); evidence of compliance with the Washington State Environmental Policy Act (if needed); and evidence of compliance with the other applicable enforceable policies of the CZMP (if needed). Ecology will not approve a coastal zone management consistency determination without a water quality certification.

No license will be granted by FERC until Ecology has made a consistency determination. If Ecology fails to act within six months of receiving a complete request for a consistency determination, including all necessary data and information, then Ecology's concurrence shall be presumed. If Ecology denies consistency or finds consistency, but imposes conditions on the project, under the provisions of the CZMA, the applicant can appeal Ecology's decision to the Secretary of the U.S. Department of Commerce. If the Secretary of Commerce overrides Ecology's decision, the federal agency can approve the license or permit. However, federal agencies are not required to approve applications with which the state has concurred.

For more information regarding Washington's Coastal Zone Management Program, refer to *Managing Washington's Coastline - Washington State's Coastal Zone Management Program.*

3. Submitting the 401 water quality certification application and supporting documents

During the integrated licensing process, the applicant must file a water quality certification within 60 days after FERC has issued its ready for environmental Analysis At least one-and- one-half years before the 401 water quality application is due, Ecology encourages the applicant to let us review and comment on study and other information that will be needed for Ecology to make a 401 water quality certification decision.

Upon receipt of a request for 401 water quality certification the state has one year to make a decision whether to accept of deny the application. If the information supporting this decision is insufficient or relevant investigations are incomplete, Ecology may deny the application without prejudice. The applicant may then resubmit the application with additional information.

Ecology asks that the request is made in the form of a completed Existing Hydropower Water Quality Certification Application Form. This form should be sent to:

Water Quality Hydropower Certification Coordinator
Water Quality Program
Department of Ecology
P.O. Box 47600
Olympia, WA 98501

The major reason for the Existing Hydropower Water Quality Certification Application Form is to streamline Ecology's process. It will identify the application as a 401 certification and start the one-year clock.

Because the one-year deadline is important, Ecology should formally acknowledge the receipt of the 401 water quality certification request in the form of a certified letter to the applicant and clearly identify the action deadline. If Ecology finds the information lacking, it can deny the 401 water quality certification. If the one-year deadline is approaching and the applicant has yet to submit sufficient information to support its request or Ecology's analysis of the project impacts is not completed, Ecology will make this known to the applicant who may decide to withdraw the request for a 401 water quality certification and reapply. If the applicant decides not to withdraw, Ecology is put into a position of denying the project. Many existing hydropower projects withdraw and reapply for their 401 certification a number of times, since the development of the conditions can frequently take longer than a year.

Ecology does not plan to waive its 401 water quality certification authority through the failure to meet the one-year deadline to issue a water quality certification decision. Ecology plans to never waive its authority if it has substantial environmental concerns.

A timing problem occurs when the one-year timeline between receiving an application and issuing a water quality certification ends prior to FERC's completion of its NEPA process. Ecology relies on the NEPA evaluations of

water quality, aquatic resources, and alternatives for certification as well as for Coastal Zone Management decisions. NEPA documents frequently provide valuable and objective scientific analysis on compliance with water quality standards. Especially information on project effects on designated uses. Ecology may ask the applicant to withdraw and reapply, or deny the application without prejudice to being re-filed, so that the NEPA document can be adopted and consulted as Ecology makes 401 decisions.

Ecology staff and the applicant should make a special effort early on in the licensing process to coordinate on available information. Ecology will make efforts to come to the commission's scoping meeting in the project area, or meet with applicants, during the alternative or traditional licensing process. This way the certification may be issued or amended shortly after the completion of the NEPA document unless major new information that affects the water quality decision is found in the NEPA documents or other studies or analysis.

The signatory of the 401 water quality certification will usually be a regional section manager in the lead program, either Water Quality, Water Resources, or Shoreline Environmental Assistance program.

An applicant for a FERC license must submit a request for certification. The following information will be needed:

- A completed Existing Hydropower Water Quality Certification Application Form.
- Water quality attainment plans and compliance schedules for those water quality parameters not meeting numeric and narrative criteria.
- Water quality management plans to keep within water quality standards (such as oil containment plans).
- Water quality assessments for all water quality parameters.
- Supporting documentation including biological and engineering studies, modeling, quality assurance, compliance schedules, funding commitments, and economic analyses showing how the dam will comply with water quality standards. (Reference information in FERC filings.)
- Final prevention plans for those water quality standards that have the potential to be exceeded in the future (e.g., oil spills, future construction).

The State of Washington will seek to work with other states to ensure that waters entering the State from FERC projects outside the State's jurisdiction meet Washington State water quality standards.

The state will strive to meet downstream state and tribal water quality standards. The applicant will include interested jurisdictions in the licensing process through the FERC service list. Ecology will notify other water quality standards jurisdictions whose waters will be affected and provide the

opportunity for government to government meetings to work toward achieving all water quality standards and discuss water quality certification conditions. The federal Environmental Protection Agency (EPA) is responsible for:

- Certifying projects where water quality standards have been established for a tribe, but the tribe does not have authority for certifying under section 401, and where the project or its effects are within tribal jurisdiction.
- Reviewing 401 water quality certifications for potential impacts to tribes, other states, and British Columbia and providing a hearing to resolve conflicts.

Public participation is required. Public notice of receipt of a hydropower water quality certification application is provided by Ecology. See WAC 173-225. Written comments are taken for a period of 20 days. Ecology will consider a longer comment period if asked. In order to encourage public participation, Ecology:

- Will notify interested parties through parties found in the FERC service list parties as well as any others deemed appropriate.
- May ask the applicant to publish a legal notice in a local newspaper.
- Will mail a copy of the application to any tribe who asks.

Additional up-front public participation can create more defensible water quality certifications. If possible, the largest part of this public participation should occur in the years prior to sending an application to Ecology for a water quality certification.

After an application is received, Ecology develops draft certification conditions. This will involve informational discussions with the applicant and the public. Ecology thinks transparent decision making is important for these large existing hydropower projects that have licenses for 30-50 years. During this time, Ecology will strive for consistency between federal and state requirements and timelines.

The 401 certification may be appealed. The appeal must be filed with the Pollution Control Hearings Board, P.O. Box 40903, Olympia, Washington 98504-0903 within thirty (30) days of your receipt of this Order. At the same time, the appeal must also be sent to the appropriate regional office of the Department of Ecology. The appeal alone will not stay the effectiveness of the certification. Stay requests must be submitted in accordance with RCW 43.21B.320. These procedures are consistent with Chapter 43.21B RCW.

4. *What to expect in a 401 certification*

Cover letter

The cover letter of the 401 certification is addressed to the project proponent, identifies the project name with its FERC identification number, and provides Ecology's administrative order number. It also includes the appropriate Ecology contact name (generally the project manager) and

telephone number. This letter may also reference the Coastal Zone Management determination requirements, if appropriate.

The letter is signed by the 401 responsible official at Ecology. At this time, the responsible official and signatory for 401 certifications for FERC projects is a section manager in the region in which the project is located.

Administrative Order

Each Ecology 401 certification is issued as an administrative order under RCW 90.48. This makes the conditions of the 401 certification enforceable under state law, as well as incorporated into the FERC license pursuant to the Clean Water Act.

The order identifies the project proponent, the docket number, reference to the FERC project number, the project name, and the project's location. The order also identifies the appropriate legal authorities under which the order is issued. The order describes the penalties associated with noncompliance with the order and the procedure by which the order may be appealed.

The State maintains its authority to enforce conditions in the administrative order throughout the licensing period although Ecology generally relies on FERC's authority and oversight to enforce conditions. Should the State ever consider enforcement, Ecology will first pursue coordination with federal license conditions.

The order may include a short description of the project, including location (river and/or lake), description of structures associated with the project (e.g., dam, penstock, powerhouse), size of dam, and megawatts genera**All certifications will contain:**

Specific requirements for water quality parameters

These fall into two categories.

1. Fixing known water quality problems that cause the facility to exceed water quality standards. These may be structural improvements to the dam, habitat improvements, or operational adjustments to meet narrative criteria and numeric water quality standards.

   These steps usually will be identified and discussed with interested parties well before the applicant formally requests certification from Ecology. Water quality certifications

2. Preventative measures to ensure water quality standards will not be violated in the future. Certain operations and construction activities are known to pose risks to water quality. Pollution prevention plans are requirements in all 401 certifications. They include spill prevention plans and best management plans for construction.

The final language in the water quality certification must be clear with firm dates when specific improvements activities must take place. A decision tree, time graph, or matrix can be helpful to include.

Water quality monitoring and reporting

Water quality monitoring is used to track compliance with the conditions of the 401 certification, progress toward meeting water quality standards, and track environmental conditions so appropriate steps can be taken in response to problem conditions. Monitoring requirements in a certification identify the parameters to be monitored, including specifics attributes such as location and frequency. They may also refer to a monitoring plan in which sampling methods, locations, etc., are described.

The 401 certification conditions also describe the content and frequency of the data reports to be submitted to Ecology.

General conditions

Certifications will contain specific conditions with reference to the water quality improvement goals that are to be achieved. However, certain general conditions will be necessary.

- The certification provides a specific prohibition against violation of water quality standards.
- Access shall be granted for inspections.
- Conditions are subject to changes in relevant state or federal laws that reflect better understanding of how to protect beneficial uses.
- Conditions are subject to changes based on new information as may be necessary to meet water quality standards, TMDLs, and other applicable requirements of state law.

Specific water quality certification conditions can be found on Ecology's Existing 401 certification for Dams website. In addition, we are considering developing a directory for existing licenses, so the reader can more easily find water quality certification conditions pertaining to aesthetics, recreation, etc.

5. After receiving a 401 certification

After the 401 certification has been issued, the 401 certification is subject to appeal by the applicant or another party.

Once FERC does issue the license, Ecology staff will (as resources allow) be expected to play a continuing role in managing the project. Staff will be expected to review post-licensing studies, participate in reviewing progress of compliance schedules, compliance with the conditions contained in the 401 certification, and if the conditions are not met, to take appropriate action. Enforcement actions available to Ecology are clearly outlined in Washington State's water pollution law, RCW 90.48. Ecology will rely on FERC to enforce water quality conditions in the license. If FERC fails to do so, or if the water quality conditions have not yet been incorporated into the new license, Ecology will take enforcement action under state ;authority if deemed necessary.

After the applicant has received a 401 certification, they will need to provide Ecology information required by 401 certification conditions. Ecology's 401 conditions will generally include:

- Notification of specific activities.
- Ongoing monitoring.
- Targeted monitoring for areas of water quality concern where water quality compliance schedules are in effect.
- Study plans and reports for water quality parameters not meeting standards.
- Implementation activity evaluations.
- Continued planning to adjust monitoring to obtain needed water quality information.
- Continued evaluations and adjustments to implementation activities.

Chapter 3, Section 1
Information Requirements for 401 Certification Decisions

Ecology can decide to certify a hydropower facility only if there is "reasonable assurance" that a project can meet the state's water quality standards. If the applicant works with Ecology to define adequate study objectives, data quality, study designs, and analyses, Ecology will be more likely to end up with the necessary information at the right time needed to make defensible decisions.

Assessing water quality through collection and analysis of environmental data follows a set of fundamental principles that apply equally to the 401 certification process for FERC hydropower licensing as to any other environmental study. Although every dam is unique and every water quality parameter is unique, every activity to gather and assess information must satisfy five key requirements:

1. Water quality assessments that answer the appropriate questions.
2. Existing and designated use study
3. Correct information collecting methods.
4. Acceptable data quality assurance methods.
5. Schedules so deadlines (such as license renewal dates) can be met.

Utilities may use this section to work with Ecology to perform the necessary and appropriate information gathering activities.

1. Water quality assessments

Assessments include the following components:

Initial assessment entails a review of all existing data for all relevant parameters and should answer several questions for each parameter:

- What is the quality of the data, analyses, and other information?
- What do we not know about compliance with the standards?
- What is the uncertainty of what we know?
- What studies are needed to eliminate information gaps and reduce uncertainty?

Follow-up assessments to determine ability to meet water quality standards will be a series of studies, monitoring efforts, and analyses, probably conducted over several years for all potential water quality issues. These issues can be identified upon discussion with the lead Ecology staff assigned to the project. Section two of the chapter gives an indication of the types of water quality issues that may arise. Most facilities will need to look at temperature, flow, pH, dissolved oxygen, turbidity, and gas supersaturation and support for existing and designated uses; other parameters and

standards to be examined will be specific to each facility. As studies are completed and information evaluated, parameters and existing and designated uses will begin to sort themselves into those that meet water quality standards and those that either presently do not or may not in the future.

For each parameter, Ecology must decide whether sufficient information is available to certify compliance with the standards. Therefore, it is in the best interest of the applicant to collect adequate data to allow certification. Ecology must have reasonable assurance that standards will be met, but additional research may be needed to reduce uncertainty and refine implementation measures. Post-certification continuing research may be included in a compliance schedule, if needed. Post-certification ongoing monitoring and reporting may be required.

Impact assessments**,** for the parameters that are not meeting standards, quantify the impact on water quality of structural changes, operations, and other activities associated with the project being licensed.

Identification of implementation measures evaluates the potential success of various alternatives to protect and improve water quality and fix water quality problems. The identification should include the following specific steps:

- Identify potential solutions.
- Evaluate costs.
- Assess environmental effects.
- Prioritize based on cost-effectiveness.
- Develop an implementation schedule (also termed a compliance schedule).

Implementation assessment will evaluate the long-term success of actions for protecting and improving water quality. This will include establishing performance measures that will be assessed over the life of the license, with appropriate actions identified if the targets and compliance schedules established as the basis for the certification aren't met. The assessment should address the following:

- How successful are the compliance actions in achieving standards?
- Are compliance actions meeting specific targets set for management of the actions?
- How can the compliance actions be improved to increase compliance with standards?
- What is the quality of the data, analyses, and other information?

2. Existing and designated use study

An important part of each 401 certification is a determination that the proposal will protect and support existing and designated beneficial uses of

the water body in question. Correspondingly, the application should provide Ecology with a study that identifies the existing and designated beneficial uses, and the historic impacts of the project on them (if the project is being relicensed), and the anticipated future impacts of the proposal on them. The principal uses that are most often impacted are fish and recreation. Recreation includes fishing, boating, swimming and aesthetics. It should examine not only uses that do not currently exist, but also uses that would be available without the project impacts.

3. Correct information collecting methods and models

There are a number of tools available to gather information on compliance with water quality standards. They can be roughly categorized as:

- Monitoring
- Statistical analysis
- Modeling

4. Quality assurance - quality control

It is critical that Ecology use high quality information in the 401 certification. Both EPA and FERC are required by federal law to ensure data quality. EPA uses *Quality System for Environmental Data and Technology* while FERC has its own "Information Quality Guidelines." Ecology Executive Policy 1-21 states that "A Quality Assurance Project Plan is prepared for each environmental study/activity that acquires or uses environmental measurement data." Ecology's Quality Management Plan provides detailed procedures and responsibilities for implementing that policy.

According to Ecology's "Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies," data quality assurance includes:

- An organizational Quality Assurance Policy and Quality Management Plan.
- Staff training in the principles and practices of Data Quality Assurance.
- Preparation and use of Quality Assurance Project Plans.
- Preparation and use of Standard Operating Procedures.
- Use of appropriate Quality Control Procedures.
- Review, verification, and validation of data.
- Assessment to determine whether the data support the project objectives.
- Quality improvement through audits of systems and performance.
- Use of environmental laboratories accredited by Ecology.

Applicants should be able to demonstrate that either their organization or their consultant is performing these data quality assurance elements. These

elements are described in detail in Ecology and EPA guidance on data quality assurance.

5. Scheduling

Scheduling studies needed to provide the correct information has to be anticipated well in advance of when the information is needed.

The applicant should develop a study plan for each phase of assessment. Each parameter is likely to have a critical period, based on river flows and temperatures, watershed conditions, and dam operations. Therefore, for each parameter, a critical monitoring season should be identified, and then a reasonable amount of time set aside by the applicant prior to monitoring for development and review of the quality assurance plan. The time allotted should take into account several rounds of review, which may include meetings and third party review. Contracts for monitoring should be let far enough ahead to allow for this work, rather than immediately before the monitoring season. These concerns should also be discussed at scooping and study plan meetings when possible in coordination with the FERC licensing process.

Review and release of study reports should be planned to allow time for the follow-up work that has been identified through the study. Time should also be allowed to account for unexpected results or the emergence of new issues. On an annual cycle, each report should identify monitoring needs and funding for the next round of studies.

Over the life of the expected new license, a schedule should account for water quality monitoring and studies. This is necessary to continue to assess conditions, especially as efforts are made to correct water quality problems.

Total daily maximum load (TMDL) or Water Cleanup Plan

If total daily maximum load (TMDL) allocation of pollutants to a hydropower facility can provide information that helps make these water quality certification decisions, Ecology will use them. Total maximum daily loads are not separate enforceable requirements, but are used as a tool to make regulatory decisions. They are especially useful to allocate pollutants between sources in waters where there are multiple sources of pollutants. Ecology does not require a TMDL to be finished in order make water quality certification decisions.

Ecology undertakes TMDLs on a watershed basis, using a five-step, five-year process for assessing water quality conditions through TMDLs, focusing staff effort, and support water protection activities on a geographic basis. The state of Washington has been divided into 23 water quality management areas (WQMAs). Each of these areas is on a rotating five-year cycle for TMDLs:

Year 1	Scoping
Year 2 & 3	Data collection and analysis
Year 4	Technical report

Year 5 Implementation

A TMDL may be useful to the applicants by allocating the portion of the pollution that is the responsibility of applicants where there is more than one source. If a TMDL study has not been undertaken and if an applicant needs to speed up a TMDL in order to meet the licensing deadlines, there are two options:

- Work with the appropriate Ecology water quality section manager to reprioritize their TMDL schedule in order to accomplish a TMDL before the water quality certification application is due.
- Fund a TMDL study in order to meet their timeline.

Applicants will not be expected to determine impacts from activities beyond their control. However, applicants will be expected to determine their contribution to the pollution.

Chapter 3, Section 2
Water Quality Standards

The purpose of this section of the guidance is to acquaint applicants and other stakeholders with how each water quality parameter and existing and designated uses may be affected by hydropower dams, monitoring considerations, and potential improvement actions.

The parameters in this section are the pollutants most likely to be of concern for hydropower facilities in terms of dam impacts to water quality. This list is supposed to be useful, but is not inclusive. Not all parameters, considerations, or possible impacts will apply to each project.

Washington State's water quality standards provide protection in several different ways:

- Numeric standards are regulatory thresholds for water quality parameters specifically listed in water quality standards. An example of a numeric standard is the 110 percent total dissolved gas criteria. The common numeric criteria associated with hydropower facilities are grouped together in the first half of this section.

- Narrative criteria rely on the analysis of impacts to uses such as fishing, aquatic organisms, boating, swimming, and aesthetics. Narrative criteria are implemented on a case-by-case basis to protect water quality and beneficial uses from the effects of water pollution.

Narrative criteria are used where numeric standards are not sufficient to protect a sensitive beneficial use.

- Use protection is the bottom line of the standards. Even if numeric criteria are attained, if studies show the beneficial uses in the water body are being harmed by the activities to be permitted,, the narrative criteria may be invoked to further restrict the activities.

  Uses designated in the water quality standards must be protected unless a formal process called a use attainability analysis (UAA), is conducted on the water body in question to show the use(s) do not exist or are not attainable.

- The antidegradation policy in the water quality standards protects beneficial uses by providing a three-tiered system of protection:

  - Tier I, protection and maintenance of existing and designated uses. *The Tier I criterion will apply to existing dams.*
  - Tier II, protection of waters of higher quality than the standards. *Tier II generally will not apply to relicensing except for expansion projects that alter the characteristics of the water body. Tier II criteria would apply to new dams.*
  - Tier III, protection of outstanding resource waters. *These are pristine waters where no pollution is allowed. A public process is used to assign waters to Tier III. No water bodies in Washington presently exist in this category.*

- Natural conditions are defined as “surface water quality that was present before any human caused pollution.” Pollution is broadly defined to include most kinds of activities that harm beneficial uses. The standards provide a general condition that if natural conditions cannot meet the assigned criteria, natural conditions become the assigned criteria. Some parameters specify criteria for incremental changes from natural conditions.

- Reservoirs with a mean detention time of greater than 15 days are considered as lakes under the water quality standards. The water quality standards for lakes are often based on maintaining natural conditions, but the fact is the dam and the “lake” behind it are not natural. This means that Ecology cannot simply assume any impact to water quality above or downstream of the dam and its lake is natural. To address this situation the certification should focus on meeting the water quality criteria downstream of the dam, and achieving the highest attainable water quality condition within the reservoir**.** This goal is most consistent with the water quality standards and the state’s water pollution control laws. This is because achieving the highest attainable quality in a reservoir is essentially the same as maintaining a natural lake in its highest natural state of quality. It is important to recognize, however, that since the reservoir is not natural the discharge from the reservoir will not be considered a natural

condition and thus may not cause or contribute to an excursion from the downstream water quality standards. The highest attainable water quality condition will be determined as part of a water quality attainment plan established under a formal compliance schedule as part of issuing any certification.

Descriptions for each water quality parameter follow, and include:

- Background
- Water quality standard
- Possible causes of impairment
- Monitoring considerations
- Protection and improvement actions

Total Dissolved Gas (TDG)

TDG is the amount of air (composed of several gasses—78% nitrogen, 20% oxygen, 1% argon and 0.3% carbon dioxide) held in saturation in the water. Criteria in the standards are in terms of percent of saturation pressure relative to ambient barometric pressure. TDG can also be expressed in units of pressure. TDG has been a major water quality issue for many dams.

Background

Fish and other gill breathers can be harmed by water supersaturated with dissolved nitrogen. Fish in this water may not display signs of difficulty if the higher water pressures at depth offset high TDG pressure passing through the gills into the blood stream. However, if the fish inhabit supersaturated water for extended periods, or rise in the water column to a lower water pressure at shallower depths, nitrogen may come out of solution within the fish, forming bubbles in their body tissues. This gives rise to gas bubble disease, which can be lethal at high levels, or give rise to chronic impairment at lower levels. Air bubbles also form on the outside, and for invertebrate insects can cause death by lifting them off the bottom and exposing them to predation and changed habitat.

Several phenomena can increase TDG levels. Water plunging into a deep pool with entrained air bubbles, such as below a dam spillway or natural waterfall, can rapidly increase TDG levels. Bubbles introduced into the high pressure zones around a hydropower turbine can have a similar effect.

The response of organisms to elevated TDG levels depends on species and life stage. Adult salmon are relatively resistant to high TDG, perhaps due to their mobility and physiological factors. Shallow dwelling, territorial fish (such as some species of sucker), have been found to be more sensitive to TDG.

Water quality standard

Total dissolved gas measurements shall not exceed 110 percent at any point of measurement. Water quality standards for TDG do not apply during natural flood conditions. This is a calculated flow defined as the highest flood

that occurs for seven consecutive days in a ten-year period, the 7Q-10. Ecology has directions for how to determine 7Q-10 for high flows.

On the Columbia and Snake rivers, there is an exception to the 110 percent TDG standard to allow for passage of juvenile fish downstream over the dams rather than through the turbines. On these rivers, the standard is not to exceed 125 percent TDG as a one-hour average; not to exceed 120 percent TDG in the tailrace; and not to exceed 115 percent TDG in the forebay of the next dam downstream as measured as an average of the 12 highest consecutive hourly readings in any one day (24-hour period). This exception is based on a risk analysis study conducted by the National Oceanic and Atmospheric Administration (NOAA) fisheries. The study weighed the benefits of spilling water to assist juvenile salmon avoid turbine mortalities against the mortalities of fish exposed to harmful levels of dissolved gas. In order to receive this exemption, a gas abatement plan developed by the applicant must be approved by Ecology. The plans include compliance schedules that are to be used in 401 water quality certification conditions.

Possible causes of impairment

- Spill over the dam pushes air deep into a plunge pool where, under pressure, the air is forced into solution.
- Air is injected into the turbines during power up or power down (ramping) to avoid/reduce cavitation at the turbine blades. These usually small amounts of supersaturated gas can remain for long periods of times if found in slow moving water below the dam.
- Air injection to spin the turbines with no water and no power generation. The wicket gates are closed, but water leaks into the turbine area where air is being injected. Under the head water above the dam, this air is pressurized, and leaking wicket gate water is gassed and collects in the draft tubes.
- Passive entry of air from ventilation during powering up or powering down turbines.
- Other operations, such as continuous fish bypass spills and opening trash sluiceways.

Monitoring considerations

- Violent hydraulics below a dam create safety hazards.
- Entrainment of turbine water into high volume bubbles of surface spill.
- Spill and turbine waters often travel great distances downstream with little mixing.
- Gradual mixing and dilution with turbine waters downstream.
- Gradual to rapid degassing downstream depending on river hydraulics and bathymetry.

- Rapid effervescence (degassing) in the aerated zone below the dam. Below this zone, degassing depends on the water depth and velocity and wind speed.
- Under most conditions a dam's spill reaches a new equilibrium independent of upstream conditions as it spills and plunges.
- Typically, water passes through the hydro turbines unchanged from upstream conditions.

Refer to the USGS Monitoring Protocol for initial data gathering to characterize conditions, transect data gathering if a problem is found, and permanent monitors for long-term data collection.

Protection and improvement actions

Refer to the US Army Corps of Engineers' work on the Columbia and Snake rivers for examples of methods to reduce gas super-saturation through operational and structural improvements.

Dissolved Gas Abatement: Technical Report US Corps of Engineers, Portland District 1996
Dissolved Gas Abatement Studies, Phase II, Volumes I and II. US Corps of Engineers, Portland District

Temperature

Water temperature is usually measured in degrees Celsius, using either a liquid thermometer or an electronic thermistor. Both narrative criteria and numeric standards are discussed here. Temperature has been a major issue for storage reservoirs as well as an issue of concern for many run-of- river dams.

Background

Water temperatures can have significant effects on the health, distribution, and abundance of fish, amphibians, aquatic insects, other benthic organisms, and aquatic plants. Bull trout, salmon, and steelhead are examples of well known native species adapted to cool temperature regimes.

Many native frogs and salamanders require temperatures similar to those needed by salmon and trout. Bull trout require temperatures several degrees lower than optimum for salmon and trout. Many benthic macroinvertebrates, an important source of food for fish and an indicator of overall stream health, also require cool water to thrive. High water temperatures can help trigger algal blooms, excessive growth of aquatic macrophytes, and fish diseases. Sudden changes in water temperature, as well as unnaturally cool waters, can also harm aquatic organisms. (See also Aquatic Plants, Trophic Status, and Flow.)

Water quality standard

Washington's *numeric* criteria for temperature are designed to protect the most sensitive beneficial uses of a particular river or stream, and are keyed to one of several native salmonid species. When a water body's temperature

is warmer than the numbers provided in the standards and the condition is due to natural conditions, then cumulative human actions may not cause the temperature of that water body to increase by more than 0.3C.

Although the numeric criteria set the maximum temperatures allowed in the state's waters, the water quality standards also require that populations of native aquatic species be protected from the sudden temperature swings. These sudden temperature changes include unnaturally cool waters that sometimes result from dam operations, and any other numerically undefined temperature that harms beneficial uses.

The 1997 Water Quality Standards provide criteria for temperature in fresh water where dams occur are for instantaneous measurements: 16° Celsius for Class AA waters and 18° Celsius for Class A waters. The Columbia River has a special condition of 20° Celsius. These are for instantaneous measurements. An incremental increase is specified that varies depending on whether natural conditions are above or below the criterion.

The 2003 Water Quality Standards for temperature have an instantaneous maximum high as a narrative criterion, one-day maximum high, and several seven-day average maximum temperatures based on fish species. They allow for only incremental increases up to the seven-day average maximum. An incremental increase varies depending on whether natural conditions are above or below the criterion.

2003 Criteria: Table 200 (1)(c)
Aquatic Life Temperature Criteria in Fresh Water*

Category	Highest 7-Day Average Daily Maximum
Char	12°C (53.6°F)
Salmon and Trout Spawning, **Core** Rearing, and Migration	16°C (60.8°F)
Salmon and Trout Spawning, **Noncore** Rearing, and Migration	17.5°C (63.5°F)
Salmon and Trout Rearing and Migration **Only**	17.5°C (63.5°F)
Non-Anadromous Interior Redband Trout	18°C (64.4°F)
Indigenous Warm Water Species	20°C (68°F)

* Certain waters will require protection for more sensitive life stages

Several rivers (e.g., the lower Columbia and the Pend Oreille among others) have specific standards for temperature, often a one-day maximum of 20°C. See the 2003 water quality standards, WAC 173-201A-600 and the use designation tables in WAC 173-201A-602 to determine the temperature standard for these particular rivers.

Although the numeric standards set the maximum one and seven-day average temperatures allowed in the state's waters, the *narrative* criteria also require that populations of native aquatic species be protected from the instantaneous high temperatures, sudden temperature swings, unnaturally cool waters that sometimes result from dam operations, and any other numerically undefined temperature that harms beneficial uses.

Possible causes of impairment

Dams can influence reservoir and river temperatures in one or more of the following ways.

- By decreasing flow in the diversion reach, leading to increased warming during the hotter months. The water in the diversion reach is shallower and there is less of it than there would be without the diversion.
- Withdrawing cooler subsurface water from a thermally stratified reservoir immediately upstream of the dam and routing this water through the penstocks and turbines back into the river downstream of the dam. Even if there is only moderate surface warming, subsurface withdrawal can too quickly cool the river downstream.
- Spilling warmer surface water.
- Changing flow release quantities to respond to power demands. This can cool or heat up downstream waters, sometimes almost instantaneously, especially when the reservoir behind the dam is stratified. Rapid fluctuations in river levels can strand fish in pockets of water which can heat up to lethal levels on hot days.
- Impounding the river behind the dam. Some reservoirs generally heat up more during the summer than a free-flowing river because of slower moving water and more surface area exposed to solar and air temperature influence.
- Diverting small volumes of river water into fish ladders to aid in upstream movement of fish. Because of the small volumes, these diverted streams of water tend to heat rapidly, especially if uncovered and exposed to the sun.
- .Blocking groundwater inputs to the river, because the impounded water keeps the river at higher elevations than pre-dam (especially during the summer low-water season.) Local groundwater inflows to rivers can create cold-water refuge areas for fish and other aquatic organisms.
- Eliminating spring flood flows. In some rivers, cold, high spring runoff saturates the banks of the river, recharging the local aquifer. Relatively cool ground water then seeps out during warmer, lower flow months and provides cold-water refugia for aquatic organisms.

Monitoring considerations

There are three ways to understand how a specific dam affects temperature: an empirical method, statistical analysis, and modeling. Each project will need to evaluate the availability of data to decide what to use.

Protection and improvement actions

Applicants for FERC licenses improvement actions will vary depending on the nature of the dam and how it operates.

Ecology will have to consider the combined effects of reservoir management of dissolved oxygen and temperature and benefits and tradeoffs between managing for one or the other.

Turbidity

Turbidity is a measure of water clarity which measures the effect of suspended particles to block the passage of light through water. Therefore, it is also an indirect measure of suspended solids. Turbidity is expressed in nephelometric turbidity units (NTU) and measured with a calibrated turbidimeter. Turbidity is a major numeric water quality concern for dam construction and dam removal.

Background

Elevated turbidity can cause clogging of gills; organism avoidance behavior; reduced ability to find food; reduced photosynthesis and primary production; and smothering of benthic organisms, spawning areas, and habitat with settled solids. Turbidity is also related to aesthetic values since water clarity is highly valued by human users. Turbidity can be an indicator of other environmental problems, such as riparian habitat loss to stream bank erosion or channel cutting from watershed hydrology change. Because many toxic compounds tend to adsorb to organic and clay particles, turbidity can be associated with the uptake, transport, and deposition of toxic materials.

Water quality standard

Water quality numeric criteria for turbidity are described in WAC 173-201A-200 (1)(e).

2003 Criteria: Table 200 (1)(e)
Aquatic Life Turbidity Criteria in Fresh Water

Category	NTUs
Char	Turbidity shall not exceed: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Salmon and Trout Spawning, **Core** Rearing, and Migration	Same as above.

Salmon and Trout Spawning, **Noncore** Rearing, and Migration	Same as above.
Salmon and Trout Rearing and Migration **Only**	Turbidity shall not exceed: • 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the background turbidity is more than 50 NTU.
Non-Anadromous Interior Redband Trout	Turbidity shall not exceed: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Indigenous Warm Water Species	Turbidity shall not exceed: • 10 NTU over background when the background is 50 NTU or less; or • A 20 percent increase in turbidity when the background turbidity is more than 50 NTU.

Possible causes of impairment

Turbidity problems can be divided into several categories:

- Construction activities.
- Erosion of downstream channels due to excessive, unnatural flows from dam releases.
- Erosion of the reservoir shoreline caused by fluctuations in the level of the reservoir.
- Erosion of areas exposed during drawdown, including sheet erosion of denuded banks and down cutting of tributaries into deposited sediment.
- Mass wasting due to wetting and drying of the soils on the reservoir shore.
- Effects of watershed development stimulated by the dam and reservoir.
- Sediment settling in the reservoir can make discharge water in the rriver below unnaturally clear with corresponding losses of fish productivity.

Monitoring considerations

Turbidity monitoring presents some unique challenges because of the need for data on background conditions. The water quality standards allow some flexibility in how turbidity is compared to reference conditions. Data sets for statistical comparison are needed that are large enough to provide some statistical power. In this way, the patterns of turbidity and the frequency that the five NTU threshold is exceeded can be evaluated.

A minimum baseline level of turbidity to promote juvenile salmon survival may also be considered. The baseline may be found to be different than the numeric criteria.

Turbidity has traditionally been measured by grab samples and laboratory analysis. However, turbidity sensors are now available for data logging meters, allowing the collection of data over long time series in multiple locations. This is particularly helpful in evaluating storm events and other intermittent releases, and developing large data sets for statistical evaluation. Care must be taken to choose representative background and assessment locations.

Protection and improvement actions

The approach to identifying corrective action will vary depending on the nature of the activity that could cause a violation of standards.

Advanced planning can avoid some, but not all, emergencies like: drawdown for emergency repairs, extreme floods, and other unexpected activities addressing health and safety. Advanced planning can also eliminate turbidity problems caused from: construction, periodic maintenance, unexpected maintenance, unusual weather, and unusual energy prices.

Applicants performing routine activities (e.g., maintenance, drawdown for runoff storage, ramping for power production) need to complete compliance and best management turbidity prevention plans.

pH

The pH is a measurement the water's acidity or alkalinity. "Standard units" range from 0 to 14, where 7 is neutral, lower values are acidic, and higher values alkaline or basic.

Background

See also "Dissolved Oxygen," "Toxics," and "Aquatic Plants."
Aquatic life requires ranges of pH that do not vary widely from the neutral pH of 7.

A critical characteristic in the response of an aquatic system to pH changes is buffering capacity. Well-buffered systems have high concentrations of dissolved minerals and are resistant to pH changes. Poorly buffered systems, such as rivers in pristine watersheds with granitic bedrock, are highly sensitive to pH changes.

Changes in pH can impact dissolved metals. Low pH levels may release dissolved metals from sediments into the water column. Conversely, high pH levels may cause dissolved metals to precipitate onto suspended solids or into sediments. Therefore extreme shifts in pH can produce increased toxicity in the water column or sediments due to changes in metals concentrations.

Water quality standard

Numeric criteria for pH are presented in WAC 173-201A-200 (1)(g):

2003 Criteria: Table 200 (1) (g)
Aquatic Life pH Criteria in Fresh Water

Use Category	pH Units
Char	pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units.
Salmon and Trout Spawning, **Core** Rearing, and Migration	Same as above.
Salmon and Trout Spawning, **Noncore** Rearing, and Migration	pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units.
Salmon and Trout Rearing and Migration **Only**	Same as above.
Non-Anadromous Interior Redband Trout	Same as above.
Indigenous Warm Water Species	Same as above.

Possible causes of impairment

- Reduced flow in reservoirs and the creation of shallow flooded areas allows plants to maintain a foothold at the edges of the reservoir as well as allowing the growth of phytoplankton. Increased photosynthesis can drive pH in these areas above 8.5-9.0 due to the absorption of CO_2 in the form of carbonic acid.
- Nutrients (usually phosphorus) from lakeshore development can contribute to increased productivity.
- Chemical discharges, most commonly wet concrete. Other chemicals used at the project might increase or decrease pH, either through use or by a spill. Possibilities include alkaline cleaners or acid washing.
- Decay of organic material, such as in wetlands or in the anoxic bottom layers of a lake.
- Steady, reduced flow in the bypass reach can contribute to excessive plant growth.

Monitoring considerations

- Critical period for pH from nutrient-enhanced productivity will be spring and summer.
- Monitoring for pH should be included in any trophic assessment. The highest pH from productivity will probably occur mid-afternoon, associated with high DO levels.
- A quantitative evaluation of the compliance with Lake Criteria (since they refer to natural conditions) would have to include modeling of pH, which can be very challenging. The usual approach to pH is through DO and trophic status.
- Impacts on pH from construction should be monitored downstream of any concrete pour or grout work. If high or low pH chemicals are being used near waters, some monitoring may be necessary during that operation.
- Buffering capacity should be assessed for a project where poor buffering capacity is suspected.

Protection and improvement actions

- Aquatic plant management programs are designed to decrease biomass of non-native aquatic plants growing in the reservoir during the summer.
- Nutrient management to reduce primary productivity.
- Best Management Practices to prevent spillage of concrete or other high and low pH chemicals.

Dissolved Oxygen (DO)

The level of oxygen dissolved in water is usually expressed as milligrams of oxygen per liter of water (mg/L), a unit that is interchangeable with “parts per million” (ppm). DO as a percent of saturation relative to ambient barometric concentration is also of interest.

Background

DO is of critical importance to gill-breathers, who are able to remove DO from the water to meet metabolic needs. Organisms vary in their sensitivity to low DO levels between species and at different life stages.

DO levels are determined by interaction of water temperature, re-oxygenation, decay of organic materials, chemical oxidation, respiration, and the rate at which new plant biomass is formed by photosynthesis, otherwise known as primary productivity. DO saturation concentrations drop as water temperatures increase because colder water can hold more DO. DO is also influenced by currents, rapids and physical barriers that may cause aeration. DO levels are in dynamic equilibrium with the atmosphere, so wind, turbulence, and water depth can affect re-oxygenation rates. DO saturation concentrations are also lower at higher elevations due to the lower partial pressures in the atmosphere.

The amount of oxygen used by decay and oxidation is termed "biochemical oxygen demand," or BOD. BOD loading can originate from external sources, both from human activities (e.g., sewage, manure, or industrial wastes), or from natural sources (e.g., leaf fall). One source of BOD is the death and decay of algae or rooted plants.

Water quality standard

Water quality numeric criteria for dissolved oxygen can be found in WAC 173-201A-200 (1)(d):

2003 Criteria: Table 200 (1)(d)
Aquatic Life Dissolved Oxygen Criteria in Fresh Water

Category	Lowest 1-Day Minimum
Char	9.5 mg/L
Salmon and Trout Spawning, **Core** Rearing, and Migration	9.5 mg/L
Salmon and Trout Spawning, **Noncore** Rearing, and Migration	8.0 mg/L
Salmon and Trout Rearing and Migration **Only**	6.5 mg/L
Non-Anadromous Interior Redband Trout	8.0 mg/L
Indigenous Warm Water Species	6.5 mg/L

(i) When a water body's D.O. is lower than the criteria in Table 200 (1)(d) (or within 0.2 mg/L of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the D.O. of that water body to decrease more than 0.2 mg/L.

(ii) For lakes, human actions considered cumulatively may not decrease the dissolved oxygen concentration more than 0.2 mg/L below natural conditions.

(iii) Concentrations of D.O. are not to fall below the criteria in the table at a probability frequency of more than once every ten years on average.

Possible causes of impairment

- A dam project can increase BOD if there are associated wastewater sources, such as a sewage treatment plant for workers or for an associated recreation facility.
- The project can also exacerbate problems from other BOD sources because of reduced aeration in the reservoir or low flows below the dam.
- Increased macrophyte and algae growth can lead to increased daily swings in DO with very high levels during daylight and sags after dark.

- Thermal stratification in reservoirs, when warmer water stays near the surface and cooler, denser water sinks to the bottom. This can lock up a deeper layer of colder water where DO commonly reaches very low levels.
- Deep releases from a stratified reservoir are likely to show very low oxygen levels, causing fish kills and foul odors.
- All of these problems can combine: high algal biomass can use up the oxygen in the lower levels of a reservoir. Ammonia inputs can both exert BOD by oxidizing and can serve as a nutrient source for algae.
- Where deposits of organic material are found within the reservoir or streambed, an assessment of DO should be targeted, especially for areas of potential spawning activity.

Monitoring considerations

The critical period for DO is usually late summer and early fall because of high temperatures and low flows. Depending on local conditions, the critical period can begin in the late spring and extend late into fall. Cooler temperatures and higher flows in the winter and early spring usually prevent low DO impacts.

DO is also strongly affected by primary productivity, i.e., the photosynthesis of aquatic algae and plants. Photosynthesis can produce a net increase in DO during the day, while at night respiration drives DO down. A diurnal cycle of DO (and pH) is common and requires a need for continuous monitoring to capture this pattern and minimum levels in the early morning.

Protection and improvement actions

- Reduce macrophyte biomass for any low DO levels caused by overly abundant macrophyte growth.
- Decrease temperature in the reservoir.
- Reduce nutrient loading to the reservoir.
- Reduce BOD sources to reservoir. Herbicide application is not a source reduction, however removing aquatic plants can reduce biomass.
- Hypolimnetic aeration through bubblers or oxidant chemicals.
- Selective withdrawal for hydropower.

Ecology will have to consider the combined effects of reservoir management of dissolved oxygen and temperature and benefits and tradeoffs between managing for one or the other.

Nutrients/Trophic Status

Background

Nutrient enrichment can have adverse impacts on the environment. The extent of the impact is determined by which nutrient is “limiting” and other environmental factors that control the growth of plants and algae, such as temperature, light, and habitat conditions. Nutrient depletion may also be an issue in some situations.

Water quality standard

Based on DO, aesthetics, pH (see other sections), and lake nutrient criteria (WAC 173-201A-230).

Trophic status in a lake is the amount of nutrients in the system. It is generally measured by three parameters:

- Total phosphorus (TP).
- Chlorophyll *a* concentration (related to productivity levels as well as color).
- Water clarity (Secchi depth).

Other criteria include oxygen deficit, indicator species, and carbon uptake.

Lakes generally are placed into three categories:

- Oligotrophic: very low nutrient levels (<10 ug/L TP), low productivity (<4 ug/L chlorophyll *a*), and very high clarity (>4 meters Secchi depth).
- Mesotrophic: moderate nutrient levels, good productivity, moderate clarity.
- Eutrophic: high nutrient levels (>30 ug/L TP), very productive (>6 ug/L chlorophyll *a*), low clarity (<2 meters Secchi depth).

The lake nutrient criteria provide guidelines for setting TP criteria for trophic status protection. Action levels are described by ecoregion that can be used to trigger the establishment of criteria. For the Coast Range, Puget Lowlands, and Northern Rockies ecoregions, the action value is 20 ug/L TP, which corresponds to the upper boundary for “lower mesotrophic” conditions. In the Cascades ecoregion, the action value is 10 ug/L TP, corresponding to the upper boundary for oligotrophic conditions. In the Columbia Basin Ecoregion, the action value is 35 mg/L TP, which is the upper boundary of “upper mesotrophic” conditions.

Possible causes of impairment

Trophic level is closely tied to the effects on DO and pH from the rate at which plant biomass is formed, so refer to those sections for more information. The “natural” trophic status is determined primarily by the geology of the watershed, the morphology of the reservoir, and the meteorology of the region.

Factors caused by human activities in a reservoir include:

- Nutrient loading into the reservoir
- Nutrient recycling from sediments
- Lake height, volume, and residence time
- Changes in watershed hydrology
- Increased erosion
- Increased fertilizer use from development

- Increased wastewater discharge
- Changes in the sediment balance in the reservoir and watershed
- Changes in reservoir hydraulics
- Water release depth

Monitoring considerations
Monitoring of trophic status will consist primarily of measuring total phosphorous (TP), chlorophyll *a*, and Secchi depth.

- TP measurements are usually a "volume-weighted average" over the season.
- Chlorophyll *a* is also a volume-weighted average, but only from the photic zone.
- Secondary measurements can be taken to assess trophic status such as:
    - Identification of phytoplankton assemblages at several different times
    - Carbon 14 uptake studies
    - Light-dark bottle experiments can look at oxygen production and respiration
    - Surface light levels and attenuation with depth
    - Modeling the full suite of nutrients
- Monitoring is required over the entire growing season, and ideally over the entire year.
- Nutrients transported within sediments during high winter flows can be released from the sediments in summer.
- Measuring inputs from streams is relatively straight forward, although monitoring storm events is more difficult.
- Ground water, surface erosion, and aerial deposition contribute nutrients.
- For free-flowing waters, complex site-specific studies may be necessary.

Protection and improvement actions
Nutrient source control is the first step to balance the relative responsibility for creating the reservoir and attracting new sources of nutrient against sources already present or entering from outside the project boundaries. Various management tools are available to manipulate the lake to control the trophic status. A few of these are:

- Chemical sealing of sediments to reduce nutrient cycling.
- Chemical clarification of the water column (e.g., with alum).
- Reduction of algal biomass with pesticides (e.g., copper sulfate).

These types of interventions introduce new potential impacts that must be carefully evaluated.

Fecal Coliform

Fecal coliform is a bacteria used as an indicator of the presence of bird and mammal (including human) feces.

Water quality standard

Numeric criteria for bacteria can be found in WAC 173-201A-200 (2)(b):

2004 Criteria: Table 200 (2)(b)
Water Contact Recreation Bacteria Criteria in Fresh Water

Category	Bacteria Indicator
Extraordinary Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 50 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 100 colonies/100 mL.
Primary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL.
Secondary Contact Recreation	Fecal coliform organism levels must not exceed a geometric mean value of 200 colonies/100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 400 colonies /100 mL.

Possible causes of impairment

- Septic system failures caused by raising groundwater levels (from rises in reservoir levels).
- Increased potential for fecal coliform presence may occur if increased camping facilities provided by the applicant (as a relicensing condition) do not provide adequate facilities. Increased use of water's edge by pet owners may occur and associated pet wastes can add to fecal counts.

Monitoring considerations

If sources of fecal coliform are potentially caused by dam operations or utility activities, a survey of septic tanks and drain fields in the vicinity of the reservoir should be conducted to determine horizontal and vertical separation distance and compare to local health district's criteria. The study should be designed to separate out any other potential human and natural sources, for instance upriver municipal sewage treatment facilities.

Protection and improvement actions

Septic systems leakage:

- Keep lake levels low

- Move drain fields away from high water mark
- Follow local county and city requirements

Bacterial pollution from increased recreation:

- Increased availability of septic dumping stations for boats (in large reservoirs) and recreational vehicles.
- Pooper scooper policies for campers.
- Pet restricted areas.
- Public education.
- Sufficient restroom facilities.

Utilities can take responsibility only for those actions that reduce pollution or its affects that are directly under their control. The prime responsibility for controlling human feces contamination often lies with the city or county.

Oil and Grease

Background

There are numerous sources of oil and grease at dam facilities. Oils continuously escape into the river via various avenues. Routine oil losses to the water have exceeded several hundred gallons per year at a facility. Equipment failures and other unplanned incidents have resulted in large and small periodic spills, up to several thousand gallons. Most oil and grease products concentrate somewhere in the system — on the shore or on the bottom. Some of the byproducts bioaccumulate in fish. When fresh grease, oil, hydraulic fluids, and used collected oils are stored on site, the potential exists for spills into the river.

Water quality standard and applicable laws

There are several sections of the Clean Water Act and Washington State laws and regulations that apply and can be referenced in 401 conditions.

- *RCW 90.48 Pollution Control Act*

  This enabling law for the water quality standards found in the rule, WAC 173-201A, gives Ecology the authority to insure the purity of all waters of the state consistent with public health, public enjoyment, protection of wildlife and aquatic life, and the industrial development of the state; and to that end require the use of all known available and reasonable methods by industries and others to prevent and control the pollution. It provides for assessment and compensation to the state from oil spills (90.48.366-368)

- *WAC 173-201A Water Quality Standards*

  Pollution from oil or petroleum products is generally considered as harming beneficial uses and is therefore a narrative criterion.

- *Clean Water Act Section 401*

Under Section 401 (d) of the CWA, other applicable state laws can be written into 401 certifications. Ecology has regularly required compliance with other laws in 401 certifications.

- *RCW 90.56 Oil*

The applicable sections of 90.56 are: duty to report spill and liability for cleanup costs. Development of five-year oil spill prevention plans and cleanup plans and natural resource damage assessments for spills that have already occurred are required.

- *RCW 90.76 Underground Storage Tanks (UST)*

These facilities are required to obtain a permit and comply with several installation and operational requirements and reporting of releases. The rules implementing this law are in WAC 173-360-(Underground Storage Tank Regulations). Cleanup of releases from UST facilities is generally handled under the Model Toxics Control Act.

- *RCW 70.105D Model Toxics Control Act (MTCA)*

This law applies to all facilities where there has been a release or threatened release of a hazardous substance that may pose a threat to human health or the environment. The rules implementing this law are in WAC 173-340 (MTCA Cleanup Regulation) and WAC 173-204 (Sediment Management Standards).

Possible causes of impairment

- Grease and heavy oil used for lubrication and hydraulics are generally comprised of longer, bigger aliphatic and aromatic molecules than most fuels, and have about 100 times less solubility in water than gasoline.
- Servomotors leak oils to the bottom of the turbine pit.
- Wicket gates lubricants can leak directly into the water.
- Turbine guide bearing oil is usually stored in large tanks on site. Gravity brings most of the lubricant into a sump where it is pumped back into the lubrication system. Leakage occurs and oil from other sources collects to be pumped to large sumps prior to being discharged to the river.
- Lubrication of spill gate mechanisms, turbine gate mechanisms, etc.
- Most transformers have been purged of PCB oil and now contain “mineral” oils. Low levels of PCBs may still be found in purged transformers, due to incomplete purging or desorption from transformer materials.
- The mineral oil used in transformers typically is less refined than the store-bought variety and contains low levels of contaminants, such as metals and organic contaminants that accumulate during use.
- Oil leakage from the vehicle onto facility pavement is likely to result in contaminated storm water, if untreated. The washing of equipment can also result in an oily discharge, if untreated.

- Vehicle and boat use in the watershed is likely to increase due to recreation and development encouraged by the reservoir behind the dam. Increased vehicle use may result in increased oil levels in storm water. Studies have shown recreational boats to be a major source of oil discharges — from spills, leakage, and engine pass-through.

Monitoring considerations

- Detailed and accurate records must be kept of all oil uses, transfers, and disposal (including sorbent materials).
- For dams that leak at seals or discharge oily waters, setting a numeric discharge limit may be insufficient protection due to the tremendous amount of dilution that occurs through normal river flows.
- Many types of lubricants and hydraulic fluids are used, and toxicities of each product to aquatic life are largely unknown.
- The types of petroleum products used do not dissolve much in the water, and instead have a tendency to concentrate at the surface or sorb onto particulate matter or sediments.
- Where accumulation in the sediment is suspected, bioassays may be undertaken to determine if the accumulated product has adverse impacts on benthic (sediment dwelling) organisms.
- Determination of the source of the sediment contamination may be difficult to determine with 100 percent assurance due to the myriad of other potential sources of petroleum to the surface water.
- Sighting of a sheen can be followed by careful sampling of the surface water layer.
- Specific activities can be targeted for monitoring, such as cleaning operations, oil changes, stormwater event sampling, or monitoring during periods of high recreational use.

Protection and improvement actions

FERC applicants should be expected to use the best technology, and all known and reasonable methods to make sure that oil, grease, and hydraulic fluids do not enter the river.

Dam operators are required to file Spill Prevention, Control, and Countermeasure (SPCC) plans with the Environmental Protection Agency (EPA) to meet the requirements of 40 Code of Federal Regulations, Part 112. These plans describe oil storage at the project, as well as detailing spill prevention and cleanup measures for potential leaks from the turbines, transformers, generators, storage tanks, delivery trucks, and any other potential sources of oils at the dam.

Dam owners have successfully reduced oil and grease discharges by using more environmentally friendly lubrication products, increasing maintenance and cleaning of turbine and wicket gate parts, replacing seals earlier than normally scheduled, replacing seals with non-grease type seals, aggressive

sump cleaning regimen, spill response plans, stormwater and washwater retention ponds, and boater education and inspections at boat launches.

Toxics

Water quality standard

The *numeric* water quality standards provide numeric limits for many metals and organic and inorganic compounds found in the water column or pore water in the sediment. *Narrative* water quality criteria for toxics are measured in three ways at specific sites: first in fish tissue, second in bioassays of benthic invertebrates, and third by literature reviews for chemicals with no State criteria.

Toxic substances shall not be introduced above natural background levels that have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health. Ecology has a list of substances, primarily pesticides and metals, for which acute and chronic levels have been established. (WAC 173-201A-040).

Possible causes of impairment

Toxics related to dam projects can be categorized as:

- Sources from the project itself
- Sources that increase due to the projects influence
- Increases due to the project operation's impacts on transport of sediments

Dams are industrial sites, so many of the sources of toxics associated with industrial activities are likely to be found. Examples of sources to consider are:

- Solvents for equipment maintenance and repair
- Metals from equipment wear and maintenance
- Paint from maintenance
- Legacy toxics, such as PCBs, in transformers
- Pesticides used for grounds maintenance

Indirect sources could include increased residential, commercial, and industrial development; and associated increases in vehicle use, landscape care, cleaning, maintenance, and toxic source materials. All have a typical suite of toxics associated with the activity, including metals, solvents, paints, pesticides, and other materials.

Dam reservoirs accumulate contaminated sediments as the water slows and the suspended toxic materials from upstream sources settle to the bottom of the reservoir. A related problem could be the release of such substances, if a dam is removed.

Other possible issues include: the use of toxic materials as fill during construction projects, the release of toxics in anoxic sediments in the lake bottom, past disposal of toxic materials such as transformer oils containing PCBs, and wind dispersal of toxics from exposed sediments during drawdown.

Monitoring considerations
The first step is to inventory the possible source of toxics and identify pathways. This can help focus monitoring. Sampling methods are specified in the water quality standards.

Protection and improvement actions

- Develop and follow a Pollution Prevention Plan that addresses toxics.
- Disallow use or disposal of toxic materials as fill during construction of the dam.
- Develop a cleanup strategy for contaminated sites.

Aquatic Plants and Animals

See also DO, pH, and Nutrients/Trophic Status

Background
The excessive growth of non-native aquatic plant and animal species and even native aquatic plants in reservoirs can increase pH, raise water temperatures, and increase or decrease dissolved oxygen and total dissolved gas and otherwise influence the designated uses. Both aquatic and emergent vegetation and invasive animal species can interfere with recreation, degrade aquatic and near shore habitat, cause flooding, interfere with irrigation and power generation, create fish passage problems, trap excessive quantities of sediments and attached nutrients, and be aesthetically displeasing.

Water quality standard
Overly abundant plant or animal growth can interfere with many beneficial uses as well as contribute to violations of several numeric standards including pH, dissolved oxygen, and temperature.

Dams create additional habitat for aquatic macrophytes and invasive aquatic animal species by increasing shallow, slack water areas along the shoreline of the river or reservoir. Sediments are deposited in these areas because of the slow current velocities. These areas also tend to be warmer than the free-flowing river. Still water, warmer temperatures, and the nutrients attached to sediments all better conditions for the growth of invasive species than would be found in free-flowing rivers.

Boaters drawn to the reservoir and the facilities developed under a FERC license can introduce invasive non-native species and spread them throughout the reservoir.

Monitoring considerations
The following information should be collected:

- A baseline map of the extent and species composition of aquatic plant beds should be prepared during the peak of the growing season. Ecology has a web page discussing methods for plant surveys and how to identify aquatic plants.
- A periodic monitoring plan developed and carried out to detect new non-native plant and animal introductions with special attention to potentially destructive species such as zebra mussels and hydrilla.
- If pH and DO don't meet state water quality standards, and plant growth is suspected as a contributing factor, water column profiles of parameters upstream, downstream, and in the plant beds should be collected to understand the effects of macrophytes on pH and DO. (See sections on pH and DO.)
- Nitrogen and phosphorous should be monitored, upstream and downstream of large plant beds and within them, to provide information on the impact of the plants on nutrients in the reservoir.

Protection and improvement actions

Where a problem exists, a group of interested agencies, tribes, and citizens (including the dam operators) should be convened to cooperatively design and implement an Integrated Aquatic Species Management Plan. The plan should cover:

- Containment methods for invasive plants and animals growing in the reservoir.
- A strategy for quickly detecting new invasive species and rapidly responding to eradicate, control, or contain the new infestation, where feasible.
- A plan to prevent or reduce the risk of new aquatic invasive species introductions from recreational watercraft
- A schedule to address any plant and animal problems.
- Provisions for adaptive management as new technologies are developed and/or conditions change.

Ecology's Citizen's Manual for Developing Integrated Aquatic Vegetation Management Plan is a helpful reference when preparing aquatic plant management plans. It details manual, mechanical, biological, chemical, and other plant control options. Also, see Ecology's website for the most up-to-date information about aquatic plant control methods.

The Washington State Aquatic Invasive Species Management Plan should also be referred to when addressing these issues.

The severity of the plant and animal problem needs to be judged against the impacts of the controls because any control method will have environmental effects of its own:

- Increased turbidity may result from diver dredging or rotovating.

- Water level drawdowns may freeze out the roots of native plants as well as those of invasive exotics.
- Herbicides have various side effects.

Fish Habitat including Flow

The quantity of water directly affects many other water quality parameters that affect fish. Flow for fish has been the single biggest 401 certification issue related to hydropower in Washington State. Many local groups are developing flow recommendations under Washington's Watershed Planning Act. Dam operators should coordinate with these efforts. Contact information can be found on Ecology's Watershed Planning website.

Evaluation of fish habitat also looks at a variety of other factors besides flow and ramping rates. This includes large woody debris, gravel, and channel formation and destruction processes. A good source for evaluating these factors is the Integrated Streambank Protection Guidelines developed by Washington Department of Fish and Wildlife, Washington Department of Transportation and Washington Department of Ecology http://www.wdfw.wa.gov/hab/ahg/ispgdoc.htm.

If additional habitat improvements, such as, large woody debris, gravel, channel stability are an issue, then Ecology will rely on the Integrated Streambank Protection Guidelines.

Water quality standard

Adequate flows are necessary to protect fish and other aquatic organisms. Water flows also greatly influence numeric water quality parameters like temperatures, gas super-saturation, dissolved oxygen, and turbidity.

Possible causes of impairment

Water flows create, take away, or influence many different aspects of fish habitat. The important flows affecting habitat may typically be one or a more of the following dam operations:

- No flows or low flows in the river channel from diverting water from the river channel into turbines located downstream from the dam or outside the river basin altogether.
- Periodic no or low flows to high flows in the river channel from managing water for power generation, recreation, or flood control.
- Scouring flows from large releases and floods.
- Quickly varying flows from peaking — routing flows through the turbines mostly during periods of daily or weekly high electricity demand.
- Varying flows due to power generator demands, flood control, maintenance, or other operations.
- Flow blockages and impediments affecting upstream or downstream migration of fish.
- Reservoir fluctuations

How water is held back or passed though or over the dam affects water quality parameters such as total dissolved gas below the dam and temperature in the reservoir and in the river below.

Basic monitoring considerations

Flows affect fish survival in many ways. Ecology requires studies for 401 certifications to answer the questions of how flow is related to fish survival for various fish species:

- *Fish species* - What species are or were present?
- *Fish distribution* - Which species would use which stream reaches?
- *Fish habitat needs for spawning* - What streamflow provides adequate depth, velocity, substrate, and cover for each species' spawning needs for long-term health?
- *Fish habitat needs for rearing* - What stream flow provides adequate depth, velocity, substrate, and cover for each species' rearing needs for long-term health?
- *Side channel habitat* - At what flow are the side channels connected for rearing and spawning? At what times of year are the side channels connected or not connected?
- *Water temperature* - Will the water temperatures be too high for juvenile and adult survival and migration during summer and fall and spawning during fall? Do they meet the state water quality standards?
- *Dissolved gases* - Is nitrogen super-saturation a problem? Does it meet the state standard?
- *Adult fish passage upstream* - Are flows of adequate depth for adult migration of each fish species? Is a pulse of water needed to stimulate upstream passage?
- *Juvenile smolt migration downstream* - Are flows of adequate velocity for juvenile migration? Is a pulse of water needed to stimulate downstream passage?
- *Incubation* - Will there be adequate depth, velocity, and temperature for incubation?
- *Predation* - Is more depth needed to prevent bird predation? Is more velocity needed to prevent fish predation of key species? Are non-native species causing an increase in predation on native species?
- *Food supply* - Will the wetted width of the stream allow terrestrial insects to provide food for fish, and will the water velocities be maintained to allow for drift of aquatic insects?
- *Hydrology* - What flow pattern have the fish evolved with? Will any flow changes cause a change in the usual location of fish redds which will cause increased scouring of redds during high flows? Will the rate at which flow is ramped up and down cause juveniles to be stranded in potholes on gravel bars or in side channels? Will lowered flows prevent proper flushing of fines from gravel and prevent successful spawning

and incubation? Will lower flows in winter allow the formation of anchor ice and the freezing of eggs and juveniles?

To address fish habitat, Ecology usually requests use of an instream flow method which estimates the amount of habitat available at different flows that might occur with and without the proposed project. In most cases, this request is met by using the Physical Habitat Simulation (PHABSIM), part of the Instream Flow Incremental Methodology (IFIM), following quality control and model limitations consistent with the state's Instream Flow Study Guidelines. These processes require consultation with Ecology, fish agencies, and affected tribes.

Different types of studies measure different things. One "size" does not fit all. Methodologies are available to quantify the necessary instream flows for such specific values as fish, wildlife, and recreational use. There are many tools available for assessing instream flows. To begin the process of choosing a method, one needs to consider the following factors:

- Level of detail needed
- Time and money constraints
- Target species (e.g., game, non-game, threatened, and endangered)
- Assessment of instream values and priorities (fish, wildlife, recreation, etc.)
- Availability of historical flow records

Detail about these methodologies are to be found on Ecology's website for instream flows.

Protection and improvement actions

Resolution of habitat flow problems for existing dams usually involves some balancing between fish needs, recreation, navigation, and water quality issues.

While dams often create recreational opportunities, they can also create barriers to recreation. Correcting water quality problems, caused by flow or lack of flow, is most often an operational fix. Operational improvements usually center around three areas:

- Increasing flow
- Stabilizing flow
- Improving hydraulics

Localized flows, such as those used to attract adult spawning salmon to fish ladders or channel improvements to increase habitat, can require structural adjustments to the dam or the river channel.

Recreation and Aesthetics

Water-related recreational uses are a significant hydropower water quality issue. Shelby (1992) found a curvilinear relationship between instream flow and recreational benefits; that is, the quality of the recreation typically increases with increases in instream flow up to a point, and then decreases

with further increases in flow. The graphical depiction of this relationship is referred to as a suitability curve.

Background

Instream flows and reservoir levels for recreation

Recreation occurs in a number of different ways: motor boating, fishing, swimming, wading, rafting, canoeing, kayaking, inner-tubing, and aesthetic enjoyment. Many of these activities are closely related to streamflow.

Instream flows and reservoir levels for aesthetics

Water features are often valued for their aesthetic properties. Beyond the mere presence or absence of water features, however, it also is possible to determine preferences for specific attributes of water features themselves (e.g., flow quantity, water clarity)**.**

Water quality standard

Recreation and aesthetics (sight, smell, touch, and taste) are beneficial uses specifically protected in Washington's water quality standards.

Possible causes of impairment

Recreation

- Direct dam effects can include: river hydraulics; water depth, velocity, wetted perimeter, and turbulence; and reservoir levels.
- Indirect effects on recreation include changes to reservoir levels and in-channel features such as sinuosity, sediment movement, channel movement, gravel bars, and beaches. Because of flow changes, there also may be changes to riparian vegetation which, in turn, may affect the recreation experience.

Aesthetics

Aesthetic impairment can include results of placing river flows through turbines, and can include other structural, operational, and indirect effects of dams on the senses. Growth and decay of aquatic plants; fish kills, boats, litter, and human or pet waste; reservoir levels; and other problems contributable to dams or dam operations can affect taste, touch, smell, and sight

Monitoring considerations

A user-based survey provides an excellent means to get qualitative responses from the user community regarding river conditions. It also offers the opportunity to query users about other aspects of the recreational opportunity in addition to instream flow. A user-survey approach could be combined with other assessment methods as well.

Recreation

A comprehensive recreational flow study can accomplish the following objectives:

- Describe the resource.

- Determine which resource attributes are important to each subcategory of recreation use.
- Describe the hydrology—proposed, existing, and pre-project.
- Describe the relationship between flows and physical conditions in the project setting.
- Evaluate flow needs for specific opportunities (e.g., boating type, skill level, etc.).
- Integrate flow needs for various opportunities.
- Develop strategies to protect/provide flows.

See Instream Flows for Recreation: A Handbook on Concepts and Research Methods, 1993.

Protection and improvement actions

- Integrate flows for recreation and aesthetics with the flow needs for fish and other values using an interdisciplinary approach. Some accommodation among uses will likely be necessary, because it is unlikely that any flow can simultaneously optimize the needs of all uses.
- Use education, cleanup, and enforcement to address irresponsible waste disposal.
- Provide education and ordinances to limit boating speeds and hours.
- Involve the public when siting net pens and other potentially visually controversial facilities.

Wildlife Habitat

Wildlife relies on the water of reservoirs and rivers. Ecology relies on the Washington Fish and Wildlife Agency to identify critical wildlife concerns directly related to water quality.

Water quality standard

Beneficial uses include wildlife habitat. “Wildlife habitat” is defined in the state standards (WAC 173-201A-020) as “waters of the state used by, or that directly or indirectly provide food to support to, fish, other aquatic life, and wildlife for any life history stage or activity.”

Possible causes of impairment

Dams replace rivers with reservoir systems, as well as changing reservoir pool and downriver fluctuations:

- Operations can greatly affect the habitat of the reservoir. Depending on the season, in reservoirs with long holding times, drawdown can create zones barren of most vegetation and inhospitable to most wildlife.
- Operations may affect side channel or seasonal flood stage areas used during different seasons.

- The riparian habitat, as well as the wildlife using the habitat, is impacted by project operations. One of the most significant impacts is water fluctuations resulting in shoreline flooding below the dam for short periods of hours or days.
- Riprap reduces aquatic and terrestrial habitat. Recovery of riparian habitat is difficult.

Monitoring considerations
Ecology relies on the Washington State Department of Fish and Wildlife (WDFW) to work with the project applicant to identify federal and state endangered and threatened species and species of concern. They also address all other wildlife species by categories (game animals, waterbirds, shorebirds, reptiles, insects, plants, etc.) potentially found in the vicinity, and then identify impacts the project could have on any of the species.

Protection and improvement actions
Enhancement measures for wildlife and their habitats should come from protection, mitigation, and enhancement measures negotiated by WDFW as part of the FERC licensing process. However, Ecology is ultimately responsible for the contents of the 401 certification. Ecology also relies on information provided by *local jurisdictions* about shoreline issues in the area.

Wetlands

Wetlands are important for maintaining water quality. They:

- Remove sediment, phosphorus, nitrogen, and toxics
- Provide habitat for cover, rearing, and food chain support
- Retain waters reducing impacts from runoff
- Provide water during low flow periods
- Cool water
- Abate erosion

Water quality standard and applicable laws
The antidegradation policy in the water quality standards requires the protection of wetlands by ensuring all human activities that may lower water quality are:

- Necessary,
- In the overriding public interest, and
- Do not harm any existing or designated uses.

All known, available, and reasonable methods of prevention, control, and treatment must be applied.

Shoreline Management Act (Chapter 90.58 RCW)
The Shoreline Management Act (SMA) regulates setbacks and buffers for those wetlands within 200 feet of jurisdictional shorelines and wetlands "associated" with these shorelines.

Possible causes of impairment

- Turbidity, nutrients, and toxins, because of direct or indirect dam operations or construction of, can exceed the wetland's ability to assimilate sediments.
- The introduction of nutrients or organic material to a wetland can lead to a high biochemical oxygen demand (BOD), which in turn can lead to reduced dissolved oxygen. Increases in nutrients can favor one group of organisms (such as algae) to the detriment of other types such as submerged aquatic vegetation. This potentially causes adverse health effects, objectionable tastes and odors, detrimental impacts to aquatic organisms and wildlife, and other problems.
- Changes in water height and flow can significantly affect a wetland's ability to provide water quality and water quantity support to the beneficial use of water supply.
- Severe water fluctuations limit denitrification and phosphorus retention. Changes in pH to more acidic conditions can reduce the wetland's ability to process nitrogen and phosphorus.
- Increases in water volume and/or velocity increase loading and decrease sedimentation rates in the wetland, thereby decreasing the effectiveness of the wetland's ability to remove and retain nutrients and sediments.
- Increased velocities can also cause decreased water storage time in the wetland, which will reduce the opportunity for the wetland to serve as a groundwater recharge source.
- Drawdown of wetland water levels often concentrates and mobilizes nutrients locked up in the exposed substrate.
- Changes in water velocity and volume may result in reduction of wetland quality and diversity of wetland types.

Changes to a wetland's outlet also can significantly affect the water within the wetland. Wetlands with no outlets or constricted outlets have an increased probability of adsorption, biological processing, and retention of nutrients. Alterations to the outfall that increase the flow out of the wetland will reduce the ability of the wetland to perform these functions.

Removal, change, or death of vegetation, because of dam operations or construction activities, alter the wetlands ability to remove or store water, nutrients, and other materials.

Monitoring considerations

Historic records such as surveyor notes and aerial photographs, combined with the National Wetlands Inventory, can be used to identify historic and current wetlands conditions. This inventory should include all areas within the historic flood migration zone of the channel that is impacted by the operation of a facility. Classification and delineation of wetlands should be done in accordance with the Washington State Wetlands Identification and Delineation Manual, March 1997.

Protection and improvement actions
A plan might be developed to improve and restore those wetlands that no longer exist or have been converted because of dam operations. In addition, they are identified through evaluation of the historic record to have existed, and support designated uses listed in the water quality standards. If no such designated uses are listed in the standards, restoration plans may address wetlands lost after November 28, 1975.

An existing violation of a particular water quality standard should be considered when identifying the wetlands or wetland functions in need of restoration. The possibility of creating mitigation banks could be explored as a method for dam operators to achieve restoration and defer associated costs while restoring the natural function of the wetlands along the impacted reach.

Shorelands

Development activities under the control of the applicant are expected to meet Shoreline Management Act requirements and be compatible with local shoreline regulations.

Water quality standard and applicable laws
Shoreline development can directly and indirectly affect both numeric criteria and water quality standards.

The goal of the Shoreline Management Act (Chapter 90.58 RCW) is to prevent adverse impacts to shorelines by controlling piecemeal development of those shorelines. Shorelines are those areas adjacent to lakes and streams exceeding certain sizes and flows, respectively, that extend 200 feet landward from the water and include associated wetlands. Local governments are required to develop plans governing shoreline development in their jurisdiction.

Possible causes of impairment
Dam construction and operation increase the potential for adverse water quality impacts by making shoreline areas more attractive for development. This is accomplished by increasing the amount of shoreline available, controlling water levels, and providing easy access to shorelines. For example, manipulating flow through dams may alter the ordinary high water (OHW) mark of water bodies. The OHW mark serves as the basis for determining appropriate setbacks of structures and buffer zones. The raising of the OHW mark can result in once compliant structures becoming nonconforming uses, backing up septic systems and otherwise affecting water quality. Lowering of an OHW mark can result in structures or activities being allowed to occur closer to a water body than neighboring uses, creating a perception of inequity and promoting further encroachment upon the water body and habitats.

Intensive development of shorelines presents a potential to compromise water quality by:

- Creating incompatible uses
- Encouraging the construction of building in-water structures
- Removing vegetation that controls contaminated surface water runoff
- Promoting soil erosion as a result of vegetation removal, grading, and filling

Monitoring
Work with local shoreline jurisdictions to make sure the local program is consistent with the actions of the dam operation. Dam operators should work closely with local jurisdictions in conducting comprehensive updates of SMPs.

Protection and improvement actions
Because a change in dam operation can promote development of shorelines, it creates a financial and resource burden for local and state government in conducting permitting and compliance programs, resulting in intensified pressure on the resource from a water quality standpoint.

Applicants and operators should participate in the applicable local government Shoreline Master Program update process in order to ensure that their issues and concerns are addressed, and to promote a partnership with the jurisdictions in developing an effective and adequate public education and compliance program. Local land-use controls in shoreline areas should reflect any long-term plans dam operators have for flow variation. FERC also recognizes, through its shoreline planning process, that it is in the best interest of dam operators to clearly understand and recognize surrounding land-use and ownership patterns, which can be accomplished by participating in the local shoreline inventory process.

Guidance for Shoreline Management Planning at Hydropower Projects, Office of Energy Projects, FERC, April 2001

Introduction to Washington's Shoreline Management Act, Ecology publication 99-113, December 1999

Project related indirect and cumulative impacts

Background
Activities that should be addressed are those that affect water quality and are within the scope of the applicant's control.

Project related indirect impacts
When hydropower projects produce inexpensive power, consistently available water, a predictable water elevation, and improved public access, then certain types of activities increase more rapidly than they would otherwise. Examples include oil and gas releases from increased septic seepage and nutrient loads from land use practices made possible due to reservoir management. These activities can lead to water quality problems. Some of these have been discussed earlier in this document. Additionally, the creation of reservoirs and changes in river hydraulics can cause upstream pollution sources to exert greater impacts and be the ultimate yet indirect cause of

standards violations. Indirect effects are addressed on a project-specific basis.

Cumulative impacts

Cumulative impacts are best described as: how the licensing action would interact with effects associated with other FERC-licensed projects or with actions outside of the FERC's proceeding. FERC and the applicant are required to address cumulative impacts within the NEPA document. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time. Such impacts may be addressed in the 401 certification insofar as they result from the project.

Water quality standard

Other state authorities may be cited in the 401 certification in order to ensure that water quality will be maintained during future activities. These include:

Shorelands Management Act Ch. 90.58 RCW Coastal Zone Management
Watershed Planning Act Ch. 90.82 RCW - Watershed planning
Federal Power Act, Section 10(a)(1)
Washington State Senate Bill 5028 d

Possible indirect causes of impairment

- Recreation within control of the project.
- Creation of habitat conducive to invasive species; also, effects of physical and chemical control of these species can cause harm.
- Shoreline recreational development and public access development associated with license conditions and within control of the applicant, such as docks and marinas, jetties, rip-rap, boat launch ramps, camp grounds,and roads. This includes recreational reservoir levels in the FERC license.
- Roads building for construction of project facilities.
- Construction activities at the dam.
- Construction activities within the project boundaries resulting from mitigation for recreation, fish, and navigation.
- Construction activities outside project boundaries that affect water quality resulting from off-site mitigation for recreation or fish and wildlife.

Monitoring considerations

On-going, post-license monitoring may be needed to track compliance with specific activities and projects. If periodic post-licensing monitoring detects increased levels of pollutants, further monitoring may be needed to trace to pollutants to their source(s).

An analysis of project-related and cumulative impacts will need to be done by the project proponent to consider present, and reasonably foreseeable future, project activities that may have an impact to water quality.

See also information about specific parameters: aquatic plants, turbidity, phosphorous, shorelands, fish habitat, and oil and grease.

Protection and improvement actions

Assessing and planning for future activities will prepare the applicant to address the full range of consequences of actions, so that water quality standards can be met throughout the life of the license. Activities that should be addressed in plans incorporated into 401 certifications are those that affect water quality and are within the scope of the applicant's control.

Appendix 1
Acronyms and Water Quality Terms

Acronyms

401 certification	Section 401 of the Clean Water Act requiring, among other things, federally licensed projects to meet state water quality standards
404	Section 404 Clean Water Act
7Q-10 Flow	One week period of extreme flows calculated to happen once in 10 years
AIR	Additional information request
ALP	Alternative Licensing Process
BOD	Biological oxygen demand
CFR	Code of Federal Regulations
CWA	Clean Water Act
CZMP	Coastal Zone Management Program
DEA	Draft Environmental Assessment
DEIS	Draft Environmental Impact Statement
DNEPA	Draft National Environmental Policy Act
DO	Dissolved oxygen
EA	Environmental Assessment
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FERC	Federal Energy Regulatory Commission
IFIM	Instream Flow Incremental Process
IIP	Initial Information Packet
ILP	Integrated Licensing Process
NEPA	National Environmental Policy Act
NOI	Notice of Intent (to file for a FERC licence)
NTU	Nephelometric turbidity units
PDNEPA	Preliminary Draft National Environmental Policy Act
PHABSIM	Physical Habitat Simulation, a flow model
pH	Measure of alkalinity or acidity
PM&E	Protection, mitigation and enhancement measures
PAD	FERCs required Pre-Application Document
QAPP	Quality Assurance Planning Process
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
REA	Ready for Environmental Analysis (FERC's NEPA EIS)
SEPA	State Environmental Policy Act
SMP	Shoreline Master Program

SOD	Sediment oxygen demand
SPCC	Spill Prevention and Control Plans
TDG	Total dissolved gas
TLP	Traditional Licensing Process
TMDL	Total Maximum Daily Load
TP	Total phosphorous
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WQS	Water Quality Standards

Water Quality terms

Refer to the 2003 Water Quality Standards for a more complete definition

Compliance Schedules for Dams	Ten-year plans for dam owners who are currently violating water quality standards to develop a process and schedule for implementing all reasonable and feasible structural and operational changes they can to meet water quality standards. After this time, other water quality standards tools such as use attainability analyses, variances, and site-specific criteria become available. See WAC 173-201A-510
Designated Uses	Those uses specified in the Water Quality Standards (Chapter 173-201A WAC) for each water body or segment, regardless of whether or not the uses are currently attained. See WAC 173-201A-020.
Existing Uses	Means those uses actually attained in fresh or marine waters on or after November 28, 1975, whether or not they are designated uses. Water body surveys, historic records, and to a limited extent, anecdotal accounts should be relied on. Introduced species that are not native to Washington, and put-and-take fisheries comprised of nonself-replicating introduced native species, do not need to receive full support as an existing use. See WAC 173-201A-020.
Highest Attainable Uses for Dams	The most sensitive (requiring the most stringent water quality conditions) existing or designated uses that can be feasibly achieved (Determined procedurally through WAC 173-201A-510 and 40 CFR 131.10).

Narrative Criteria	Are non-numeric water quality criteria that establish qualitative performance goals to protect beneficial uses from detrimental conditions (e.g., meet requirements of use, no toxic effects, no offensive odors, no blockage of migration, etc.).
Natural Conditions	Means surface water quality that was present before human-caused pollution. See WAC 173-201A-020.
Numeric Standards	Numeric water quality criteria assigned to protect designated uses in the water quality standards (Chapter 173-201A WAC) from the detrimental effects of specific water quality constituents.
Site-Specific Criteria	Uses science-based study designs to show that species at a site are more tolerant of a pollutant than are the species used in the national or state studies that formed the basis for the state criteria. Site specific criteria must be formally adopted into the water quality standards and approved by the USEPA under the federal Clean Water Act. See WAC 173-201A-430.
Use Attainability Analyses (UAA)	Structured scientific assessments of the factors affecting the attainment of the waterbodies' designated uses which may include physical, chemical, biologic, and economic factors. A UAA can be used to remove a designated use from the water quality standards (Chapter 173-201A WAC) that is neither existing nor attainable. See WAC 173-201A-440.

Appendix 2
Ecology Contacts

Ecology Contacts

The headquarters Water Quality Hydropower Certification Coordinator or the regional directors can help you get in contact with the appropriate staff that will be working on your 401 certification.

Headquarters

Water Quality Hydropower Certification Coordinator.....360-407-6484

Northwest Regional Office

Regional Manager.....425-649-7010
Water Quality Section Manager 425-649-7033
Water Resources Section Manager 425-649-7270
SEA Section Manager.....425-649-7096

Southwest Regional Office

Regional Manager.....360-407-6307
Water Quality Section Manager 360-407-6271
Water Resources Section Manager 360-407-6058
SEA Section Manager.....360-407-0271

Eastern Regional Office

Regional Manager.....509-329-3516
Water Quality Section Manager 509-329-3534
Water Resources Section Manager 509-329-3464
SEA Section Manager.....509-329-3561

Central Regional Office

Regional Manager.....509-457-7120
Water Quality Section Manager 509-457-7107
Water Resources Section Manager 509-454-3989
SEA Section Manager.....509-574-3992

Appendix 3

Application Form

Place cursor in first fill-in field and use F11 to tab through fields.

Water Quality Certification Application (401) for Existing Hydropower Dams Form

(For use in Washington State)

Send to:

Water Quality Certification Hydropower Coordinator
Water Quality Program
Washington State Department of Ecology
P.O. Box 47600
Olympia, WA 98501

NOTE: For other permitting and regulatory questions, contact the Office of Regulatory Assistance at 1-800-917-0043, assistance@ora.wa.gov, or www.ora.wa.gov. Use the Joint Aquatic Resources Permit Application (JARPA) for any construction activities.

Please type or print in black ink. *ALSO be sure to complete the Signature Block on page two.*

1. Applicant:			
Mailing address:			
Work phone:	E-mail address:	Home phone:	FAX #:

If an agent is acting for the applicant during the permit process, complete #2.

2. Authorized agent:			
Mailing address:			
Work phone:	E-mail address:	Home phone:	FAX #:

3. Waterbody(s) of FERC project: Is this waterbody on the 303(d) list? Yes ☐ No ☐ Has, or could, the project contribute to exeedance of any water quality standard? Yes ☐ No ☐ If yes, what parameter(s)? Website for 303(d) list: http://www.ecy.wa.gov/programs/wq/links/impaired_wtrs.html	Tributary of:	WRIA #: http://www.ecy.wa.gov/services/gis/data/hydro/wria.gif

4. Attached materials: Attach a complete list of all applicable studies, research, summaries, and information that is needed for Ecology to conclude that water quality standards will be met for the project.

Application is hereby made for a certification that water quality standards will be met. I will make available to Ecology, upon request, any information necessary for Ecology to make a 401 water quality certification decision. I am familiar with the existing information and believe that it is sufficient to show that water quality standards will be met for this project. To the best of my knowledge and belief, such information is true, complete, and accurate.

Signature of applicant	*Date*
Signature of authorized agent	*Date*

I hereby designate to act as my agent in matters related to this application for permit(s). I understand that if a federal permit is issued, I must sign the permit.

Signature of applicant	*Date*

This application **must** be signed by the applicant and the agent, if an authorized agent is designated.

AGENCY USE ONLY

Circulated by:	Date Received:
Forwarded to (regional office lead):	Date Forwarded:

If you need this publication in an alternate format, please contact us at 360-407-6404. If you are a person with a speech or hearing impairment, call 711 or 800-833-6388 for TTY

Appendix 4
FERC Process Charts

Integrated Licencing Process