

## **Appendix H**

### **Study Plans**

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## **Study Plans**

Beginning in November 2005, Douglas PUD organized and participated in 28 informal RWG meetings with interested stakeholders. This voluntary process led to the cooperative development of issue statements, issue determination statements, a list of study plans related to Terrestrial, Aquatic, Water Quality, Cultural and Recreation and Land Use resources.

This appendix of the PAD contains each of the 12 study plans developed collaboratively with interested stakeholders.

A list of RWG approved Study Plans is included below:

### **Terrestrial Resources**

- An Evaluation of the Effects of and Alternatives to the Existing Bird and Mammal Control Programs
- Plant and Wildlife Surveys and Cover Type Mapping for the Wells Hydroelectric Project 230 kV Transmission Corridor

### **Aquatic Resources**

- Survival and Rates of Predation for Juvenile Pacific Lamprey Migrating through Columbia River Hydroelectric Projects
- An Assessment of Adult Pacific Lamprey Spawning within the Wells Project
- Adult Pacific Lamprey Ladder Passage and Behavior Study
- Assessment of DDT and PCB in Fish Tissue and Sediment in the Lower Okanogan River
- An Investigation into the Total Dissolved Gas Dynamics of the Wells Project
- Development of a Water Temperature Model Relating Project Operations to Compliance with the Washington State and EPA Water Quality Standards
- Continued Monitoring of DO, pH and Turbidity in the Wells Forebay and Lower Okanogan River

### **Cultural Resources**

- Cultural Resources Investigation

### **Recreation and Land Use Resources**

- Evaluation of Public Access to and Use of Wells Reservoir as it Relates to Reservoir Fluctuations, Aquatic Plants and Substrate Buildup
- An Evaluation of Recreation Needs within the Wells Project

**AN EVALUATION OF THE EFFECTS AND ALTERNATIVES TO THE  
EXISTING BIRD AND MAMMAL CONTROL PROGRAMS  
(TERRESTRIAL ISSUE 6.2.3.1)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington

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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Terrestrial Resource Work Group (RWG), which is composed of stakeholders (resource agencies and tribes) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The Terrestrial RWG, through a series of technical meetings, is proposing a study intended to evaluate the effects and develop alternatives to the existing bird and mammal control programs.

Douglas PUD currently implements several bird and mammal control programs that are primarily related to fish survival goals within the Wells Habitat Conservation Plan (HCP).

The Wells HCP requires Douglas PUD to implement a predator control program. The goal of the predator control program is to reduce the number of juvenile salmon and steelhead that are consumed by predators. Both the hatchery and predator control programs are important in meeting the No Net Impact (NNI) survival goals in the Wells HCP.

The primary objectives of the study are:

- Identify and count the current and historic number and species of birds and mammals feeding on fish at the Project hatcheries and in the Wells Tailrace;
- Assess the potential impacts of mortality caused by piscivorous birds and mammals to ESA listed, sensitive and recreationally important species;
- Describe each of the existing nuisance wildlife control measures, including species targeted, reason for control, frequency of control and effectiveness of the control method;
- Evaluate alternatives, including the costs and benefit of each measure recommended. The study will provide alternative methods of preventing predation of fish at the Wells Project and in hatchery rearing ponds.

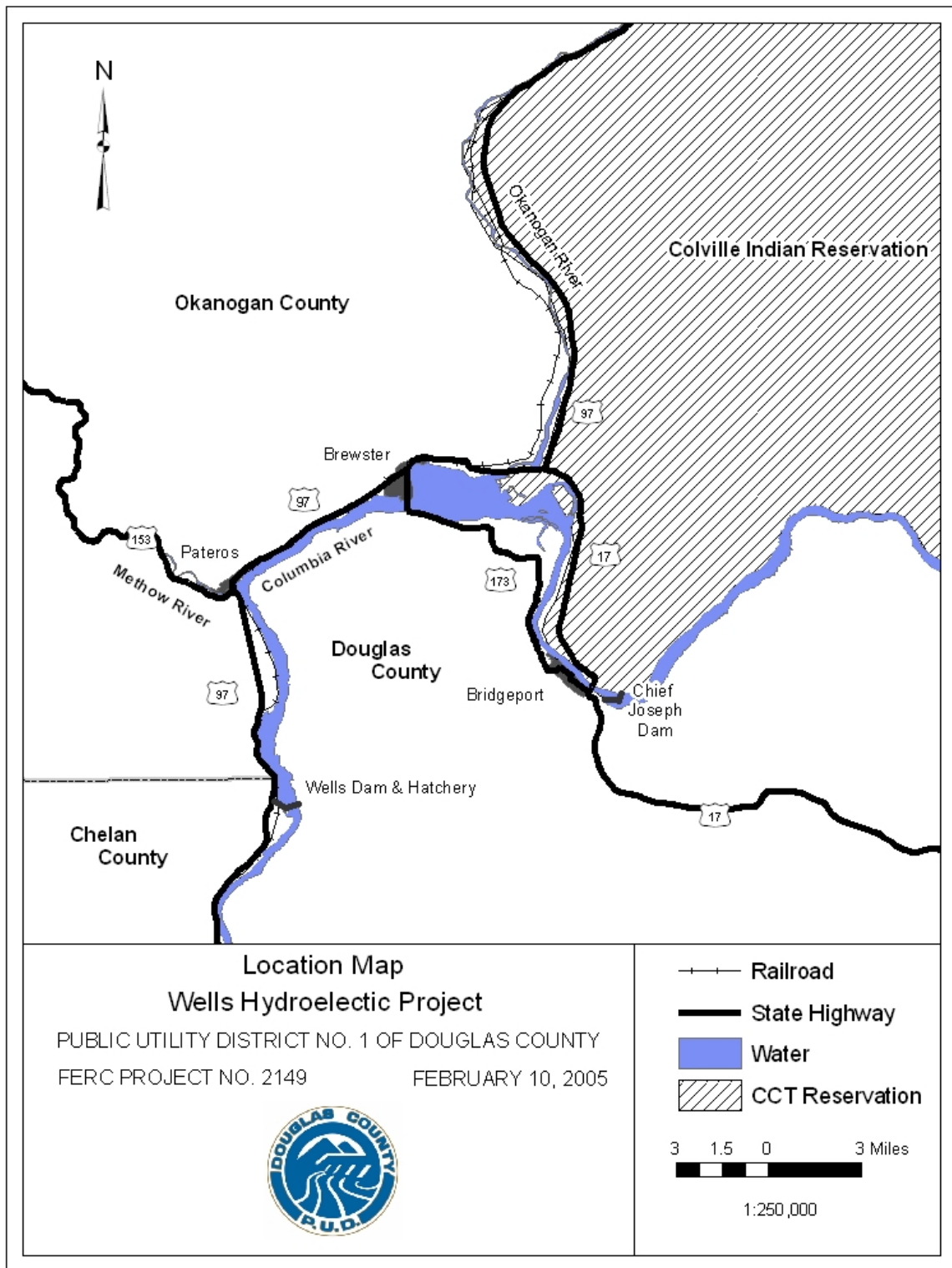
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**

## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The goal of the study is to evaluate the effectiveness of the ongoing predator control programs and identify potential alternatives where appropriate.

The objectives of the study include the following:

- Identify and count the current and historic number and species of birds and mammals feeding at the Project hatcheries and in the Wells Tailrace;



- Assess the potential impacts of mortality caused by piscivorous birds and mammals to ESA listed, sensitive and recreationally important species.
- Describe each of the existing nuisance wildlife control measures, including species targeted, reason for control, frequency of control, and effectiveness of the control method.
- Evaluate alternatives, including the costs and benefit of each measure recommended. The study will provide alternative methods of preventing predation of fish at the Wells Project and in hatchery rearing ponds.

### **3.0 STUDY AREA**

The study area includes the Wells Reservoir and Wells Tailrace and adjacent Project related lands (Figure 1.1-1), the approximately 15 acre Wells Hatchery in Chelan County (Figure 3.0-1) and the 19 acre Methow Hatchery, including the Twisp (2.6 acres) and Chewuch (0.7 acres) acclimation pond sites, located in Okanogan County (Figure 3.0-2). The Methow Hatchery and associated acclimation ponds are located outside of the Wells Project boundary. The Wells Hatchery is located on the west bank of the Columbia River immediately downstream of the Wells Dam and is entirely contained within the boundary of the Wells Project.



**Figure 3.0-1      Air Photo of Wells Hatchery**



**Figure 3.0-2**      **Location map for the Methow Hatchery and associated off-site acclimation ponds**

## **4.0 BACKGROUND AND EXISTING INFORMATION**

### **4.1 Past and Current Activities to Reduce Fish Predation**

The Wells and Methow hatcheries raise steelhead (*Oncorhynchus mykiss*) and spring Chinook (*Oncorhynchus tshawytscha*) that are listed as threatened and endangered, respectively, under the federal Endangered Species Act. The Washington Department of Fish and Wildlife (WDFW) estimates that 7 to 14 percent (depending on rearing pond) of the steelhead and summer Chinook reared at Wells Dam in 2005 were eaten by birds and mammals. The hatcheries have a goal for the number of yearling steelhead and Chinook smolts released each spring. To reach these goals, additional brood stock must be trapped to compensate for the mortality due to predation, thereby impacting the number of ESA listed fish left to spawn naturally.

Methods of controlling avian predation at Wells Hatchery have changed over the years. Until the mid-1980s, Washington State hatchery policy encouraged hatchery employees to kill piscivorous birds feeding on fish reared in its hatcheries along with hazing to reduce fish mortality. More recently, hatchery staff has relied solely on hazing, pyrotechnic shotgun shells (cracker shells) and exploding rockets along with propane cannons, to reduce bird predation. Hazing efforts were marginally successful.

In 1993, Douglas PUD hired the U. S. Department of Agriculture (USDA) Wildlife Services to reduce the bird predation at Wells Tailrace. The USDA installed bird exclusion wires to reduce access by flying birds in the tailrace. In 1994, USDA installed bird exclusion wires over the hatchery rearing ponds. They also used hazing methods listed above and shot a few birds as a dispersal technique to reduce bird densities, enforcing hazing techniques.

Information that can be used in the study can be found from two sources. WDFW has information that estimates the number of fish consumed by piscivorous birds and mammals at each of the hatcheries. USDA has information on the number of birds hazed and/or shot at Wells Hatchery and in the Wells Tailrace.

### **4.2 Terrestrial Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established a Terrestrial Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD)

Through a series of meetings, the Terrestrial RWG cooperatively identified a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria (see Section 1.2) and would be useful in



making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these meetings and discussions, the Terrestrial RWG is proposing to include a study plan into the Wells PAD which addresses the need to evaluate the effects of and alternatives to the piscivorous bird and mammal control programs (6.2.3.1). The need for this study was agreed to by all of the members of the Terrestrial RWG, including Douglas PUD. This study will help inform future relicensing, wildlife and fisheries management decisions and will fill data gaps that have been identified by the Terrestrial RWG.

### **4.3 Issue Statements**

#### **Issue Statement (6.2.3.1)**

Ongoing control of nuisance wildlife may influence wildlife species abundance and diversity.

#### **Issue Determination Statement (6.2.3.1)**

Douglas PUD conducts a nuisance wildlife control program to reduce predation on fish. The effect of this program on wildlife populations found within the Wells Project is unknown.

Removal of bird and mammal predators is an important part of reducing predation on ESA listed steelhead and spring Chinook at the Wells Project and associated hatchery facilities. In 2005, WDFW estimated loss due to predation at the Wells Hatchery at 7-14 percent. Douglas PUD, through the U.S. Department of Agriculture and WDFW's nuisance species trapping program, has developed and continues to employ many alternatives to lethal removal and only uses removal actions when non-lethal measures have failed. Hazing consists of noise makers, propane cannons, decoy predators, electric fence, tailrace and hatchery wires, fencing, hatchery covers and the hiring of hazing personnel. As a last resort, removal techniques, including the use of traps and shot guns, would be utilized.

Project operations related to wildlife control, specifically lethal removal, may have an effect on terrestrial resources and additional information is needed to determine which species may be significantly affected under this program and if there is a significant impact on sensitive or recreationally important species.

The resource work group agrees that a study is needed during the two-year ILP study period to evaluate existing practices, evaluate alternatives and inform future management decisions.

## **5.0 PROJECT NEXUS**

Douglas PUD owns and pays for the operation of the Wells and Methow hatcheries and acclimation ponds as mitigation for unavoidable losses of juvenile anadromous salmonids resulting from the existence and operation of the Wells Hydroelectric Project. The fish raised at these facilities are an important component in meeting the No Net Impact (NNI) survival requirements contained within the Wells HCP. The hatcheries raise spring Chinook, summer/fall

Chinook, steelhead, and rainbow trout. Spring Chinook and steelhead are listed as endangered and threatened under the federal Endangered Species Act.

Section 4.3.3 of the Wells HCP includes the requirement that Douglas PUD implement a control program to reduce the level of predation at Douglas PUD's two salmon hatcheries and in the tailrace and reservoir surrounding Wells Dam. Douglas PUD hires the USDA to employ various techniques to harass piscivorous birds at hatcheries and in the tailrace below Wells Dam. In the past, USDA has also conducted limited control activities on the Wells Reservoir.

Existing avian harassment techniques include aerial pyrotechnics, propane cannons, and the physical presence of humans in the area. The USDA has also installed wires over the hatchery ponds and over the Wells Tailrace to deter piscivorous birds from feeding, and has installed electric fencing around the hatchery ponds to reduce the level of mammalian predation on hatchery fish. The Methow Hatchery rearing ponds are enclosed with canvas covers. The Methow Basin acclimation ponds are surrounded by cyclone fencing and are protected from avian predators through the installation of overhead wires.

## **6.0 METHODOLOGY**

A random, stratified sampling protocol will be implemented throughout the study period. Observations of bird and mammal predation will be documented. Each bird or group of birds recorded will be identified by species, number, type of activity, time of observation and weather condition. Bird feeding information will be collected for one year. All evidence of piscivorous mammals near the ponds will also be noted. The bird sighting data will be compiled in a database.

To make control methods more effective it must be determined which bird species cause the highest predation loss and when those losses occur. A sufficient number of birds, as recommended by permitting agencies, of each species known to feed at the hatchery ponds and in the Wells Tailrace will be collected. The esophagus, proventriculus and gizzard will be excised from the collected birds and food items removed. All identifiable food items will be collected, counted, weighed and recorded. Due to their special status, raptors will be excluded from this portion of the study.

A literature review of life histories of all bird species known to feed at the hatcheries and in the tailrace, during the year, will be conducted. The life history information will include information on the number, size and weight of prey items identified at other salmon and trout hatcheries. Information on regional species population levels will also be compiled. The literature review will also be conducted on the current technology for hazing birds and excluding birds and mammals from hatchery raceways and ponds.

The report will quantify the impact of specific bird and mammal predation on several species of fish within the Wells Project and associated hatcheries. The report will also detail the control methods used, effectiveness of each method and literature reviewed. It will provide recommendations (with estimated cost) to reduce bird and mammal predation at the hatcheries, reservoir and tailrace.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

A contractor will be hired to do the literature search for life histories and predation control methods. The contractor will also be responsible for determining the population status of known predators found throughout the Wells Project and associated hatchery facilities.

A contractor will conduct bird counts and will document the presence of known piscivorous mammals. The contractor will work toward the collection of bird diet samples.

The report summarizing the results of the study will be written by the contractor.

## **8.0 BUDGET**

The estimate for total person hours required to complete the study is approximately 1,620 hours. The field work will require approximately 1,320 person hours and study coordination, data analysis and report writing will require approximately 300 person hours. The study is estimated to cost \$46,614.

## **9.0 SCHEDULE**

The field work related to this proposed study will be initiated after FERC's issuance of the Study Plan Determination in October 2007. An Initial Study Report will be provided to the Terrestrial RWG, stakeholders and FERC in October 2008 with a final report summarizing the processes of model development, analyses, and results by October 2009.

**PLANT AND WILDLIFE SURVEYS AND COVER TYPE MAPPING  
FOR THE WELLS HYDROELECTRIC PROJECT 230 kV  
TRANSMISSION CORRIDOR**

**(TERRESTRIAL ISSUES 6.2.3.2 AND 6.2.3.3)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
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The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5). A Terrestrial Resource Work Group (RWG), which is composed of stakeholders and Douglas PUD staff, was formed for the purposes of identifying issues and information gaps that may require study during the relicensing of the Wells Hydroelectric Project. The Terrestrial RWG, through a series of technical meetings, has identified the need for a study to assess the effects of the Project's 230 kV transmission line corridor on wildlife.

This proposed study is intended to fill the gaps in local knowledge of botanical resources, including rare, threatened and endangered (RTE) plants, invasive plant species, and vegetation communities within the 235-foot Wells Project 230 kV transmission line corridor. The study will also provide bird species presence, identify if bird collision, with the line and structures, is a problem and provide information on the extent of use and dependency on the transmission corridor by sage grouse (*Centrocercus urophasianus*) and sharp-tailed grouse (*Tympanuchus phasianellus*), both RTE species. Surveys will also be conducted for RTE mammals and reptiles. The study plan outlines methods that will be used to collect information on these plants and animals.

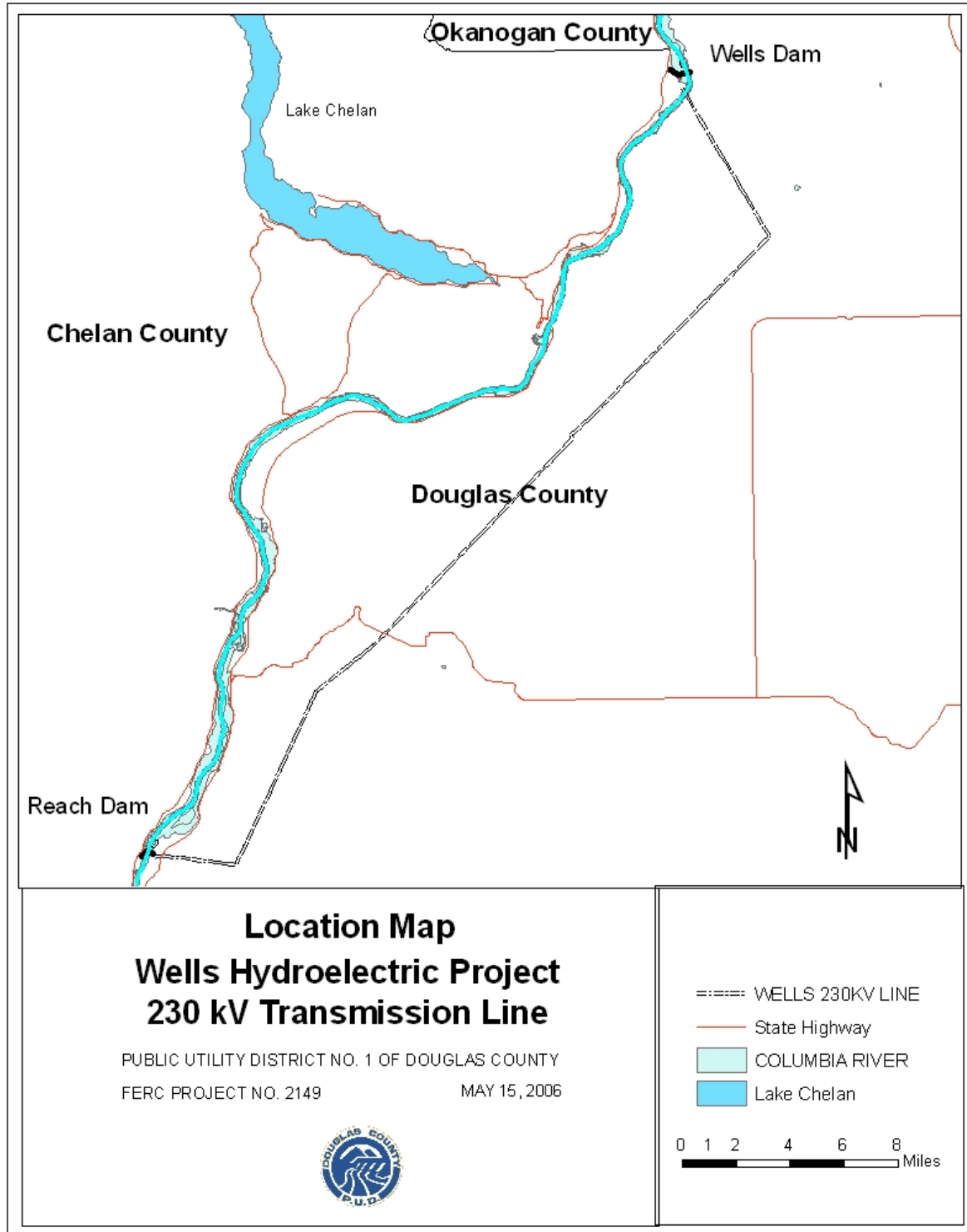
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project, owned, and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas county (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map – Wells Dam 230 kV Transmission Line Corridor**

## **1.2 Relicensing Process**

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
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- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## **2.0 GOALS AND OBJECTIVES**

The overall goal of the wildlife and botanical surveys along the Project transmission lines is to provide information needed to guide land management decisions, avoid damage to valuable habitat during future transmission corridor management activities and minimize the spread of invasive weeds. The study will provide baseline data on birds found near the corridor and information on the presence of RTE plant or animal species in the corridor. In addition, this study will provide information needed to meet the FERC requirements during the Wells ILP. The study objectives are divided into botanical and wildlife resource categories.

Pursuant to CFR 18.5(vii), RTE species in this study plan include:

- Federally listed as threatened, endangered, proposed or candidates under the ESA;
- State listed as threatened or endangered;
- State listed as candidate (wildlife only);
- State listed as sensitive (plants only); or
- State listed as Review List 1 (plants only).

## **2.1 Botanical Resources**

The main objectives of the botanical study are:

- (1) Identify and document the location of RTE plant species that occur within the transmission line corridor.
- (2) Identify and classify the specific vegetation cover types in the study area.
- (3) Generate detailed information on the species composition and classification of these plant communities and their structures.
- (4) Create a detailed GIS cover type map of the study area showing the locations of these plant communities, their distribution, areas of coverage (acres), and note locations of habitats of special concern or unique areas observed.
- (5) Identify any invasive plant species in the transmission corridor. For this transmission line corridor study, invasive species are Washington State Class A and B-designate noxious weeds.

## **2.2 Wildlife Resources**

### **2.2.1 Avian**

The main objectives of the avian study are:

- (1) Identify and document the location of any federal and state RTE avian species that use the study area.
- (2) Describe the habitat features used by RTE avian species observed within the corridor.
- (3) Document the presence of other avian species and provide relative abundance for birds using the study area.
- (4) Document raptor and corvid nesting and sharp-tailed and sage grouse use within the study area.
- (5) Document any evidence under the transmission line of avian collisions.

### **2.2.2 Mammal**

The main objectives of the mammal study are:

- (1) Identify and document the location of federal and state RTE mammal species that use the study area.
- (2) Describe the habitat features used by RTE mammals observed within the corridor.
- (3) Document the presence of other mammal species in the study area.

### **2.2.3 Reptile**

The main objectives of the reptile study are:

- (1) Identify and document the location of federal and state RTE reptile species that use the study area.
- (2) Describe the habitat features used by RTE reptiles observed within the corridor.
- (3) Document the presence of other reptile species in the study area.

## **3.0 STUDY AREA**

Two 230 kV transmission lines connect Wells Dam with the Douglas switchyard next to Rocky Reach Dam (Figure 1.1-1). The transmission lines occupy a 235-foot corridor that is 41 miles long. The transmission lines begin at Wells Dam, cross the Columbia River from Carpenter Island in Chelan County to Douglas County. The transmission lines travel southeast to the Boulder Park area then turn southwest across wheat fields, past the town of Waterville and over Badger Mountain. The lines descend the west slope of Badger Mountain and end at Douglas Switchyard. The study area is the 235-foot transmission line corridor, excluding all actively cultivated fields.

## **4.0 BACKGROUND AND EXISTING INFORMATION**

### **4.1 Botanical Resources**

The US Fish and Wildlife Service (FWS) maintains a list of all plants that are listed or proposed as threatened or endangered under the Endangered Species Act. In addition to the federal list, Washington Department of Natural Resource's Natural Heritage Program (WNHP) maintains a database on the known locations of federally listed and proposed, as well as state listed threatened, endangered, sensitive and Review List 1 plants in Washington. Historic rare plant information is also available at both Washington State University and University of Washington. Invasive plant species potentially occurring in the study transmission line corridor are available from the Washington State Weed Board and Washington State Extension Service.

## 4.2 Wildlife Resources

The FWS maintains a list of all wildlife listed or proposed as threatened or endangered under the Endangered Species Act. The Washington Department of Fish and Wildlife (WDFW) maintains a list of all wildlife species listed or proposed for listing under the WAC-232-12-297. WDFW also maintains a list of RTE species and a database with locations of all recorded sightings. Cassidy et.al. (1997) also provides species range information for all wildlife that may be found in the transmission line corridor.

## 4.3 Transmission Corridor Maintenance

Douglas PUD conducts an ongoing maintenance program on the 230 kV transmission corridor. Maintenance activities include noxious weed control at transmission corridor structures and along access roads in the spring and fall. Target weed species are primarily diffuse knapweed (*Centaurea diffusa*) and Dalmatian toadflax (*Linaria dalmatica*). Transline<sup>®</sup> herbicide is applied in the spring as a contact herbicide with a limited residual and is also used for spot applications in the fall. Transline<sup>®</sup> is used because it has minimal impacts on native grass species and sagebrush shrub species. Douglas PUD releases the biological control insect *Calophasia lunula* to control Dalmatian toadflax. Weedar-64<sup>®</sup> and Curtail<sup>®</sup> are also used to control broadleaf weeds.

The maintenance program also includes an overall inspection for damaged roads or structures. Tower structures are inspected on foot or using a four-wheeled all terrain vehicles (ATV) with low pressure tires. At the request of land owners, maintenance roads were not constructed across approximately 25 miles of wheat fields, on the Waterville Plateau, when the transmission lines were built. Existing roads require periodic maintenance if there is damage to the road from storms or rock falls or if the road requires grading for repairs to the 230 kV lines.

## 4.4 Terrestrial Resource Work Group

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established a Terrestrial Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Terrestrial RWG collaboratively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.



Based upon these meetings and discussions, the Terrestrial RWG is proposing to include a study plan into the Wells PAD which addresses the need to collect baseline botanical information for the existing 230 kV transmission line running from Wells Dam to Douglas Switchyard.

This proposed study is intended to fill data gaps in local knowledge of botanical resources including RTE and invasive plant species. This study will also provide information on bird species presence, identify if bird collision is a problem and provide information on the possible use of the transmission corridor by sharp-tailed or sage grouse. The study will also provide information on Washington ground squirrel and striped whipsnake which are both RTE species, that have a range that overlaps with the study area.

## **4.5 Issue Statements**

### **Issue Statement (6.2.3.2)**

Presence of the transmission lines could kill or injure birds and the presence of the transmission towers could affect wildlife behavior and use of adjacent habitat.

### **Issue Determination Statement (6.2.3.2)**

The Wells Project license includes two 230 kV single-circuit transmission lines. The lines run 41 miles in length from the switchyard at Wells Dam to the Douglas Switchyard operated by Douglas PUD. The lines run parallel to each other on 45-85 foot steel towers along a common 235-foot wide corridor.

The transmission lines and towers could have impacts on wildlife, including bird collisions and raptor nesting. Baseline studies have not been completed to assess these potential impacts. Wildlife and botanical species inventories have not been completed along the transmission corridor.

The RWG agrees that a study is needed during the two-year ILP study period and is proposing to complete baseline wildlife and RTE inventories along the transmission corridor. In addition to documenting baseline conditions, this study would be used to document presence (whether raptors, corvids and prairie grouse are found within or adjacent to the transmission corridor). A literature review will also be completed to specifically identify potential effects on raptors and prairie grouse.

### **Issue Statement (6.2.3.3)**

Maintenance of the transmission corridor could affect wildlife and/or botanical species (e.g. weed control and road maintenance).

### **Issue Determination Statement (6.2.3.3)**

The Wells Project license includes two 230 kV single-circuit transmission lines. The lines run 41 miles in length from the switchyard at Wells Dam to the Douglas Switchyard operated by

Douglas PUD. The lines run parallel to each other on 45-85 foot steel towers along a common 235-foot wide corridor.

Maintenance activities along the transmission corridor could have an impact on wildlife and botanical resources. Wildlife and botanical species inventories have not been completed along the transmission corridor.

The resource work group agrees that a study is needed during the two-year ILP study period and is proposing to complete baseline wildlife, botanical and RTE inventories along the transmission corridor.

There is some existing information on botanical and avian resources in the study area as described below.

## **5.0 PROJECT NEXUS**

The two Wells 230 kV transmission lines were included in the FERC order issuing the Wells Project license (issued: July 12, 1962). Exhibit K maps of the transmission line corridor transmitted copies of as build Exhibits J and K showing the route of the transmission line of the Wells Project 2149. FERC approved the Exhibit J and K drawings and amended the license by order (issued: January 5, 1979).

The results of the RTE botanical and wildlife surveys will be used for Section 7 consultation under the ESA. Direct effects of the transmission corridor and/or maintenance of the corridor on RTE species or habitats are unknown. Ongoing maintenance of the transmission corridor could adversely affect RTE plants or wildlife, if any are present. The avian and botanical surveys will also be used to help guide future corridor management activities and to determine whether additional measures are needed to reduce the spread of noxious weeds and bird collisions.

## **6.0 METHODOLOGY**

The methods for conducting the botanical and terrestrial surveys described in the goals and objectives are each described below.

### **6.1 Botanical**

#### **6.1.1 RTE Plant Surveys**

The surveys for RTE plants will comprise the following tasks: (1) pre-field review; (2) field surveys; and (3) documentation and mapping of results. Each task is described below.

The pre-field review task consists of developing a “target” list of RTE plant species to guide field surveys. The pre-field review task will be initiated by sending letters to the FWS and WNHP requesting the latest information on RTE plant species known to occur or potentially occurring in or near the Wells Project area. The target list of RTE species potentially occurring in the Wells Project area will be developed based on input from the FWS and WNHP.

Information on habitat requirements, such as elevation, soils, and associated vegetation community, will be used to refine the list to those species most likely to be found in or near the Project area. This information will also be used to identify the habitats to be surveyed, with an emphasis on those that support RTE species with federal or state status as threatened or endangered. Botanists from the WNHP will also be asked for any additional information related to RTE species that may occur in the area.

Prior to beginning field surveys, project botanists will review the morphological characteristics of target RTE plant species to develop a search image, which improves detection and recognition abilities. This process will include reviewing herbarium specimens and collecting information on vegetative, floral, and fruit characteristics for each target species and other species that are closely related or otherwise difficult to distinguish from the target RTE species.

Surveys for RTE plants in the transmission line corridor will involve visually searching suitable habitat. RTE plant surveys will be conducted on foot using a random meander approach described in Nelson (1985). Surveys will be conducted by botanists experienced in conducting RTE plant surveys.

The habitat requirements of RTE species will be used to refine survey efforts. Habitats with a high probability of supporting one or more RTE plants will receive thorough coverage. Habitats with a lower likelihood of supporting these species will be surveyed less intensively. Actively cultivated fields will not be surveyed. RTE species will be recorded and mapped when encountered and habitats will be described.

The timing of RTE plant surveys is critical to the success and validity of the survey. The number of surveys to be conducted in 2008 will be determined by the blooming period of each RTE plant species.

RTE plants will be identified in the field using the Flora of the Pacific Northwest (Hitchcock and Cronquist 1973) and the Field Guide to Selected Rare Plants of Washington (WNHP 2004). A variety of sources will be utilized to verify tentative species identification including other floras, published papers, herbarium specimens, and consultation with appropriate taxonomic specialists. A list of all plant species identified during field surveys will be compiled and provided in the final report.

WNHP sighting forms will be completed for each RTE plant population found in the transmission line corridor. Data collected will include population size and area, phenology, habitat, slope, aspect, elevation, soils, and associated species. Factors affecting survival of RTE species (e.g., deer browse, disturbance, etc.) will be noted if applicable. The population locations will be mapped on survey maps and Global Positioning System (GPS) coordinates will be collected to verify the mapped location. Photographs will be taken of the RTE plants and habitats where they are growing.

Population size for RTE species will be visually estimated (for large populations) or counted (for small populations). For large RTE plant populations (and with agency permission), a voucher specimen will be collected, pressed, and dried for deposition at the University of Washington

Herbarium. Where collection poses a risk to the population, photographs will aid in verification by taxonomic specialists.

### **6.1.2 Invasive Species Surveys**

The surveys for invasive plants will comprise the following tasks: (1) pre-field review; (2) field surveys; and (3) documentation and mapping of results. Each task is described below.

Invasive species surveys will be focused on plants listed in Washington State as Class A and Class B Designate weeds. Class A weeds are non-native species with a limited distribution in the state; eradication of all Class A weeds is required by state law. Class B weeds are non-native species whose distribution is limited to portions of Washington State and control requirements vary between counties. A list of weed species will be developed of all Class A and B weeds found in Douglas County. Prior to beginning field season surveys, botanists will review the morphological characteristics of Class A and B weeds to develop a search image, which improves detection and recognition abilities.

Surveys for invasive plant species will be conducted in the transmission line corridor. These surveys will be conducted in conjunction with RTE plant surveys and field verification of the Vegetation Cover Type Map. Since many invasive species are easiest to see and identify later in the growing season, these surveys will be conducted in the June to August time period. All class A or B species will be mapped.

Infestations of invasive species will be mapped on project maps and GPS coordinates will be collected to verify the mapped location. Each infestation will be mapped as accurately as possible, to a resolution of 0.1 acre. Data gathered for each infestation will include the estimated total number of plants and the aerial cover and density by cover by class, as developed by the North American Weed Management Association (NAWMA 2003): trace ( $T < 1\%$ ), low ( $L = 1-5\%$ ), moderate ( $M = 5.1-25\%$ ), and high ( $H = 25.1-100\%$ ).

### **6.1.3 Cover Type Mapping**

The vegetation mapping study will involve three phases of work. The first two phases will identify general cover types through photo interpretation and field verification. The third phase will be the production of the final cover type map.

Douglas PUD received digitized color aerial photography of Douglas County from Natural Resources Conservation Service. The color digital orthophotos have a pixel resolution of one meter. Using these digital orthophotos, general vegetation types will be delineated by heads-up digitizing in ArcView Geographic Information system (GIS). Vegetation types and land use classifications will also be assigned.

ArcView GIS will be used to generate field maps containing the color orthophotography and the cover type polygons. Preliminary maps of vegetation cover types will be verified in the field by a botanist. This work will be completed while conducting RTE and invasive plant surveys. Field verification will involve checking a subset of the boundaries of the cover type polygons and correcting the assigned cover type classification and reassigning correct classifications as

needed. Corrections to the boundaries and cover type designations will be made directly on field copies of the maps.

Additional data will be collected during the field verification to describe the characteristics of each mapped cover type including species composition, stand structure, habitat quality and land use. Information collected will include:

- Plant species composition, including the dominate and more prominent associated species in each vegetation layer (tree, shrub and herbaceous layers);
- Structural data, including estimates of average heights and aerial cover of each vegetation layer;
- Predominant land use(s) associated with each cover type;
- Rare, unique and particularly high quality vegetation/habitat will be noted.

The contractor will use ArcView GIS to change any cover type polygons found to be in error during the field verification of the cover type map. The contractor will provide Douglas PUD with copies of all map products.

The contractor will be responsible for all equipment necessary to complete the field verification work.

## **6.2 Wildlife**

Assessments to be conducted include avian point counts, prairie grouse, raptor and corvid nesting surveys. In addition, surveys will be conducted for reptiles and mammals. Incidental to all wildlife and botanical surveys, avian mortalities will be located, recorded and collected. Special emphasis will be made to documenting the presence of RTE species and their habitat during these surveys.

### **6.2.1 Avian Surveys**

#### **6.2.1.1 Point Counts**

Avian surveys will be conducted to gather data on bird species that use various habitat types in the vicinity of the Wells Project 230 kV transmission line corridor. Surveys will be conducted four times from the first of May through the end of June, which is considered the peak of breeding season in North Central Washington. Four fall surveys will be conducted from September to October to capture the variability of the fall avian migration.

Assessing avian use during the breeding season will involve the use of point count stations (Bibby et al. 1992, Ralph et al. 1995) and transects (Leukering et al. 2000, Altman and Bart 2001). Because of the high degree of ecological variability associated with “special species” which are those species that: (1) are in habitats that are not well monitored, (2) are too rare or erratic to be sampled effectively, or (3) have an ecology that is not conducive to standard methodologies (e.g., inconspicuous, colonial, nocturnal, low densities), Altman and Bart (2001) recommend using a combination of monitoring methods to gather occurrence and relative abundance data. Thus, a combination of point count stations and transects distributed throughout

the study area will be sampled to maximize the probability of detecting the less common species as well as collecting adequate data on all species. This approach is termed a “point transect” (Altman and Bart 2001) and involves conducting standard 5-minute point count surveys at stations (Bibby et al. 1992, Ralph et al. 1995) and recording all detections of special species while walking routes between point count stations (Altman and Bart 2001). Point count stations will be a minimum of 820 ft (250 m) apart to avoid double-counting individual birds.

Avian surveys during the breeding season will take place between sunrise and 10:00 am (Altman and Bart 2001) and fall surveys will also start at sunrise and be completed by noon. Each bird detected via visual sighting or auditory call will be recorded, as well as the primary habitat type and the estimated distance from station center in 16 ft. (5 m) increments. All mammals or reptiles seen will also be recorded. Data will also be recorded to gather information on likely nesting or foraging behaviors or signs. Detections at point count stations will be divided into two time periods: 0-3 minutes and 3-5 minutes. For each detection made along survey transects, biologists will record species, number of individuals, habitat, and behavior. GPS will be used to document the point count and transect locations and to estimate the linear length of the transect survey. All biologists conducting the avian surveys will have expertise in auditory as well as visual identification of birds.

To provide a general description of the land surveyed, biologists will record habitat data at each survey station/transect. Habitat parameters will be estimated qualitatively and will include:

- Tree layer cover, height, and average diameter at breast height (DBH),
- Shrub layer height and cover,
- Herbaceous layer height and canopy cover,
- Snag and Large Woody Debris (LWD) abundance, and
- Dominant species.

Locations of avian survey stations and transects will be stratified based on: (1) study area zone, (2) vegetation cover type, and (3) adjacent land use immediately outside of the study area. The actual number of point-transects and point count stations will be determined following further review of aerial photography. However, based on study area size, it is anticipated that approximately 50-70 stations will be established along the point-transects, which will be distributed among the five study area zones in proportion to their relative land base and river length.

All data will be entered into and stored in a database. Analysis of avian data will involve calculation of species richness and species relative abundance (number per station per survey period) for each of the five habitats and for the five study area zones. Data collected during the walking and boat transect portions of the surveys will be analyzed independently from the point count stations. ArcView GIS will be used to develop report maps that display survey locations and significant findings.

#### 6.2.1.2 Prairie Grouse Surveys

Field surveys will be conducted during two time periods (late winter after snow melts and in September). Grouse transects will be placed randomly within large continuous blocks of native habitat in the study area along the transmission line corridor. A biologist will walk the transect looking for evidence of sage grouse or sharp-tailed grouse. All evidence of grouse use will be recorded and feathers collected for verification. Geographic coordinates of the location of any grouse observations will be established with a GPS receiver and recorded for later mapping.

All data will be stored in a database and mapped using ArcView GIS.

#### 6.2.1.3 Raptor and Corvid Nest Surveys

The raptor and corvid nest surveys will be conducted along the length of the transmission line corridor. A helicopter will be used during the surveys to search the transmission line lattice towers and the surrounding large conifer and deciduous trees, within 1/4 mile, for nests. The helicopter will travel at a speed that allows the observer to scan each tower and all the likely trees. The helicopters will remain far enough away from the nest to prevent the adults from flushing. A biologist familiar with raptor and corvids nesting will accompany the pilot and conduct the nest surveys and record data. The survey will be conducted in late May.

### 6.2.2 Mammal Surveys

Mammals using the project area will be documented by recording visual observations or sign, including scats, tracks and calls incidental to all field surveys (Call 1986). All observations of RTEs mammals will be recorded, habitat characteristics identified and locations mapped.

#### 6.2.3 Reptile Surveys

The use of the study area by striped whipsnake and other reptiles will be documented by visual encounter surveys (VES). Surveys will be conducted in representative native habitat, within the study area. Surveys will be conducted only during warm weather. The VES method involves searching habitat in a defined area, examining ground vegetation and under large objects (large rocks and woody debris) that may provide cover. All cover objects will be returned to their original position to avoid degradation of habitat. All reptiles will be identified without capturing them, if possible. If necessary, attempts will be made to capture individuals for identification, which will be followed by immediate release. All observations of RTEs reptiles will be recorded, habitat characteristics identified and locations mapped.

### 6.3 Documentation

Results of the botanical and wildlife surveys will be documented in a single report. The report will also summarize the methods used for each of the surveys. The results section of the report will include botanical information and wildlife species documented in the Project area. It will also include a matrix of wildlife species by habitat type and results of analyses of species abundance and distribution. Maps of survey locations and the distribution of RTE species will

also be part of the report. A draft report will be produced for review prior to preparing the final report.

The report will also include a description of the transmission corridor maintenance program. Potential impacts of the maintenance program to native habitat and RTE wildlife will be identified and summarized in the report.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

The botanical and wildlife studies will require botanists and biologists with requisite experience to conduct all surveys described above.

The contractors will be responsible to provide a helicopter for the raptor surveys.

The contractors will be responsible for all field data sheets, notebooks, binoculars, flora and other personal field equipment.

The contractors will be responsible for obtaining any permits required for the study.

## **8.0 BUDGET**

The estimate for total person hours required to complete the study is approximately 1756 hours. The botanical portion of the study is estimated at 848 person hours and the wildlife portion of the study at 908 person hours. Estimated hours include pre-field preparation, all field work, data analysis and report writing. The study is estimated to cost \$165,000.

## **9.0 SCHEDULE**

Planning for plant surveys will begin shortly after the issuance of FERC's Study Plan Determination in October 2007, with a pre-field research to refine a list of potential RTE plants and invasive species. Applications for permits that may be required for the botanical studies will be sent in during late 2007. Plant collections in the University of Washington herbarium will be studied to develop a sight picture of the RTE plants. Botanical field work is scheduled between May and the end of August 2008 and is dependent on the time RTE species bloom.

Planning for the wildlife surveys will begin in late 2007 with the application for a Scientific Collection Permit from WDFW. The wildlife field studies will begin in May 2008 and continue through the end of October 2008.

An Initial Study Report will be provided to the Terrestrial RWG, stakeholders and FERC in October 2008 with a final report summarizing the study results provided by October 2009.



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**SURVIVAL AND RATES OF PREDATION FOR JUVENILE PACIFIC  
LAMPREY MIGRATING THROUGH COLUMBIA RIVER  
HYDROELECTRIC PROJECTS  
(AQUATIC ISSUE 6.2.1.1)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington

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## ABSTRACT:

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (resource agencies and tribes) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The Aquatic RWG, through a series of technical meetings, is proposing a study intended to fill gaps in the local knowledge of juvenile Pacific lamprey (*Lampetra tridentata*) survival migrating through the Wells Project.

Although there is a growing body of information on adult Pacific lamprey and their interactions at hydroelectric projects, relatively little information exists related to the survival of outmigrating juvenile lamprey (macrophthalmia) at hydroelectric projects. A review of the recent body of literature related to juvenile lamprey survival passing through hydroelectric projects concludes that there is currently a lack of methodologies and technologies to effectively quantify the level of survival of juvenile lamprey migrating through a hydroelectric facility. In other words, no studies currently exist that document the level of survival attributed to a project's operations, nor does an accepted technology currently exist that would achieve this level of assessment for juvenile lamprey.

In lieu of being able to directly measure survival for juvenile lamprey passing through the Wells Project, the Aquatic RWG proposes to conduct an updated literature review which will compile all of the available information regarding juvenile lamprey survival at hydroelectric projects in the Columbia River Basin. Additionally, a field study will be implemented during the 2-year ILP study period to assess the significance of juvenile lamprey in the diets of predatory fishes and birds present in the Wells Forebay and Tailrace. Stomach samples of both predatory fishes and birds will need to be obtained and an effort will be made to coordinate with pre-existing activities that may already be collecting such specimens (An evaluation of the effects and alternatives to the existing piscivorous bird and mammal control program (Terrestrial Issue 6.2.3.1)).

A technical report summarizing the results of this study will be produced to provide a current state-of-the-science assessment of juvenile lamprey survival to address the issues raised by the Aquatic RWG. Furthermore, the results of the study will inform future Wells Project relicensing decisions by assessing the effectiveness of existing predator control programs (which have traditionally targeted salmonid predators) for juvenile lamprey.

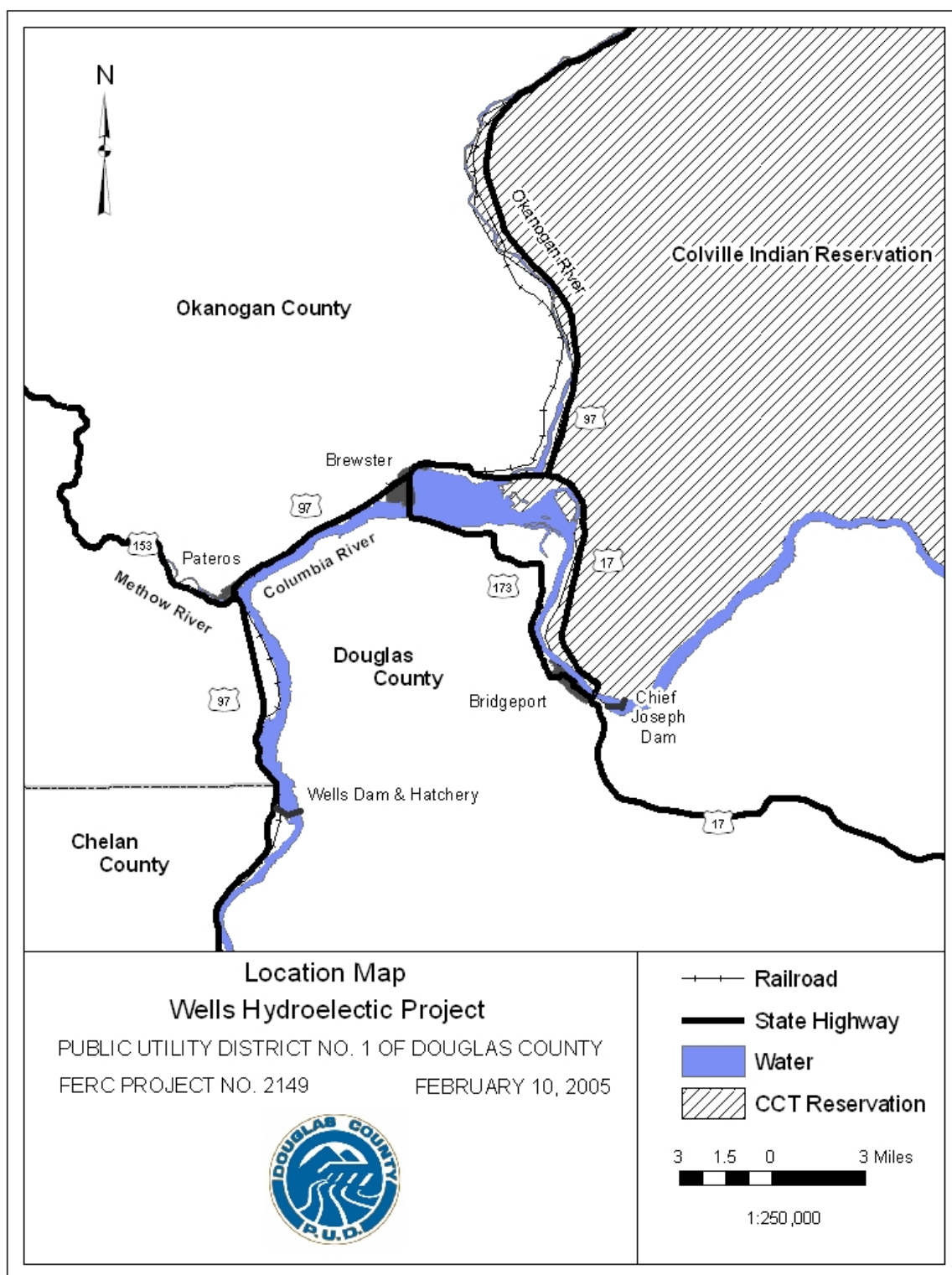
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project, owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for the Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1. Location Map of the Wells Project**

## **1.2 Relicensing Process**

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## **2.0 GOALS AND OBJECTIVES**

The goal of this study is to collect up-to-date information on the survival and the rates of predation of juvenile Pacific lamprey *macrophthalmia* migrating through Columbia River hydroelectric Projects and to collect site specific information on rates of predation on juvenile lamprey in the waters immediately upstream and downstream of Wells Dam. This information will be used to inform existing predator control programs in the reduction of predation on juvenile lamprey *macrophthalmia*.

The specific work needed to accomplish this goal is:

- Conduct a literature review on juvenile lamprey macrophthalmia survival and predation studies conducted at Columbia River hydroelectric projects.
- Conduct an analysis on the stomach contents of predatory fish and birds (if feasible) to assess the location (only applicable to fish) and level of predation that may be occurring on juvenile Pacific lamprey macrophthalmia in the Wells Forebay and Tailrace.

### 3.0 STUDY AREA

The study area for field activities will consist of the Wells Forebay and Tailrace. The Wells Tailrace is defined, for this study, as the waters immediately below Wells Dam downstream to a distance of 3000 feet. The definition of the Wells Forebay, for this study, extends 1,000 feet upstream from the face of the dam (Figure 1.1-1).

### 4.0 BACKGROUND AND EXISTING INFORMATION

Pacific lamprey (*Lampetra tridentata*) are present in most tributaries of the Columbia River and in the mainstem Columbia River during their migration stages. They have cultural, utilitarian and ecological significance including the ceremonial, subsistence and medicinal use of adult lamprey by Native Americans (Close et al. 2002). As an anadromous species, they also contribute marine-derived nutrients to the aquatic and terrestrial ecosystem found in the interior Columbia Basin. Little specific information is available on the life history or status of lamprey in the mid-Columbia River watersheds. They are known to occur in the Methow, Wenatchee and Entiat rivers (NMFS, 2002) and recently have been captured during juvenile trapping operations in the Okanogan River.

In general, adults are parasitic on fish in the Pacific Ocean while ammocoetes (larvae) are filter feeders that inhabit the fine silt deposits in backwaters and quiet eddies of streams (Wydoski and Whitney, 2003). Adults generally spawn in low-gradient stream reaches in the tail areas of pools and in riffles, over gravel substrates (Jackson et al. 1997). Adults die after spawning. After hatching, the ammocoetes burrow into soft substrate for an extended larval period filtering particulate matter from the water column (Meeuwig et al. 2002). The ammocoetes undergo a metamorphosis to macrophthalmia between 3 and 7 years after hatching, and migrate from their parent streams to the ocean from October to April (Close et al., 2002). Adults typically spend 1-4 years in the ocean before returning to freshwater tributaries to spawn.

Pacific lamprey populations of the Columbia River have declined in abundance over the last 40 years according to counts at dams on the lower Columbia and Snake rivers (Close et al. 2002). Starke and Dalen (1995) reported that adult lamprey counts at Bonneville Dam that regularly exceeded 100,000 fish in the 1960s. More recently lamprey counts have ranged between 20,000 and 120,000 for the period 2000-2004 (DART - [www.cqs.washington.edu/dart/adult.html](http://www.cqs.washington.edu/dart/adult.html)).

Close et al. (2002) identified several factors that may account for the decline in lamprey counts in the Columbia River Basin. This includes reduction in suitable spawning and rearing habitat from flow regulation and channelization, pollution and chemical eradication, reductions of prey in the ocean, and juvenile and adult passage problems at dams (Nass et al., 2005).



Although there is a growing body of information on adult Pacific lamprey and their interactions at hydroelectric projects, relatively little information exists describing the effects of hydroelectric plant operations on outmigrating juvenile lamprey (macrophthalmia). Recent juvenile lamprey studies at hydroelectric projects have addressed testing for lamprey macrophthalmia survival through juvenile bypass facilities (Bleich and Moursund, 2006), impingement by intake diversion screens (Moursund et al., 2000 and 2003), validation of existing screening criteria (Ostrand, 2005), and responses of juvenile Pacific lamprey to simulated turbine passage environments (Moursund et al., 2001; INL, 2006). Results of other studies targeting predaceous birds and fish suggest that juvenile lamprey may compose a significant proportion of the diets of these predators (Poe et al., 1991; Merrell, 1959).

A review of the recent body of work addressing juvenile lamprey at hydroelectric facilities concludes that there is a current lack of a methods and tools to effectively quantify the level of survival for juvenile lamprey migrating through hydroelectric facilities. Furthermore, no studies exist that assign a level of survival attributed to a project's operations. This is due to the lack of miniaturized active tag technologies to overcome two study limitations. Macrophthalmia (juvenile outmigrating lamprey) are relatively small in size and unique in body shape and they tend to migrate low in the water column resulting in the rapid attenuation of active tag signal strength. In an effort to develop a tagging protocol, the Bonneville Power Administration (BPA) annually funds Oregon State University (OSU) to identify and develop tag technologies for lamprey macrophthalmia. Recent reports on this developmental effort have concluded that the smallest currently available radio-tag was still too large for implantation in the body cavity of a juvenile lamprey (Schreck et al., 2000). Additionally, external application was not effective as animals removed tags within the first week and fish performance was affected. This report also concluded that internal implantation of Passive Integrated Transponder (PIT) tags was the most viable option for tagging juvenile lamprey although this method included severe limitations such as the limited range of detection systems and the ability to tag only the largest outmigrating juvenile lamprey (Schreck et al., 2000).

## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these meetings and discussions, the Aquatic RWG is proposing to include a study plan into the Wells PAD to collect and summarize the existing literature related to juvenile lamprey survival at hydroelectric projects and to assess the level of juvenile lamprey predation taking place within the Wells Tailrace. The need for this study was agreed to by all of the members of the Aquatic RWG, including Douglas PUD. This study will help to inform future relicensing decisions and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Finalized Issue Statement (6.2.1.1)**

Operations of the Project may affect juvenile Pacific lamprey dam passage and reservoir survival (survival, route of passage and timing) during their downstream migration.

### **Final Issue Determination Statement (6.2.1.1)**

It is unknown as to whether there is a Project effect on juvenile lamprey. At this time, there are no studies documenting Project effects on juvenile lamprey. However, dam passage survival can be broken down into 4 specific areas of concern; survival, route of passage, timing and predation. Currently, there are two limitations to the implementation of a field study for dam passage survival; 1) tag technology for juvenile macrophthalmia is currently being developed; and 2) obtaining macrophthalmia in sufficient numbers within the Project to meet sample size requirements for a statistically rigorous study is not practicable. Reservoir predation on juvenile lamprey is unknown. A review of existing data and literature on predation, including bird predation in the tailrace, would be beneficial.

The resource work group agrees that a study is needed during the two-year ILP study period. This study will include an updated literature review on juvenile lamprey survival and predation on juvenile lamprey and will examine the stomach contents of fish. If permits can be obtained, the study will also examine the stomach contents of birds.

## **5.0 PROJECT NEXUS**

Anadromous lamprey actively migrate from estuarine and marine waters to freshwater spawning areas as adults. Upon metamorphosis, juveniles participate in both active and passive emigration from freshwater rearing areas. In the Columbia River Basin, lamprey may migrate hundreds of kilometers through both mainstem and tributary habitats. Consequently, they encounter a variety of obstacles to passage that could affect their populations. Recent research has indicated that large hydropower dams delay and obstruct adult passage (LTWG, 2005). These facilities may also affect the downstream passage of juvenile lamprey during their outmigration. Specifically, areas of turbulence in the Wells Tailrace could increase the susceptibility of juvenile lamprey macrophthalmia to predation.

Currently, little information exists as to the types and levels of impact that may occur to outmigrating juvenile lamprey through hydroelectric facilities. Given the current limitations in

technology and methods capable of accurately quantifying impacts to juvenile lamprey migrating through hydroelectric facilities, the proposed study will review and condense the most accurate and scientifically available information related to juvenile lamprey passage through Columbia River dams.

In addition to the literature review, stomach content analysis will be conducted from predatory birds and fish found within the Wells Tailrace and predatory fish found in the Wells Forebay. Stomach contents will be used to determine whether juvenile Pacific lamprey are being consumed by predators and the location where they are being consumed while migrating through the Wells Reservoir and following passage through Wells Dam. Given the difficulty in assessing the location of predation activity by birds, location information will only be applicable to predatory fish. This study plan is not proposing to develop new technologies. The information collected from this study will help to inform the development of license requirements (18 CFR § 5.9(b)(5)) by assessing the effectiveness of existing predator control programs (traditionally aimed at targeting salmonid predators) with regards to predation on juvenile Pacific lamprey. Based upon the results of the study, predator control programs may be modified to maximize protection for outmigrating juvenile lamprey while continuing to ensure high levels of protection for juvenile salmonids.

## **6.0 METHODOLOGY**

The literature review will consist of a search of all existing information currently available on juvenile lamprey survival and predation at hydroelectric projects in the Columbia River Basin. This search will examine the availability of information from peer-reviewed journals, federal and state publications, academia, private industry, and grey literature. References cited from the initial literature search that are of relevance to the subject matter will also be collected and added to the literature database. An annotated bibliography will be produced from the results of the literature search.

The field collection and analysis of stomach contents will consist of the collection of various predators known to be present in the Wells Forebay and Tailrace. Fish species that will be collected are northern pikeminnow (*Ptychocheilus oregonensis*), smallmouth bass (*Micropterus dolomieu*), and walleye (*Stizostedion vitreum*). Fish will be collected via angling and through coordination with other programs that are already capturing such species; i.e., northern pikeminnow removal program in the Wells Project and Chelan PUD predation study in the Wells Tailrace. An effort will be made to collect 20 samples of both smallmouth bass and walleye from the Wells Tailrace. Stomach contents from 500 northern pikeminnow in both the Wells Tailrace and above Wells Dam in the reservoir will be collected from the existing predator control program. These data will assist in a comparative analysis of rates of predation upon juvenile lamprey before and after passage through Wells Dam.

In addition to fish species collection, the stomach contents of avian species that are present in the Wells Tailrace will also be analyzed pending the ability to secure the appropriate permits. There may be opportunities to coordinate with existing or proposed programs that collect avian predators in the Wells Tailrace or Wells Hatchery. Currently, the United States Department of Agriculture (USDA) oversees a piscivorous bird damage management program for the protection

of juvenile salmonids on the Mid-Columbia River (USDA, 2003). This program is a potential source of avian predator samples for the study. Furthermore, the Terrestrial RWG has submitted a proposed study to evaluate the effects and alternatives to the existing piscivorous bird and mammal control program. Provided that FERC approves the study plan for the piscivorous bird control study, then there may be an opportunity to secure samples through the implementation of this study. The number of samples and the species of birds to be sampled will be dependent upon the availability of samples from these other studies. At a minimum, an effort will be made to obtain samples from at least 2 of each bird species that are removed from the Wells Project.

Both predatory fish and bird collection will occur from May through July, 2008 to coincide with the juvenile Pacific lamprey outmigration in the mid-Columbia River. Sampling effort during the study will also be segregated in an effort to collect samples throughout the entire outmigration period. General information such as location, date, and time of capture will be recorded in addition to biological information (length, weight, species, sex) of samples collected independently or through coordinated efforts. All samples collected by Douglas PUD will be sent to an accredited laboratory for analysis. Samples will be preserved according to Quality Assurance/Quality Control specifications of the accredited laboratory. Data acquired from the stomach content analysis will consist of prey species diversity, prey species percent composition, and a comparative analysis of the levels of predation observed by location (applicable only to predatory fish) and by predator species.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

Based upon discussions with the Aquatic RWG regarding specific study design and study needs, Douglas PUD will secure the assistance of a qualified consultant(s) to conduct the literature review and if necessary, coordinate the field sampling and laboratory analysis of stomach samples.

No special equipment will be necessary to complete this study with the notable exception of a boat capable of safely accessing the Wells Tailrace and permits for the collection of stomach samples from birds and fish found within the Wells Tailrace. Should the applicable permits be secured prior to the study, the existing USDA contractor will use shotguns to collect stomach samples from birds collected from the Wells Tailrace. Stomach samples from predatory fish will be collected through the existing long-line predator control program and may be augmented through other angling efforts.

The technical skills necessary to complete the study literature portion of the study are knowledge of data acquisition and management.

## **8.0 BUDGET**

The total estimated hours for study implementation is approximately 1,400 person hours. The allocation of these hours is approximately 64 hours for project management and coordination; 568 hours for the literature review; 392 hours for the predator stomach analysis; and 376 hours for data analysis and reporting. Labor costs are estimated to be \$116,000. Equipment costs and

expenses related to implementation (travel, miscellaneous supplies, boat use) are estimated to be \$12,000. Total planning level cost for this effort is approximately \$128,000.

## **9.0 SCHEDULE**

The literature review will begin shortly after FERC's issuance of the Study Plan Determination in October 2007. The results of the literature review will be detailed in a brief report and annotated bibliography.

If sampling associated with the field portion of the study is necessary, it will occur from May to July of 2008. Laboratory analysis of stomachs collected will occur in late summer 2008. An Initial Study Report will be provided in October 2008. The Initial Study Report will detail the results of the field study and literature review. A final report will be available by October 2009 for use by FERC, the Aquatic RWG and stakeholders in discussions related to the Wells Project relicensing.

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**AN ASSESSMENT OF ADULT PACIFIC LAMPREY SPAWNING  
WITHIN THE WELLS PROJECT (AQUATIC ISSUE 6.2.1.2)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (resource agencies and tribes) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The Aquatic RWG, through a series of technical meetings, is proposing a study intended to examine the effects of Wells Project operations on adult Pacific lamprey (*Lampetra tridentata*) habitat, specifically spawning habitat.

Currently, the information available in the mid-Columbia River on adult Pacific lamprey addresses only their migration through hydroelectric projects. No studies have been conducted to examine the presence of spawning within a Project area and further whether Project operations impact lamprey spawning.

The study proposes to identify sites within the Wells Project where suitable spawning habitat may be available through an analysis using Geographic Information Systems (GIS). These sites will be field verified for suitability prior to the implementation of a field study. The field study will consist of spawning surveys throughout the lamprey spawning period (typically May to July) in 2008. If spawning activity is observed, an analysis will be conducted to examine whether Wells Dam operations have an effect on lamprey spawning habitat.

A technical report summarizing the results of this study will be produced to help fill the information gap identified by the Aquatic RWG. The results of the study will assist the Aquatic RWG in future Wells Project relicensing decisions.

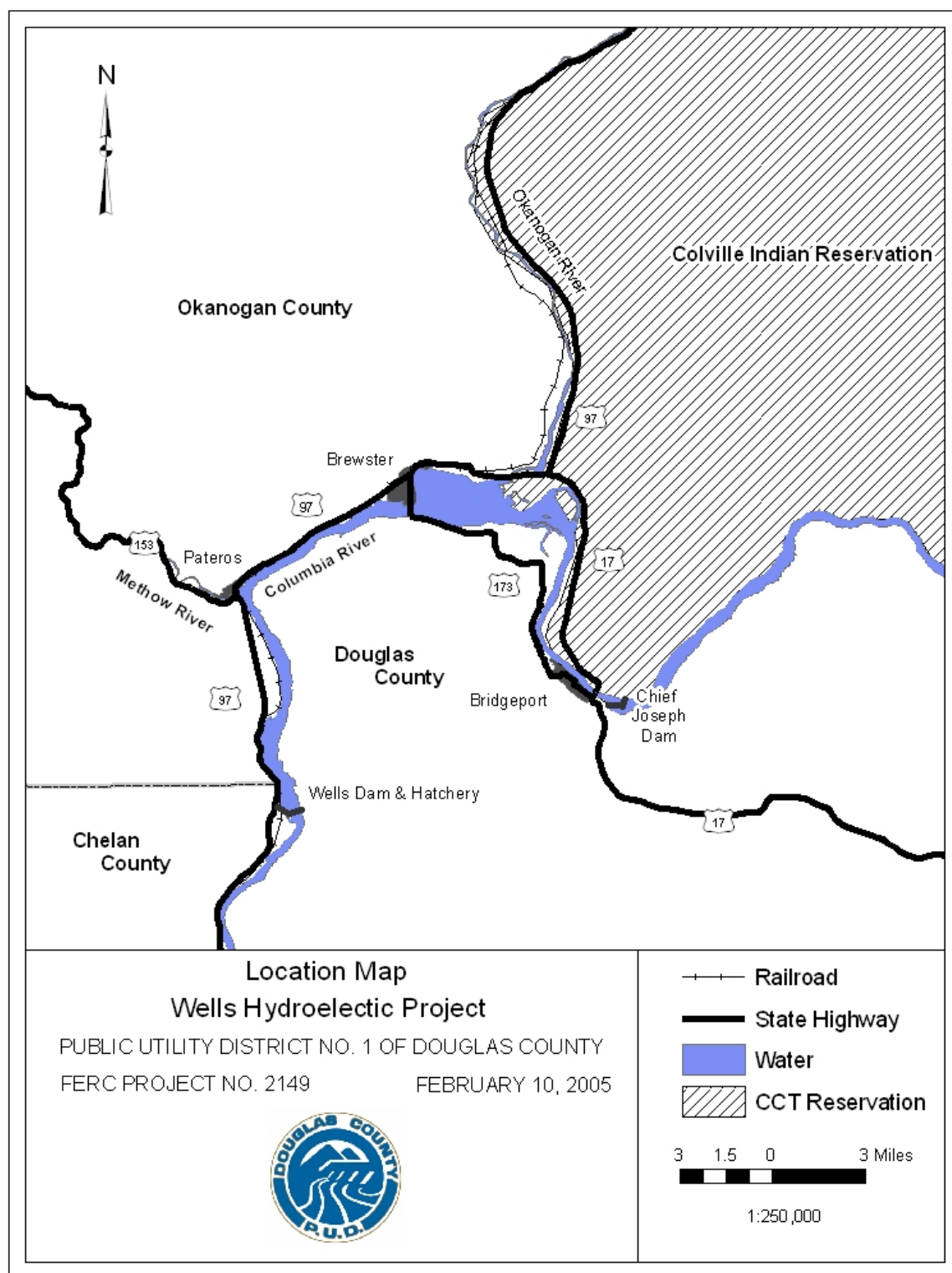
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project, owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**

## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The primary objective of this study is to assess the level of spawning activity by adult Pacific lamprey in the Wells Project and whether Wells Dam operations are affecting this activity.

Specific objectives of the study include:

- Identify areas within the Wells Project where suitable spawning habitat may exist for adult Pacific lamprey,
- Survey these areas of spawning habitat for use by lamprey to confirm suitability, and
- Assess whether the operations of Wells Dam are having adverse effects on these spawning areas (i.e., dewatering, flow alterations, scour, etc.).

### **3.0 STUDY AREA**

The study area is defined as the waters within the Wells Reservoir and Wells Tailrace. The Wells Reservoir consists of the mainstem Columbia River upstream of Wells Dam to the tailrace of Chief Joseph Dam, and the Okanogan (to RM 15.5) and Methow (to RM 1.5) rivers within Project boundary. The Wells Tailrace consists of the Columbia River downstream of Wells Dam within Project boundary (approximately 1.2 miles) (Figure 1.1-1).

### **4.0 BACKGROUND AND EXISTING INFORMATION**

Pacific lamprey are present in most tributaries of the Columbia River and in the mainstem Columbia River during their migration stages. They have cultural, utilitarian and ecological significance in the basin since Native Americans have historically harvested them for subsistence, ceremonial and medicinal purposes (Close et al., 2002).

Pacific lamprey are cartilaginous, jawless, anadromous fish that develop morphologically and physiologically in three primary stages. First, lamprey begin as larvae that hatch after approximately 19 days at 15°C (Close et al., 2002). After hatching, they remain a larvae (also known as ammocoete) for 4 to 6 years (10-200 mm body length). Ammocoetes reside burrowed in fine sediment (Close et al. 2002) during this time filter feeding on diatoms, algae, and detritus by pumping water through their branchial chamber (Beamish and Levings, 1991). Lamprey then enter a transformation phase (ocean-migrating macrophthalmia) and migrate from their parent streams to the ocean. Pacific lamprey transform from ammocoetes to macrophthalmia from July to November (Hammond, 1979 and Close et al., 2002). During transformation, the shape and angle of the head and mouth changes, and the gut develops to allow consumption of flesh and fluids (Hart, 1973). The macrophthalmia migrate to the ocean between late fall and spring and are physiologically capable of handling life in salt water. They spend 1 to 4 years as adults feeding as external parasites on marine fish and mammals before returning to freshwater to spawn (Beamish, 1980 and Close et al., 2002).

Upstream migrating Pacific lamprey are likely heading to tributaries or mainstem holding and/or spawning areas to over-winter. Though their exact timing likely varies among locations, upstream migration has been documented to cease in mid-September (Beamish, 1980), and resume in mid-March of the following spring if the final spawning destination has not been reached (Bayer et al., 2001). Somewhat like salmon, adult lamprey dig depressions in the gravel of freshwater streams. Spawning occurs in the spring and early summer (May to July) following the upstream migration year (Lê et al., 2004). Lamprey prefer low-gradient reaches, with gravel-pebble-sand substrate for spawning (Mattson, 1949 and Close, 1995). Adults generally spawn in low-gradient stream reaches in the tail areas of pools and in riffles, over gravel substrates (Jackson et al., 1997). Lamprey die after spawning (Hart, 1973).

Pacific lamprey populations of the Columbia River have declined in abundance over the last 40 years according to counts at dams on the lower Columbia and Snake rivers (Close et al., 2002). Starke and Dalen (1995) reported that adult lamprey counts at Bonneville Dam that regularly exceeded 100,000 fish in the 1960s and more recently have ranged between 20,000 and 120,000 for the period 2000-2004 (DART - [www.cqs.washington.edu/dart/adult.html](http://www.cqs.washington.edu/dart/adult.html)).

Close et al. (1995, 2002) identified several factors that may account for the decline in lamprey counts in the Columbia River Basin. This includes reduction in suitable spawning and rearing habitat from flow regulation and channelization, pollution and chemical eradication, reductions of prey in the ocean, and juvenile and adult passage problems at dams.

Little specific information is available on the life history or status of lamprey in the mid-Columbia River watersheds. They are known to occur in the Methow, Wenatchee and Entiat rivers (NMFS, 2002) and recently have been captured during juvenile trapping operations in the Okanogan River above Project boundary. In the mid-Columbia River basin, available information exclusively addresses adult lamprey passage and behavior through hydroelectric projects via radio-telemetry studies and dam counts (Nass et al., 2003 and 2005; Stevenson et al., 2005). Similarly in the Wells Project, adult passage information is available through a preliminary radio-telemetry study (Nass et al., 2003) and counts at Wells Dam (since 1998). Currently, no studies have been conducted on adult Pacific lamprey related to spawning within the Wells Project.

## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these discussions, the Aquatic RWG is proposing to include a study plan into the Wells PAD to determine whether adult Pacific lamprey are spawning within the Wells Project and if so, whether the operation of Wells Dam is affecting this habitat. The need for this study was agreed to by all of the members of the Aquatic RWG, including Douglas PUD. This study will help to inform future relicensing decisions and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Issue Statement (6.2.1.2)**

The Wells Project may affect adult Pacific lamprey habitat use.

### **Issue Determination Statement (6.2.1.2)**

There were two types of habitat identified by the group (spawning and overwintering habitat). It is unlikely that there is a Project effect on adult lamprey overwintering habitat. Literature suggests that overwintering habitat for adult Pacific lamprey consists of deep pools. In the Wells Reservoir deepwater habitat is plentiful and undisturbed by Project operations.

There is no information currently available related to adult lamprey spawning habitat within the Wells Project. Existing literature (Beamish, 1980) suggests that adult lamprey prefer smaller tributaries that are characterized by suitable spawning substrate and velocities (pool-tailouts, large gravel to small cobble substrate, depth of 1 meter). This type of habitat is generally not available within the Wells Project.

Adult Pacific lamprey spawning has not been documented within the Wells Project; however, there may be areas within the Wells Project that may have marginal spawning habitat for adult Pacific lamprey.

The resource work group agrees that a study is needed to determine whether adult lamprey are spawning within the Wells Project and if so, whether the operation of Wells Dam is affecting this habitat. This study should be conducted during the two-year ILP study period.

## **5.0 PROJECT NEXUS**

Two recent reviews of Pacific lamprey (Hillman and Miller, 2000 and Golder Associates Ltd., 2003) in the mid-Columbia River have indicated that little specific information is known on their status. Within the Wells Project waters, no studies have been conducted to address the level of spawning that may be occurring and whether Project operations affect lamprey spawning habitat. Pacific lamprey spawning has been observed in the Lower Columbia River from May to July (Lê et al., 2004)) and habitat preferences consist of the tail-outs of pools and riffles over gravel substrate (Jackson et al., 1997). This type of habitat is characteristic of the upper reaches of tributary streams in the mid-Columbia River system, however within the Wells Project boundary, there may be patches of habitat meeting these criteria. If adult lamprey are utilizing these areas of suitable habitat, it is important to assess whether Wells Project operations have any adverse effects on these areas during periods of lamprey spawning. Potential adverse effects attributed to Project operations may include flow fluctuations or dewatering of lamprey nests. The proposed lamprey spawning study will assist in filling the information gap identified by the Aquatic RWG and in the development of licensing requirements for the Wells relicensing process.

## **6.0 METHODOLOGY**

Implementation of the study will consist of three separate components:

- The use of detailed bathymetry, high resolution orthophotographic information, and knowledge of Douglas PUD staff to identify areas within the Wells Project that are consistent with spawning habitat requirements of Pacific lamprey (Beamish, 1980),

- Conduct spawning surveys of these identified potential spawning areas when the probability of adult lamprey spawning is highest (May to July), and
- If spawning is observed, assess whether Wells Dam operations affect habitat in such a way to adversely impact spawning or spawning success.

In order to develop a map of sites that may be suitable for lamprey spawning, an analysis utilizing a Geographic Information System (GIS) will be conducted. A GIS will be used to integrate bathymetric data and high resolution orthophotography to better refine potentially suitable spawning areas within the Wells Project. This information will be coupled with the knowledge of Douglas PUD staff to identify suitable spawning habitat. A map will be produced identifying the areas within the Wells Project that consist of depths (approximately 1 meter), habitat type (low gradient riffles and pool-tailouts), and substrate (large gravel) typical of lamprey spawning habitat. Sites on this map will be field verified prior to field surveys to ensure that the identified habitat is consistent with the spawning requirements of adult lamprey.

Foot and boat surveys of the potential spawning areas will occur, beginning in May, 2008 or when flows allow. All field sites will be visited once a week by two field biologists with training in Pacific lamprey nest identification. Physical characteristics of nests will be measured, including: habitat type (riffle, pool-tail out, run, pool), nest dimensions, substrate (dominant, sub-dominant and % fines), and flow. If applicable, presence of adults on the nest will be noted as well as number and sex of fish. When possible, locations of each nest will be recorded with global positioning system (GPS) technology. Nests will be marked with weighted flagging to determine nest longevity and to avoid counting nests twice upon subsequent surveys. Weighted flags will be removed on subsequent surveys if the nest no longer appears viable. Lamprey in the lower Columbia River basin typically spawn from May to July and as such, spawning ground surveys will be conducted in the Wells Project during this time period. If activity continues to be observed past this period of time, spawning surveys will continue at the identified reaches until no activity is observed.

If spawning is observed in any of the identified reaches, an assessment of the Wells Project operations and its potential effects on these areas will need to be conducted. This portion of the study will be integrated into the spawning surveys and will likely be conducted between May and July 2008 with analysis and report preparation taking place prior to October 2008. A combination of GPS locations of observed lamprey nests, detailed bathymetry of the spawning reach, historical river flow information and typical Wells Project operations during this time period can be used to develop a backwater curve to assess the likelihood of nest dewatering or scour events induced by Project operations and the magnitude of this effect to spawning lamprey.

Facilities and equipment necessary to complete the habitat assessment portion of the study will consist of a computer with GIS software and the associated data sets. Field equipment consisting of flow meters, staff gauges, waders, GPS unit, camera, flagging, and weights will be required to conduct the spawning surveys. Use of vehicles and possibly motorboats will also be necessary to access possible survey sites. If an assessment of Project effects is required, access to current and historical databases of river flow, Project operations, and data collected during the field surveys will be necessary to assess whether Wells Project operations affect spawning lamprey.



## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

Douglas PUD will provide the necessary equipment and staff to conduct all phases of the study based upon discussions with the Aquatic RWG regarding specific study design and study needs.

The technical skills necessary to complete the study are knowledge of Pacific lamprey life history and general biology, biological sampling methods including nest identification, data acquisition and management, GPS and GIS technology, hydrologic modeling (if necessary), and motor boat operation and safety.

No permits are required to complete the study.

## **8.0 BUDGET**

The total estimated hours for the implementation of a Wells Project Pacific lamprey spawning assessment is approximately 1,024 person hours. The allocation of these hours is approximately 144 hours for GIS and habitat suitability analysis; 256 hours for on-the-ground field verification of GIS analysis output; 384 hours for field spawning surveys; and 240 hours for data analysis and reporting. Labor costs are estimated to be \$84,000. Equipment costs and expenses related to implementation (travel, miscellaneous supplies, software, boat use, etc.) are estimated to be \$22,000. Total planning level cost for this effort is approximately \$106,000.

## **9.0 SCHEDULE**

Planning for this study will begin shortly after the issuance of FERC's Study Plan Determination in October 2007, with an initial analysis of potential spawning areas in the Wells Project. Results of this analysis will be used to develop the field survey portion of the study which is scheduled to take place between May and July 2008. Results of the 2008 spawning survey will be provided to the Aquatic RWG and filed with FERC in the form of an Initial Study Report due in October 2008. A final report will be provided to FERC and stakeholders by October 2009.

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**ADULT PACIFIC LAMPREY PASSAGE  
AND BEHAVIOR STUDY (AQUATIC ISSUE 6.2.1.3)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (resource agencies and tribes) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The Aquatic RWG, through a series of technical meetings, is proposing a study to examine the effects of the Wells Project and its operations on the migration of adult Pacific lamprey (*Lampetra tridentata*).

To perform this study, Douglas PUD will undertake a radio-telemetry study to assess migration and passage characteristics of adult lamprey migrating through Wells Dam. Adult lamprey will be captured in the fishways at Wells Dam during August and September 2008. All captured lamprey meeting specific size criteria will be tagged and released at or below Wells Dam. A combination of fixed-station monitoring at Wells Dam will be used to determine migration and passage characteristics of these tagged fish.

A technical report summarizing the results of this study will provide the resource information needed to inform relicensing decisions related to adult lamprey passage through Wells Dam.

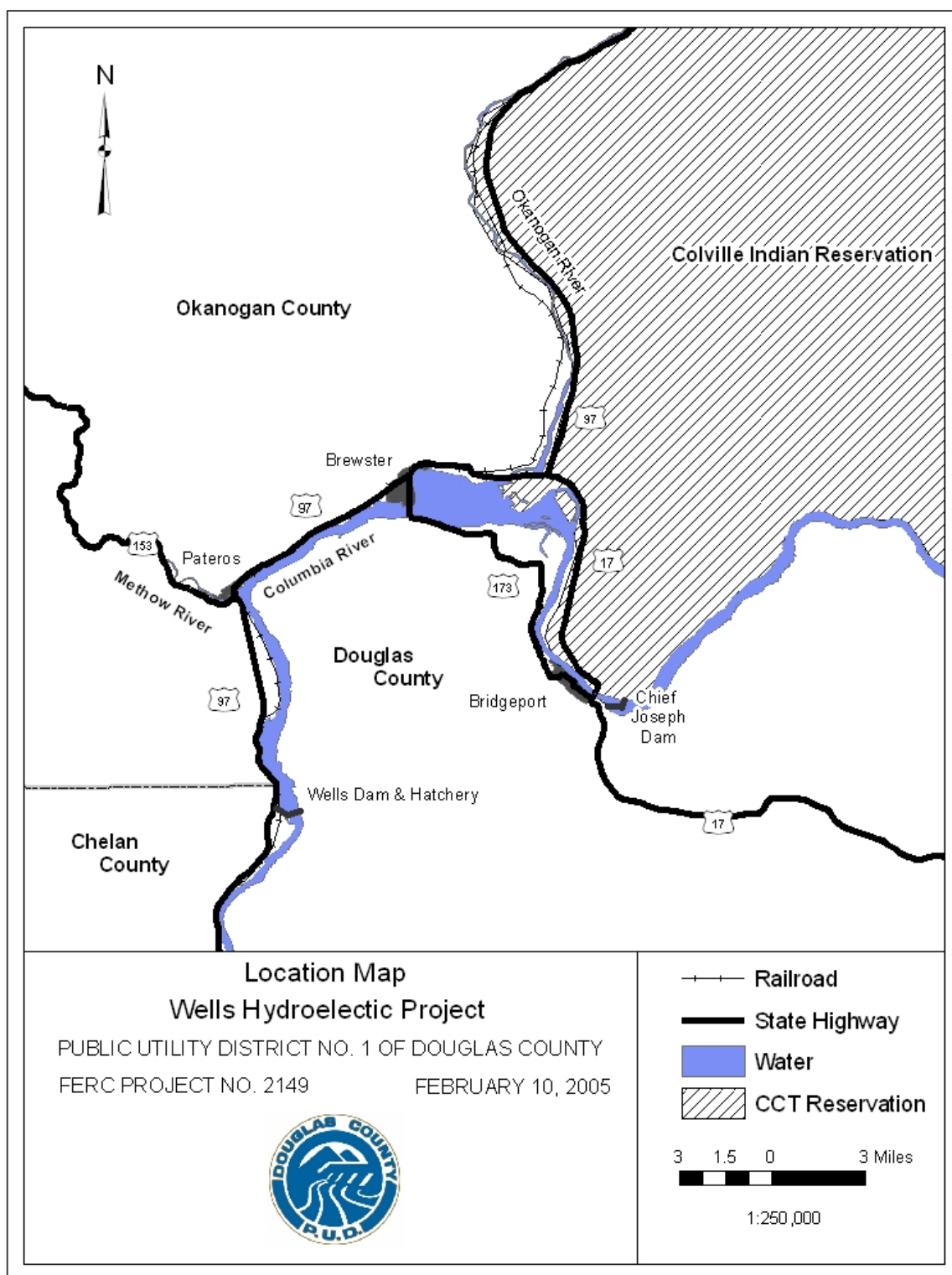
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**



## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The goal of this study is to evaluate the effect of the Wells Project and its operations on adult Pacific lamprey behavior related to ladder passage, timing, downstream passage events (drop back) through the dam and upstream migration. This information will be used to help identify potential areas of passage impediment within the Wells ladders.

Specific objectives of the study include:

- Conduct a literature review of existing adult Pacific lamprey passage studies at Columbia and Snake river dams;
- Identify methods for capturing adult Pacific lamprey at Wells Dam;

- Document the timing and abundance of radio-tagged lamprey passage through Wells Dam;
- Determine whether adult lamprey are bypassing the adult counting windows at Wells Dam;
- Where sample size is adequate, estimate passage metrics including fishway passage times and efficiencies, residence time between detection zones and downstream passage events (drop back); and
- If necessary, identify potential areas of improvement to existing upstream fish passage facilities for the protection and enhancement of adult lamprey at the Wells Project.

### **3.0 STUDY AREA**

The study area includes Wells Dam, the Wells Dam tailrace, and the Wells Dam forebay (Figure 1.1-1).

### **4.0 BACKGROUND AND EXISTING INFORMATION**

Pacific lamprey are present in most tributaries of the Columbia River and in the mainstem Columbia River during their migration stages. They have cultural, utilitarian and ecological significance in the basin since Native Americans have historically harvested them for subsistence, ceremonial and medicinal purposes (Close et al. 2002). As an anadromous species, they also contribute marine-derived nutrients to the basin. Little specific information is available on the life history or status of lamprey in the mid-Columbia River watersheds. They are known to occur in the Methow, Wenatchee and Entiat rivers (NMFS, 2002) and recently have been captured during juvenile trapping operations in the Okanogan River.

In general, adults are parasitic on fish in the Pacific Ocean while ammocoetes (larvae) are filter feeders that inhabit the fine silt deposits in backwaters and quiet eddies of streams (Wydoski and Whitney, 2003). Adults generally spawn in low-gradient stream reaches in the tail areas of pools and in riffles, over gravel substrates (Jackson et al. 1997). Adults die after spawning. After hatching, the ammocoetes burrow into soft substrate for an extended larval period filtering particulate matter from the water column (Meeuwig et al. 2002). The ammocoetes undergo a metamorphosis, between 3 and 7 years after hatching, and migrate from their parent streams to the ocean from October to April (Close et al., 2002). Adults typically spend 1-4 years in the ocean before returning to freshwater tributaries to spawn.

Pacific lamprey populations of the Columbia River have declined in abundance over the last 40 years according to counts at dams on the lower Columbia and Snake rivers (Close et al. 2002). Starke and Dalen (1995) reported that adult lamprey counts at Bonneville Dam that regularly exceeded 100,000 fish in the 1960s and more recently have ranged between 20,000 and 120,000 for the period 2000-2004 (DART - [www.cqs.washington.edu/dart/adult.html](http://www.cqs.washington.edu/dart/adult.html)).

Close et al. (2002) identified several factors that may account for the decline in lamprey counts in the Columbia River Basin. This includes reduction in suitable spawning and rearing habitat

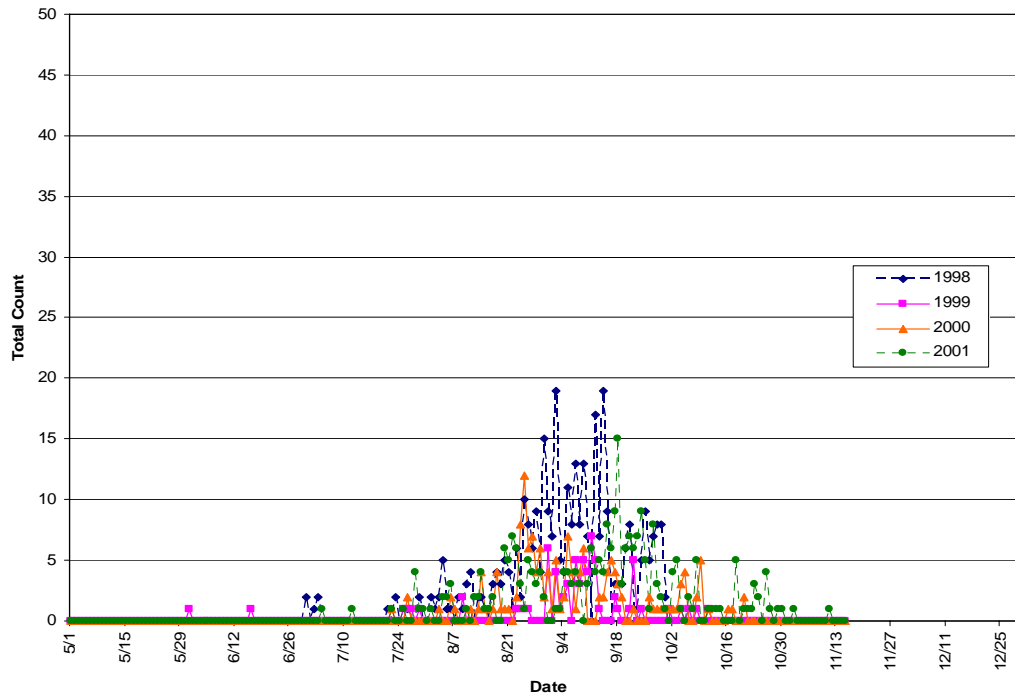
from flow regulation and channelization, pollution and chemical eradication, reductions of prey in the ocean, and juvenile and adult passage problems at dams (Nass et al., 2005).

Returning adult Pacific lamprey have been counted at Wells Dam since 1998. Between the years of 1998 and 2005, the numbers of lamprey passing Wells Dam annually has averaged 401 fish and ranged from 73 fish in 1999 to 1,417 fish in 2003 (Table 4.0-1). The relatively small number of adult lamprey observed at Wells Dam can be attributed to fact that the Wells Project is the last passable dam on the mainstem Columbia River and the fact that the Wells Project is over 500 miles upstream from the Pacific Ocean.

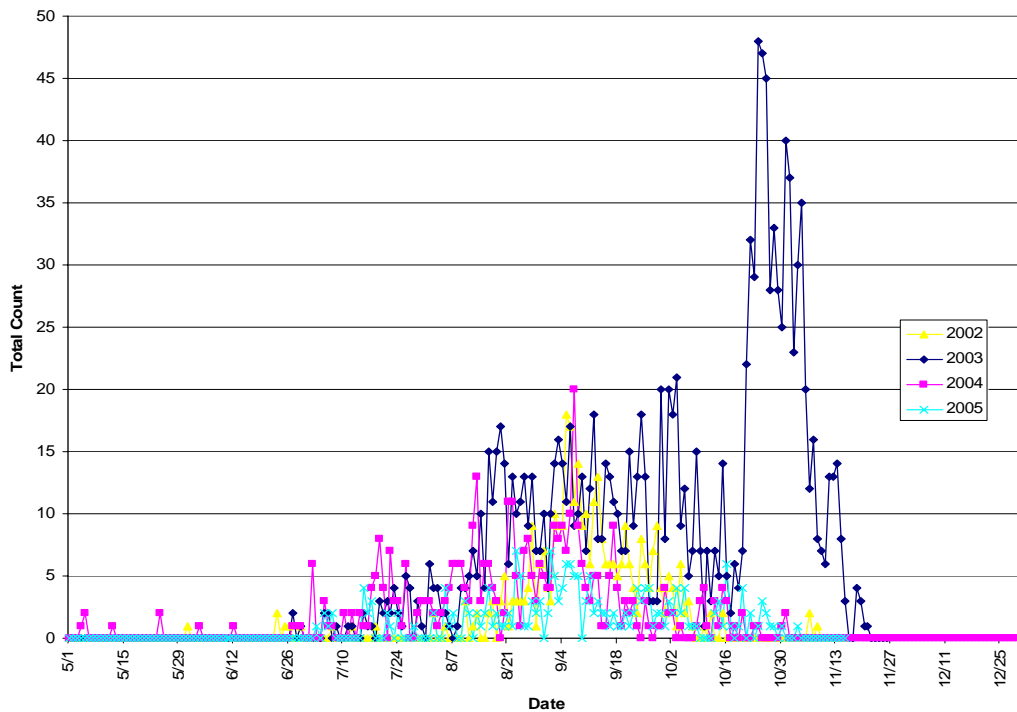
Lamprey pass Wells Dam from early July until late November with peak passage times between mid-August and late October (Figures 4.0-1 and 4.0-2). In all years since counting was initiated, Pacific lamprey counts at the east fish ladder are greater than at the west fish ladder. It is important to note that historically, counting protocols were designed to assess adult salmonids and did not necessarily conform to lamprey migration behavior (Moser and Close 2003). Traditional counting times for salmon did not coincide with lamprey passage activity which occurs primarily at night; the erratic swimming behavior of adult lamprey also makes them inherently difficult to count (Moser and Close, 2003). Furthermore, Beamish (1980) noted that lamprey overwinter in freshwater for one year prior to spawning. Consequently, lamprey counted in one year may actually have entered the system in the previous year (Moser and Close, 2003) which confounds annual returns back into the Columbia River Basin. It is unknown to what degree these concerns are reflected in Columbia River lamprey passage data. However, it is important to consider such caveats when examining historic lamprey count data at Columbia River dams including Wells Dam.

**Table 4.0-1          Adult Pacific lamprey counts at Wells Dam for east and west fish ladders, 1998-2005**

	1998	1999	2000	2001	2002	2003	2004	2005
East Fish Ladder	173	47	96	153	226	723	263	148
West Fish Ladder	170	26	59	106	117	694	140	64
Total	343	73	155	259	343	1417	403	212



**Figure 4.0-1** Daily counts of Pacific lamprey at Wells Dam during the fish counting season, 1998-2001.



**Figure 4.0-2** Daily counts of Pacific lamprey at Wells Dam during the fish counting season, 2002-2005.

Until recently, relatively little information was available on Pacific lamprey in the mid-Columbia River Basin. However, with increased interest in the species coupled with a petition for listing under the ESA, the mid-Columbia PUDs have started to initiate studies to address Pacific lamprey passage and migratory behavior in their respective project areas.

The study of adult Pacific lamprey migration patterns past dams and through reservoirs in the lower Columbia River has provided the first data sets on lamprey passage timing, travel times, and passage success at hydroelectric projects (Vella et al. 2001, Ocker et al. 2001, Moser et al. 2002a, Moser et al. 2002b). These studies have shown that approximately 90% of the radio-tagged lamprey released downstream of Bonneville Dam, migrated back to the tailrace below Bonneville Dam; however, less than 50% of the lamprey which encountered a fishway entrance actually passed through the ladder exit at the dam (Nass et al., 2005).

Similar collection and passage efficiency results were observed at Rocky Reach, Wanapum and Priest Rapids dams during tagging studies conducted at those projects (Nass et al., 2003; Stevenson et al., 2005).

Of the 125 radio-tagged lampreys released approximately 7 kilometers downstream of Rocky Reach Dam, 93.6% were detected at the project, and of those fish, 94.0% entered the fishway. Of the fish that entered the Rocky Reach fishway, 55.5% exited the ladder.

During studies at Wanapum and Priest Rapids dams in 2001 and 2002, a total of 51 and 74 lamprey were radio-tagged and released downstream of Priest Rapid Dam, respectively. Over the two years of study, the proportion of fish that approached the fishway that exited the ladders was 30% and 70% at Priest Rapids and 100% and 51% at Wanapum Dam in 2001 and 2002, respectively.

Two recent reviews of Pacific lamprey (Hillman and Miller 2000; Golder Associates Ltd. 2003) in the mid-Columbia River have indicated that little specific information is known on their status (Stevenson et. al., 2005).

In 2004, Douglas PUD contracted with LGL Limited to conduct a lamprey radio-telemetry study at Wells Dam in coordination with the Public Utility District No. 1 of Chelan County (Chelan PUD) who was conducting a similar study at Rocky Reach Dam. A total of 150 lamprey were radio-tagged and released at or below Rocky Reach Dam. The radio-tags used in this study had an expected operational life of 45 days (Nass et al., 2005). It is important to note that because of the release site of the fish was over 50 miles downstream of Wells Dam the value of the study was limited by the relatively small numbers of tagged fish observed at Wells (n=18) and the fact that many of the radio-tags detected at Wells Dam were within days of exceeding their expected battery life.

With that stated, the 2004 study at Wells was implemented through a combination of fixed-station monitoring at Wells Dam and fixed-stations at tributary mouths. Collectively, these monitoring sites were used to determine migration and passage characteristics of lamprey entering the Wells Project area. Of the 150 adult lamprey released at or below Rocky Reach in 2004, 18 (12% of 150) were detected in the Wells Dam tailrace, and ten (56% of 18) of these were observed at an entrance to the fishways at Wells Dam. Two of the 10 lamprey approached

both fishways to produce 12 total entry events. A total of 3 radio-tagged lamprey passed Wells Dam prior to expiration of the tags, resulting in a Fishway Efficiency estimate of 30% (3 of 10) for the study period. A single lamprey was detected upstream of Wells Dam at the mouth of the Methow River (Nass et al., 2005).

For lamprey that passed the dam, the majority (92%) of Project Passage time was spent in the tailrace. Median time required to pass through the fishway was 0.3 d and accounted for 8% of the Project Passage time (Nass et al., 2005).

Although the 2004 study at Wells provided preliminary passage and behavioral information for migrating adult lamprey, the limited observations due to the small sample size (n=18) is insufficient in addressing the objectives set forth in Section 2.0 with statistical confidence.

## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWGs' efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these meeting and discussions, the Aquatic RWG is proposing to include a study into the Wells PAD that would include a radio-telemetry study to assess lamprey behavior as it relates to passage, timing, drop back and upstream migration. The need for this study was agreed to by all of the members of the Aquatic RWG, including Douglas PUD. This study will help to inform future relicensing decisions and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Issue Statement (6.2.1.3)**

The Wells Project may affect adult Pacific lamprey behavior related to ladder passage, timing, drop back and upstream migration.

### **Issue Determination Statement (6.2.1.3)**

Work group members have determined that this issue has a tie to the Project as it relates to lamprey migration through Wells Dam. Preliminary passage information has been collected at Wells Dam; however, the sample size of the study was limited and additional information is needed. A radio-telemetry study would be feasible to address passage, timing, drop back and upstream migration. The results of an adult lamprey passage study would be useful during the development of PME measures.

The resource work group agrees that a radio-telemetry study to assess lamprey behavior as it relates to passage, timing, drop back and upstream migration should be conducted at Wells Dam during the two-year ILP study period.

## **5.0 PROJECT NEXUS**

The Wells Project may affect adult Pacific lamprey behavior related to ladder passage, timing, drop back and upstream migration. This issue has a tie to the Project as it relates to lamprey migration through Wells Dam. Potential problems facing successful passage of adult Pacific lamprey at dams may be related to their unique method of movement and specific areas within fishways. Specifically, adult Pacific lamprey at other projects have experienced difficulty passing over diffusion gratings and through areas of high velocity, bright light and through orifices with squared, un-rounded edges. Typically, lamprey move through an adult fishway in a repeated series of motions consisting of attaching to the ladder floor with their mouths, surging forward, and re-attaching. The physiological response of adult Pacific lamprey to exhaustive exercise may be immediate, sometimes severe, but short-lived (Mesa et al. 2003). This may suggest that lamprey have difficulty negotiating fishways with high current velocities.

Two recent reviews of Pacific lamprey (Hillman and Miller, 2000; Golder Associates Ltd. 2003) in the Mid-Columbia River have indicated that little specific information is known on their status. The 2004 study at Wells Dam provided preliminary information into the migration characteristics of adult Pacific lamprey through Wells Dam. However, it is important to note that the study was compromised by the relatively small numbers of tagged fish observed at the Project (n=18) and the fact that many of the radio-tags detected at Wells Dam were within days of exceeding their expected battery life. Combined, these factors suggest that additional lamprey passage information is needed at Wells Dam.

The proposed lamprey radio-telemetry study will assist in providing the information needed as identified by the Aquatic RWG and will inform the development of future license requirements.

## **6.0 METHODOLOGY**

### **6.1 Literature Review**

The literature review will consist of a search of all existing information currently available on adult Pacific lamprey passage studies at Columbia and Snake river dams. This search will examine the availability of information from peer-reviewed journals, federal and state

publications, academia, private industry, and grey literature. References cited from the initial literature search that are of relevance to the subject matter will also be collected and added to literature database. An annotated bibliography will be produced from the results of the literature search.

## **6.2 Telemetry Study Period**

Adult Pacific lamprey will be collected, sampled and tagged at Wells Dam during the 2008 peak migration period of August and September. To address lamprey passage characteristics, fixed station telemetry monitoring in the Wells Project will occur from August through November 2008.

## **6.3 Capture, Tagging, and Release of Lamprey**

Radio transmitters that will be used during the study are Lotek NTC-4-2L and are similar to those used by NOAA Fisheries, the Public Utility District No. 2 of Grant County (Grant PUD) and Chelan PUD in recent years. The tags are designed for a 45-day operational life.

From August to September 2008, trapping at Wells Dam will target a total of 40 lamprey which will be released post-surgery directly into the Columbia River at two locations. Distribution of tagged lamprey will generally adhere to the following:

- 10 will be released in the Wells Dam fishway; and
- 30 will be released approximately 1 mile below Wells Dam in an area of reduced flow.

## **6.4 Telemetry Array**

### **6.4.1 Fixed Stations**

The movement and passage of radio-tagged lamprey will be determined by combining detection data collected using underwater and aerial antenna arrays (dipoles and yagi antennas) at Wells Dam. The arrays are designed to monitor movements of radio-tagged lamprey from the Columbia River into the fishway entrances and through the exits at Wells Dam, and are also designed to detect downstream passage movements. Aerial antennas will be used in the tailrace, at remote stations on tributary mouths, and during mobile tracking. Underwater antennas will be used in the fishways. A total of 8 Lotek telemetry receivers, monitoring multiple arrays (6 at Wells Dam, 1 at Methow River, and 1 at Okanogan River) will be used during the study.

### **6.4.2 Mobile Tracking**

Mobile tracking will be conducted by boat in a 2 km reach of the river below Wells Dam. Tracking will be recorded using Global Positioning System (GPS) with a built-in data logger. Twin three-element aerial antennas will be mounted to a post and secured in the boat. Surveys will be conducted by transects running upstream and downstream in the river with the aerials pointed in opposite directions, and usually at each bank.



### 6.4.3 Data Analysis

The data will be analyzed using *Telemetry Manager*, *Ascent* and other computer programs developed in Visual Foxpro by LGL Limited. In order to differentiate detection locations and streamline analyses, individual antennas will be grouped into "zones" that define pivotal areas of interest, such as individual fishway entrances and exits (Nass et al., 2005).

*Telemetry Manager* imports raw ASCII data files downloaded from the Lotek SRX receivers. After importing the raw files, *Telemetry Manager* constructs an initial database containing records for each logged data transmission from the tagged fish. *Telemetry Manager* then edits the database to remove records that do not meet the criteria identified for valid data records. Examples of invalid data include background noise at the Project, records with a signal strength that are below a given threshold, single records for a given fish-location combination, and records that were recorded before the official release time and date. After filtering the invalid records, *Telemetry Manager* constructs an operational database that summarizes the time of arrival and departure from each zone of interest ("benchmark times").

### 6.4.4 Definition of Passage and Residence Times

Strategic deployment of receivers and antennas will make it possible to determine the amount of time that lamprey will be present in the tailrace, fishway entrances, and fishways. Passage times will be calculated from benchmark dates and times corresponding to the first and last detection of a given radio-tagged lamprey at specific locations. At Wells Dam, the benchmark times for lamprey that pass the Project will be:

- first detection in the tailrace,
- first detection at the fishway entrance of passage,
- last detection at the fishway entrance of passage, and
- last detection at the fishway exit.

From these benchmark times, passage times will be calculated for the following passage segments:

Segment	Time	Name
A)	1 to 2	Tailrace Passage time
B)	2 to 3	Entrance Passage time
C)	3 to 4	Fishway Passage time
D)	1 to 4	Project Passage time

From the benchmark times at each of the monitored locations, the passage times and passage efficiencies (proportions) will be calculated for each radio-tagged lamprey where,

Passage Efficiency for a section of the fishway =  
No. tags at a fishway detection zone (above)/ No. tags at the fishway zone (below), or  
No. tags at a fishway detection zone / No. tags at an entrance.

It then follows that:

$$\text{Fishway Efficiency} = \text{No. of tags at an exit} / \text{No. of tags at an entrance.}$$

The metrics described above provide a method to evaluate the extent of upstream movement in the fishways. Note that the telemetry array at Wells Dam does not include underwater antennas outside of the fishway entrances to determine when lamprey approach the fishway; antennas will be only located inside the fishway and therefore constitute an entrance to the fishway rather than an approach. This is an important distinction from other studies (e.g., Moser et al. 2002b and Nass et al. 2003) where detections on antennas external to the fishway (approaches) are used as a basis to calculate overall passage efficiency at the dam. Therefore, this particular metric can not be calculated for Wells Dam. However, the other metrics presented above are consistent with those of other studies and can be used for comparative purposes.

In addition to the above standard passage segments, a detailed analysis of the time lamprey spent in and between detection zones (i.e., residence time) in the Wells Dam fishways will be conducted.

The primary residence time analysis includes:

- Entrance – at the entrance (first to last detection),
- Between the Entrance and Upper Collection Gallery (last detection to first detection),
- Upper Collection Gallery – the first vertical wall in the fishway (first to last detection),
- Between Upper Collection Gallery and Fishway Transition (last detection to first detection),
- Fishway Transition – first section of orifice weirs which are usually inundated with water depending on the water elevation in the tailrace (first to last detection),
- Between Fishway Transition and Below Trap (last detection to first detection),
- Below Trap – just downstream of the adult trapping facility (first to last detection),
- Between Below Trap and Above Trap (last detection to first detection),
- Above Trap – mid-point in series of orifice weirs between the trap and the video station (first to last detection),
- Between Above Trap and Below Video (last detection to first detection),
- Below Video – just downstream of the video station (first to last detection),
- Between Below Video and Above Video (last detection to first detection),
- Above Video – just upstream of the video station (first to last detection),
- Between Above Video and Exit (last detection to first detection), and
- Exit- fishway exit to forebay (first to last detection).

The residence and passage times for each radio-tagged lamprey will be determined by working backwards through a sequence of detections. The fishway of ultimate passage and the respective passage time is determined by identifying a sequence of detections in the ascent of a fishway, starting with detections in a fishway exit zone.

#### **6.4.5 Definition of Downstream Passage Events and Drop Back**

For the purpose of analysis, a downstream passage event is defined as a tag that is detected at a fishway exit and subsequently detected in the tailrace or a fishway entrance without any detections at antennas monitoring the inside fishway zones. Drop back fish will be defined as those tags in a fishway detection zone that are subsequently detected in zones directly downstream in the fishway.

### **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

LGL Limited, a consulting firm located in Ellensburg, WA has been identified as the most likely contractor to conduct the proposed study. LGL Limited has expertise in all phases of radio-telemetry studies (design, implementation, data collection and analysis, equipment maintenance and reporting) for various fish species at mid-Columbia River hydroelectric projects. From implementation of past studies at Wells Dam, LGL is familiar with the Wells Project including the Wells Dam fishway structures, operations, and staff. LGL is currently conducting a radio-telemetry study at Wells Dam as part of the 2005-2008 Wells Bull Trout Monitoring and Management Plan and was the firm responsible for conducting the 2004 Wells Dam Lamprey Study and the 2002-2004 Wells Bull Trout Radio-telemetry Study.

Due to ongoing radio-telemetry studies at Wells Dam, the monitoring equipment necessary to complete the study will already be in place and operational for the 2008 study. Tags will be purchased by the contractor prior to the study. The level of effort and necessary staff time to conduct all phases of the study will be identified by LGL in consultation with the Aquatic RWG.

Incidental take consultation for ESA-listed steelhead and bull trout will need to take place prior to the study. This can be expedited through consultation with the HCP Coordinating Committee and associated agency representatives for the USFWS and NMFS. HCP Coordinating Committee members will be provided an opportunity to comment on draft trap designs and on the operation of the lamprey traps which will need to be installed prior to the study.

A Washington State Collector's Permit will be required to collect adult lamprey for the proposed study. LGL Limited will be responsible for securing this permit prior to study implementation.

### **8.0 BUDGET**

Total estimated hours for the implementation of an adult Pacific lamprey passage and behavior study is approximately 1,034 person hours. The allocation of these hours is approximately 16 hours for project management; 664 hours for field work (includes lamprey trapping and tagging, radio-telemetry system set-up and maintenance, receiver downloading, and mobile tracking); 58 hours for data processing and management; and 296 hours for data analysis and reporting. Labor costs are estimated to be \$84,000. Equipment costs and expenses related to field implementation (travel, tagging and miscellaneous telemetry supplies, boat use, computer use, etc.) are estimated to be \$41,000. Total planning level cost for this effort is approximately \$125,000.

## 9.0 SCHEDULE

Activities related to the fabrication of trapping equipment and attainment of a scientific collector's permit will begin shortly after the issuance of FERC's Study Plan Determination in October 2007. The field portion of the study will be conducted from August to November 2008. During this time period, an Initial Study Report detailing the progress of the ongoing study will be provided to FERC, stakeholders, and members of the Aquatic RWG in October 2008.

All data collected during the field portion of the study will be analyzed and detailed in a technical report provided by the contractor to Douglas PUD. A draft report will be available for review by the Aquatic RWG by March 31, 2009. A final report will be provided to stakeholders and FERC by October 2009.

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**ASSESSMENT OF DDT AND PCB IN FISH TISSUE AND SEDIMENT IN  
THE LOWER OKANOGAN RIVER (AQUATIC ISSUE 6.2.1.4)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington

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## ABSTRACT:

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5). As part of the Wells Project relicensing process, Douglas PUD is required to obtain a water quality certificate pertinent to section 401 of the Clean Water Act. The Washington State Department of Ecology (WDOE) is responsible for the issuance of a 401 certificate as well as administering the state's Water Quality Standards. As part of the 401 certification process, Ecology must assess the effect of a hydroelectric project's operations on the transport and accumulation of toxins within the sediment as they apply to the numeric and narrative criteria of the state standard.

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (including WDOE) and Douglas PUD staff, was formed for the purposes of identifying issues that may require study during the Wells Project relicensing, identified the need to collect more information with regards to DDT and PCB in the lower Okanogan River within the Wells Project boundary and its potential human health effects related to recreational activities. In order to satisfy this request, the Aquatic RWG proposes a study to collect and analyze for the presence of toxins in fish tissue and at specific recreation sites located on the lower Okanogan River. These samples will be collected in an effort to address the human health concerns brought forth by the RWG.

In 2001-2002, WDOE conducted a technical assessment in support of the development of a Total Maximum Daily Load (TMDL) for 1,1,1-trichloro-2,2-bis[*p*-chlorophenyl]ethane (DDT) and polychlorinated biphenyls (PCBs) in the Lower Okanogan River. For the purposes of the 2001-2002 assessment, the Lower Okanogan River was defined as the portion of the river from the U.S./Canadian border at Lake Osooyos (RM 80.2) downstream to the town of Monse (RM 5.0). During this assessment, various mediums (water, sediment, and fish tissue) at various locations in the Okanogan River were assessed for concentrations of DDT and PCB. This study will augment the previous information collected during the development of the TMDL and will be consistent with the recommendations of the Water Quality Implementation Plan (WDOE, 2006) submitted by WDOE which provides recommendations to assure that DDT and PCB concentrations in the waters and fish tissues from the Okanogan River and its tributaries continue to improve with the goal of meeting the regulatory standards for these persistent bioaccumulative toxins.

Sampling locations for fish during the study will include all accessible reaches of the lower Okanogan River within Project boundary (RM 15.5 to RM 0.0). Sampling sites for sediment will include recreational sites of concern (e.g. swimming areas and boat launches) from the Okanogan River mouth up to RM 15.5. Study implementation is planned for the 2-year ILP study period (2008-2009) with sampling occurring in May 2008. Sampling frequency, timing, and methodology as well as sample analysis will be consistent with the 2001-2002 WDOE TMDL Technical Assessment as outlined in Serdar (2003) and WDOE's "Water Quality Certification for Existing Hydropower Dams: Preliminary Guidance Manual (September 2004)."



A technical report of the study will be produced to assist the Aquatic RWG in determining the concentration of DDT and PCBs in recreational fish species and in swimming areas of the lower Okanogan River within Project boundary. The information may inform the development of an appropriate information and education program to address the human health risks towards recreational use by the public in the lower Okanogan River.

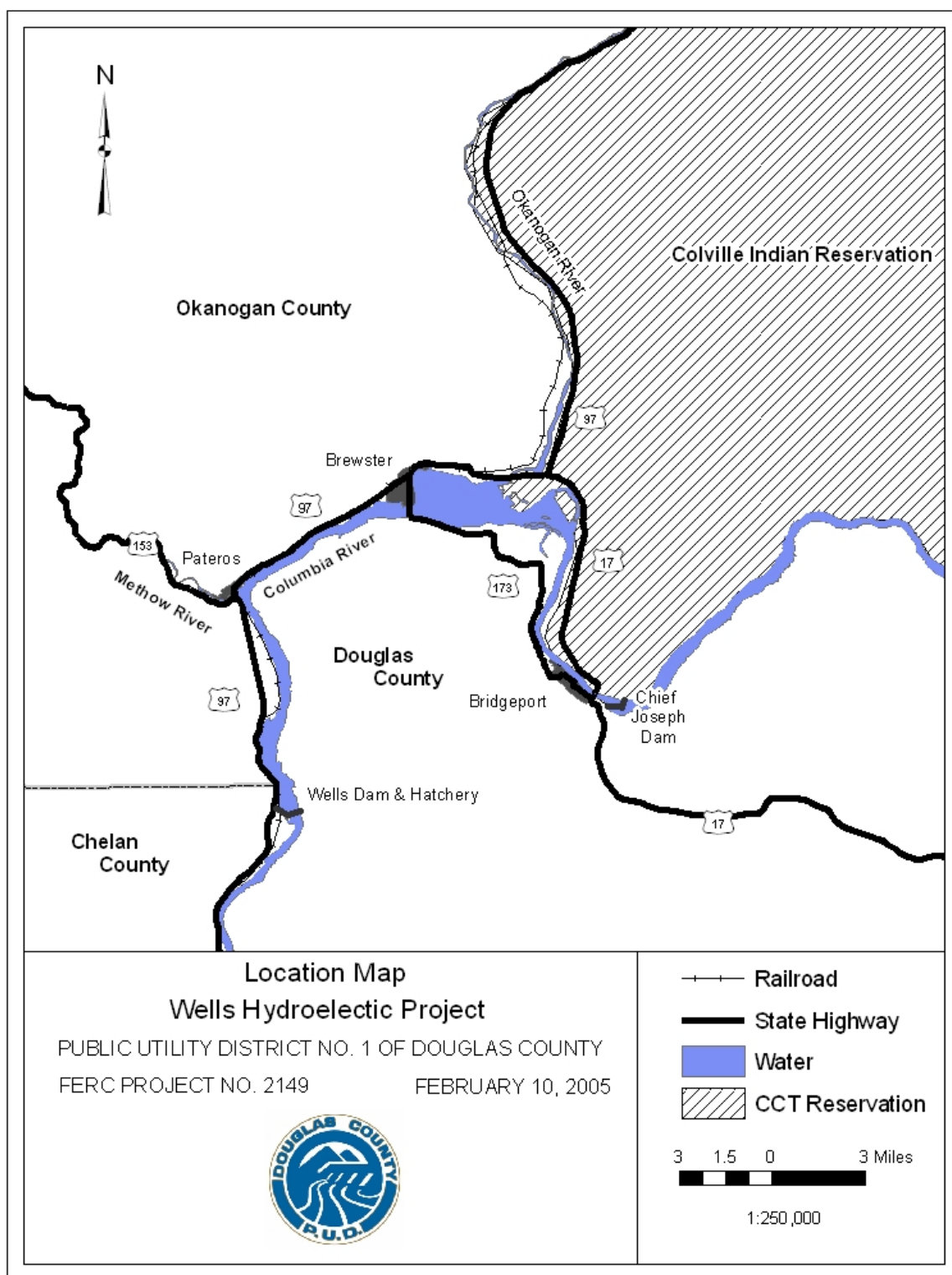
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project, owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides of the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**

## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The objective of the study is to determine the concentration of DDT and PCBs in recreational fish species and in swimming areas of the lower Okanogan River (up to RM 15.5) within the Wells Project boundary.

Tasks to be completed toward the achievement of the goal include:

- Collect and analyze sediment samples for DDT and PCBs from specific recreational sites (i.e., swim areas and boat launches) in the lower Okanogan River up to RM 15.5.
- Collect and analyze fish tissue for DDT and PCBs from recreational fish species of interest consumed by tribal and recreational anglers.

The information gathered from this monitoring effort will assist the Aquatic RWG in determining the concentration of DDT and PCBs in recreational fish species and in swimming areas of the lower Okanogan River within the Wells Project boundary. The information may inform the development of an appropriate information and education program to address the human health risks towards recreational use by the public in the lower Okanogan River.

### **3.0 STUDY AREA**

The study area consists of waters within the Okanogan River from its confluence with the Columbia River up to RM 15.5.

### **4.0 BACKGROUND AND EXISTING INFORMATION**

The Okanogan River originates in the Cascade Mountains north of the international border in British Columbia. The Okanogan River is characterized by a series of lakes north of international boundary and a free flowing river flowing out of Osoyoos Lake, which straddles the boundary; 78 miles to its confluence with the Columbia River (WDOE, 2004). The lower 15.5 miles of the Okanogan River before it joins with the Columbia River is considered within the Wells Project boundary.

Beginning in the early 1970s, Canadian investigators began documenting high levels of the insecticide 1,1,1-trichloro-2,2-bis[*p*-chlorophenyl]ethane (DDT) in fish collected from British Columbia lakes along the mainstem Okanogan River (Northcote et al., 1972). In 1983, WDOE collected data which revealed DDT and polychlorinated biphenyl (PCB) contamination in fish from the Okanogan River below the Canada border (Hopkins et al., 1985). Since then a number of WDOE surveys have verified DDT and PCB contamination in the basin (Johnson and Norton, 1990; Davis and Serdar, 1996; Johnson et al., 1997; Serdar et al., 1998, Serdar, 2003).

The WDOE Environmental Assessment Program prepared an assessment of total maximum daily loads (TMDLs) of DDT and PCBs in the lower Okanogan River basin, including Osoyoos Lake. For the purposes of the WDOE assessment, the Lower Okanogan River was defined as the portion of the river from the U.S./Canadian border at Lake Osoyoos (RM 80.2) downstream to the town of Monse (RM 5.0). Sampling conducted during 2001-2002 examined DDT and PCB concentrations in the water column of the mainstem Okanogan River, water in tributary streams, sewage treatment plant (STP) effluent and sludge, and cores of bottom sediments. Composite samples of three species of fish – carp (*Cyprinus carpio*), mountain whitefish (*Prosopium williamsoni*), and smallmouth bass (*Micropterus dolomieu*) also were analyzed for DDT and PCBs. Data from these samples were used in conjunction with historical data to develop the TMDLs (Serdar, 2003).

Results of the 2001-2002 sampling (Serdar, 2003) suggest that:

1. DDT concentrations in the mainstem water column typically decreased from upstream sites (Okanogan River at Zosel Dam) to downstream sites (Okanogan River at Malott). PCBs were not detected in the mainstem.

2. Only small loads of DDT and PCBs are delivered to Osoyoos Lake and the lower Okanogan River through tributary streams and STPs.
3. Generally, lipid-normalized t-DDT and t-PCB concentrations in fish tissue decreased from sites upstream to downstream (Oroville, Riverside-Omak, Monse) with the exception of large-sized smallmouth bass which had higher concentrations downstream at the Monse site.
4. t-DDT and t-PCB concentration trends decreased in the 1980s followed by steady concentrations in the last decade in the lower Okanogan system.
5. DDT concentrations in the Osoyoos Lake core sediments were an order of magnitude higher than core sediments of approximately equal age from the Okanogan River near the mouth (Monse).
6. PCB concentrations in core samples were low, with concentrations around 1 ng/g t-PCB. Concentrations from both sites (Osoyoos Lake and lower Okanogan River: Monse) were similar suggesting that low-level PCB sources such as STPs between the lake and the river mouth keep depositional areas enriched with low levels of PCBs. Little is known about sources of PCB contamination in the lower Okanogan River basin, except that no major sources appear evident. It is notable that while PCBs in edible fish tissues may be a human health concern at the levels reported, it is not uncommon to find similar levels in other Washington waters where no discernible sources of PCB exist (Davis and Johnson, 1994).
7. Re-suspended Osoyoos Lake sediments account for nearly all of the measured DDT loads in the lower Okanogan River which may explain the disparity between DDT load delivery and measured loads in the water column of the lower mainstem Okanogan River.
8. The Colville Tribes conducted a longitudinal transect of DDT in 40 lower Okanogan River sediments from Osoyoos Lake outlet to the mouth in 2001 (Hurst and Stone 2002). Aside from two locations, little DDT was found. 60% of sites had t-DDT less than the detection limit (0.5 ng/g) and another 35% had a concentration of 1-10 ng/g (mostly less than 2 ng/g). Two sites with significant concentrations were found just below the Osoyoos Lake outlet and just downstream of Elgin Creek (RM 28.4).
9. Acute toxicity is not considered to be a concern at concentrations in the lower Okanogan River basin.
10. According to the report, there are few realistic options for obtaining meaningful reductions in DDT and PCB loading to Osoyoos Lake and the lower Okanogan River. It appears that most loading to fish occurs internally through direct or indirect exposure to sediments. Natural attenuation will eventually reduce levels through dilution and capping, especially downstream of the Similkameen River confluence.

In conjunction with the TMDL technical assessment (2003) and TMDL (2004), WDOE submitted a Detailed Implementation Plan (WDOE, 2006) to EPA as required by the Clean Water Act in July 2006. This report provides direction to assure that DDT and PCB concentrations in the waters and fish tissues from the Okanogan River and its tributaries continue to improve with the goal of meeting the regulatory standards. The report's main recommendations are the continued monitoring of fish tissues at 5 year intervals and preventative measures that would minimize the amount of contaminants entering the river from the surrounding watershed.

Currently, there is no monitoring program for toxins (DDT and PCB) in the Okanogan River watershed. WDOE's long-term monitoring station, located near Malott (RM 17) just upstream of the Wells Project boundary, samples monthly for conventional parameters and metals; however, water samples, fish tissue and sediment cores are not collected for analysis of toxins.

## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these meeting and discussions, the Aquatic RWG is proposing to include a study plan into the Wells PAD which will determine the concentration of DDT and PCBs in recreational fish species and in swimming areas of the lower Okanogan River within the Wells Project boundary. This study will help to inform future relicensing decisions through the 401 water quality certification process and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Finalized Issue Statement (6.2.1.4)**

Project operations may affect the input, movement, accumulation and retention of toxins (sediment dynamics and water column) originating from the Okanogan River subbasin and their potential effects on aquatic organisms and humans.

### **Final Issue Determination Statement (6.2.1.4)**

The Okanogan River likely contains toxins within the sediment and in the water column. These pollutants are discharged into the river from mining, industrial and agricultural activities upstream of the Project boundary. There are numerous reports by the Washington State Department of Ecology and the Colville Tribes documenting the presence and levels of toxins within the Okanogan Basin. Of the five assessments conducted on toxins in the Okanogan River most have focused on the presence of toxins within the water column, sediment and within the fish found in the Okanogan River.

The lower Okanogan DDT PCB Detailed Implementation Plan (WDOE, 2006) submitted to and approved by the Environmental Protection Agency for the purpose of providing direction to assure that DDT and PCB concentrations are reduced to a level that meet regulatory standards recommends continued monitoring of fish tissues from the lower Okanogan River.

The resource work group agrees that a study is needed during the two-year ILP study period. The study would assess the concentration of DDT and PCBs found within fish tissues collected from the lower Okanogan River. This study would also collect sediment samples from specific recreation areas located between the mouth of the Okanogan River upstream to RM 15.5.

## **5.0 PROJECT NEXUS**

The WDOE is responsible for the protection and restoration of the state's waters. WDOE has adopted water quality standards that set limits on pollution in lakes, rivers, and marine waters in order to protect water quality. WDOE's water quality assessment of the state's waterbodies lists the status of water quality for a particular location in one of 5 categories (Category 1-5) recommended by the Environmental Protection Agency (EPA). This assessment represents the integrated report for Sections 303(d) and 305(b) of the Clean Water Act. Categories 1-4 represent the status of waters for the 305(b) report, while Category 5 represents those waters placed on the 303(d) list. Waters placed on Category 5 require the preparation of TMDLs, which are an integral tool in the work to clean up polluted waters.

The lower Okanogan River within the Project boundary was 303(d) listed for high levels of total PCB's, 4,4'-DDE and 4,4'-DDD in fish tissues in 1998. As a result of this listing, a TMDL (WDOE, 2004) was developed to address these impaired parameters in this location. Currently, the EPA-approved 303(d) list submitted in 2004 no longer includes these parameters for the lower Okanogan River as they have been re-assessed as Category 4a (impaired waters with a TMDL) waters in the Washington State Water Quality Assessment 305(b) report. The information resulting from an assessment of fish tissue and sediments in the lower Okanogan River will assist the Aquatic RWG in the development of licensing requirements through the 401 water quality certification process.

## **6.0 METHODOLOGY**

In order to collect information that will be informative of the health risks from recreational activities within the lower Okanogan River sampling stations for fish tissue will be located throughout the lower 15.5 miles of the river. Field sampling will consist of one sampling event in May of 2008 during the spring run-off to be consistent with the 2001-2002 WDOE assessment (sampling during high water).

All methods implemented will be consistent with the 2001-2002 WDOE TMDL Technical Assessment as outlined in Serdar (2003) if appropriate in addressing the objectives of this study. Additionally, any components of the study not clearly specified in Serdar (2003) will be consistent with WDOE's "Water Quality Certification for Existing Hydropower Dams: Preliminary Guidance Manual (September 2004)." Quality assurance plans will meet State and Federal guidelines.



Sediment samples will be collected using standard aquatic toxicology protocol. Fish for fish tissue analysis will be collected either via electrofishing or angling, when appropriate. Fish species of interest will be determined by the Aquatic RWG but should be fish normally consumed by either tribal or local recreational anglers and consistent with WDOE's Detailed Implementation Plan (2006). Biological data (species, length, weight and age) will be collected for all fish samples.

All sediments samples and fish tissue samples will be stored to meet quality specifications prior to transport and delivery to a qualified laboratory for analysis. Parameter analysis will also be consistent with Serdar (2003) and will consist of tests to determine the concentrations of all DDT analogs and PCBs per each sample.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

Based upon discussions with the Aquatic RWG regarding specific study design and study needs, Douglas PUD will secure the assistance of a qualified consultant to conduct the field portion of the study in addition to a qualified water quality and toxicology laboratory to analyze samples.

The technical skills necessary to complete the study are knowledge of aquatic toxicology with an emphasis on transport and accumulation, water quality sampling equipment and protocol consistent with WDOE's preliminary guidance manual, motor boat operation and safety, data acquisition and management, and Washington State water quality standards.

A Washington State Collection Permit will be required for fish sampling. The consulting firm contracted to implement the field sampling portion of the study will be responsible for obtaining this permit prior to the start of the study.

## **8.0 BUDGET**

The total estimated hours for the Lower Okanogan River DDT/PCB assessment is approximately 185 person hours. The allocation of these hours is approximately 25 hours for study plan development; 36 hours for coordination and permitting; 76 hours for field activities; and 48 hours for data analysis and reporting. Labor costs are estimated to be \$25,000. Equipment costs and expenses related to field activities (sediment sampling equipment, boat use, travel, shipping, etc.) are estimated to be \$6,000. Laboratory costs for the analysis of fish tissue and sediments are estimated to be \$20,000. Total planning level costs for this effort are approximately \$51,000.

## **9.0 SCHEDULE**

Planning for this study will begin in late 2007, shortly after the issuance of FERC's Study Plan Determination in October 2007. Activities to obtain a Washington State Scientific Collectors Permit will be implemented during late 2007. Field sampling will take place during the spring of 2008 with an Initial Study Report due to stakeholders by October 2008. A final report will be provided to FERC and the stakeholders by October 2009.

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**AN INVESTIGATION INTO THE TOTAL DISSOLVED GAS DYNAMICS  
OF THE WELLS PROJECT (AQUATIC ISSUE 6.2.1.5)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington

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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5). As part of the Wells relicensing process, Douglas PUD is required to obtain a water quality certificate in accordance with section 401 of the Clean Water Act. The Washington State Department of Ecology (WDOE) is responsible for the issuance of a 401 certificate as well as administering the state's Water Quality Standards. As part of the 401 certification process, WDOE must determine that the Wells Project is in compliance with state water quality standards for total dissolved gas (TDG).

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (including WDOE) and Douglas PUD staff, was formed for the purposes of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The Aquatic RWG, through a series of technical meetings, is proposing a study intended to further examine the TDG production dynamics at the Wells Project. The specific objectives of this study are contingent upon the results from TDG studies scheduled for 2006 and 2007.

TDG may become a water quality concern when gases supersaturate a river, lake or stream. The plunging water caused by spill at hydroelectric facilities may elevate TDG to levels that result in impaired health or even death for aquatic life residing or migrating within the affected area. Since 2003, Douglas PUD has been engaged in the assessment of TDG production dynamics at Wells Dam.

In spring of 2006, Douglas PUD examined whether or not operational scenarios (i.e. spill shaping) were able to minimize TDG production to a level that is capable of meeting the Washington State water quality standard for TDG production at Wells Dam during high flows up to 7Q10 flows (246 kcfs at Wells Dam). The 7Q10 flow is defined as the highest average flow which occurs for seven consecutive days in a once-in-ten-year period. At 7Q10 flows and above, water quality standards for TDG do not apply. Preliminary results of the study (EES et al., 2006) suggest that at 7Q10 flows specific operating scenarios that concentrate spill flows (crowned spill and full gate shapes) produce significantly lower levels of TDG in the Wells Dam tailrace. Further analysis of the data will provide a logical framework in which to base decisions focusing on the scope of continued TDG activities (i.e., more spill studies, modeling,) at Wells Dam during the 2-year ILP study period. Contingent upon the results of the 2006 and 2007 TDG studies, additional research into TDG at Wells Dam may or may not be needed.

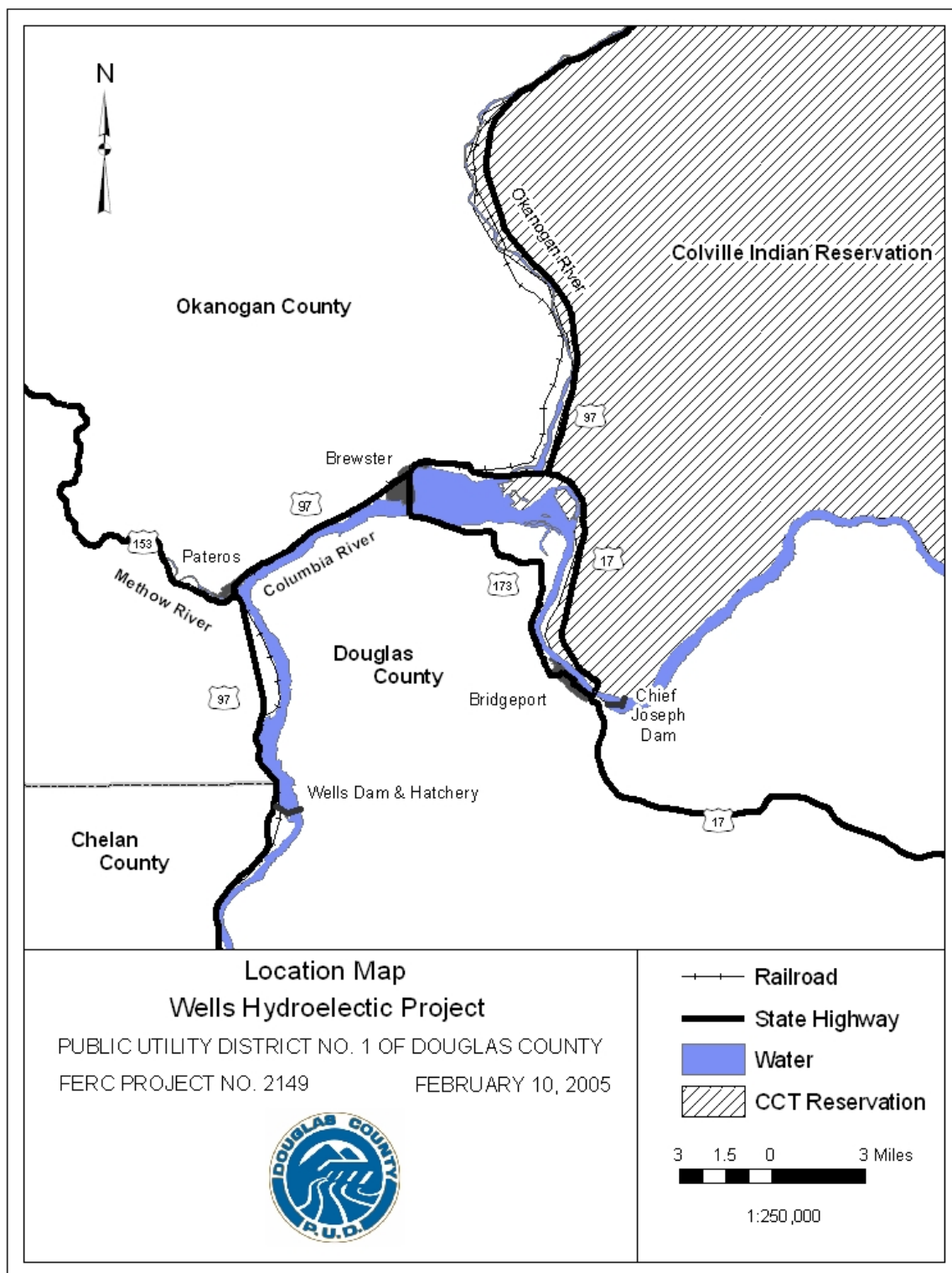
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam (Figure 1.1-1).

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**

## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The goal of the study is to better define the relationship between spill operations at Wells Dam and resultant downstream total dissolved gas pressures and, if needed, identify possible measures to improve operational performance related to TDG.

The Washington State Department of Ecology (WDOE) is the agency responsible for administering the State Water Quality Standards and for the issuance of 401 water quality certificates for hydroelectric relicensing processes in Washington. The information gathered from this study will assist WDOE in determining the extent to which a Project's spill operations affect TDG in excess of the specified numeric criteria. This determination will also assist



WDOE in the development of an implementation schedule as it applies to the 401 certification process.

### **3.0 STUDY AREA**

The study area will consist of Wells Dam (RM 515.8) including the Wells Dam forebay and tailrace area. Additional TDG information may be collected in the Rocky Reach forebay (Figure 1.1-1).

### **4.0 BACKGROUND AND EXISTING INFORMATION**

WDOE has established water quality standards in an effort to protect the beneficial uses of State water and water bodies. The Washington standards include both numeric and narrative criteria. The narrative standards address beneficial uses that include, but are not limited to, the ecological significance of water quality to aquatic biota. The importance of water quality to the health of rare, threatened, and endangered populations is also described in the narrative standards.

Dissolved gasses in water occur when gases in the atmosphere come into contact with water and when biological activity, such as photosynthesis or respiration, place metabolized gases into solution. Optimal water quality conditions of dissolved gas for fish are considered to be close to the barometric pressure seen at the air-water interface. Dissolved gas may become a water quality issue when gasses supersaturate a river, lake or stream (Klinge 2005).

Plunging water may cause an increase in total dissolved gas of a body of water as air bubbles become entrained, pushed to depth and forced into solution due to increased pressure. This phenomenon occurs naturally at waterfalls or artificially at dams. Spill at hydroelectric projects occur when river flows exceed the hydraulic capacity of the dam due to limited generation capacity or a lack of demand for power. Hydroelectric dams on the Columbia River also provide safe passage routes for migrating juvenile salmonids through spill. High levels of TDG have been shown to cause air embolisms (gas bubble trauma) in fish that result in impaired health or even death. Many variables contribute to dissolved gas supersaturation, including existing forebay gas concentrations, spill flow rates, tailwater bathymetry, air entrainment, spill plunge depths, entrainment flows, and temperature of the water (Klinge 2005).

Based upon the Washington state water quality standards developed by WDOE, TDG measurements shall not exceed 110 percent at any point of measurement in any state water body. However, water quality standards for TDG do not apply during natural flood flow conditions. Natural flood conditions are defined as any event which exceeds the highest flow that occurs for seven consecutive days in a ten-year period. These natural flood condition flows are termed 7Q10 flows.

In addition to allowances for natural flood flows, dams on the Columbia and Snake rivers, have an exception to the 110 percent TDG standard to allow for passage of juvenile fish downstream over the dams rather than through the turbines through the issuance of a waiver by WDOE. On the Columbia and Snake rivers there are three separate standards. First, in the tailrace of a dam, TDG shall not exceed 125 percent as measured in any one-hour period. Further, TDG shall not

exceed 120 percent in the tailrace of a dam and shall not exceed 115 percent 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 National Marine Fisheries Service (NMFS). The study weighed the benefits of spilling water to assist juvenile salmon in avoiding turbine mortalities against the mortalities of fish exposed to harmful levels of dissolved gas.

Starting in 1998 Douglas PUD initiated a rigorous TDG monitoring program at Wells Dam including the installation of forebay and tailrace fixed station sensors and regular maintenance and calibration of the two stations. Since initiating the monitoring program, a more accurate description of the TDG dynamic at Wells Dam has been developed. During normal fish bypass operations (7-11% spill of total discharge), TDG values in the immediate Wells Tailrace are only elevated above ambient levels by 1-2%. The fish bypass spill equation for Wells Dam indicates that for every 4% of water spilled, TDG values are elevated above ambient conditions by one percent (Klinge, 2001, 2002, 2003, 2004 and 2005).

In order to gain a better understanding of the TDG generation dynamic at Wells Dam, Douglas PUD has recently initiated a series of assessments aimed at gaining a better understanding of TDG production dynamics resulting from spill operations at Wells Dam. The District undertook studies to evaluate spill at Wells Dam during the 2003 and 2004 fish passage seasons (CBE 2003 and 2004). Both studies employed an array of data loggers arranged in a grid throughout the Wells Dam tailrace. The studies indicated that the tailrace fixed monitoring stations exhibited a delayed response to operational changes by Wells Dam when compared to mid- and upstream locations. Despite this delay, averages of the twelve highest daily TDG saturations (the compliance measure used by the State of Washington) varied little between stations.

The 2003 study also attempted to determine the fate of powerhouse released water by comparing upstream and downstream volume weighted TDG saturations. The results of these efforts were limited by the range of tested flow conditions, but implied that the TDG pressures of powerhouse released water may have been influenced by spillway operation. The 2004 study generally supported previous findings, indicating that Wells Powerhouse released water was gassed by spilled water.

In 2005, Douglas PUD initiated several spill tests to examine the relationship between water spilled over the dam and the production of TDG (CBE, 2006). The two objectives of the study were to determine the degree to which Wells Powerhouse released water is influenced by spillway operation (i.e., dilution or absorption) and to explore ameliorative operational scenarios to reduce TDG production. A variety of scenarios were examined during this spill study, including spill over loaded and unloaded units and flat versus crowned spill configurations. Due to the low snow pack experienced during the 2005 water-year, only low and medium spill volumes were examined (spill Q was between 34 and 50 kcfs with total river Q between 106 and 178 kcfs).

In spring of 2006, Douglas PUD examined TDG production at Wells Dam during high flows up to 7Q10 flows (246 kcfs at Wells Dam) and whether or not operational scenarios (i.e., spill shaping) were able to minimize TDG production to a level that is capable of meeting the

Washington state water quality standard for TDG. Preliminary results of the study (EES et al., 2006) suggest that at 7Q10 flows, specific operating scenarios that concentrate spill flows (crowned spill and full gate shapes) produce significantly lower levels of TDG in the Wells Dam tailrace. Further analysis of the data will provide a logical framework in which to base decisions focusing on the scope of continued TDG activities (i.e., more spill studies, physical modeling, computational fluid dynamics model, etc.) at Wells Dam.

## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWGs' efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these meetings and discussions, the Aquatic RWG is proposing to include a study plan into the Wells PAD which addresses the expected need for continued investigations into the TDG dynamics of the Wells Project. This study will help to inform future relicensing decisions through the 401 water quality certification process and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Finalized Issue Statement (Issue 6.2.1.5)**

Wells Dam may affect compliance with Total Dissolved Gas (TDG) standards in the Wells Tailrace and Rocky Reach Forebay.

### **Final Issue Determination Statement (Issue 6.2.1.5)**

Wells Dam can have an effect on compliance with the TDG standard. The resource work group believes that additional information is necessary in the form of continued monitoring and that these data will be meaningful with respect to 401 Water Quality Certification. Douglas PUD has been implementing studies at Wells Dam to address TDG production dynamics. The need for future studies during the two-year ILP study period (2008-2009) is dependent upon TDG studies scheduled for 2006 and 2007.

## **5.0 PROJECT NEXUS**

TDG may become a water quality concern when gases supersaturate a river, lake or stream. The plunging water caused by spill at hydroelectric facilities may elevate TDG to levels that result in impaired health or even death for aquatic life residing or migrating within the affected area.

The WDOE is responsible for the protection and restoration of the state's waters. WDOE has adopted water quality standards that set limits on pollution in lakes, rivers, and marine waters in order to protect water quality. On July 1, 2003, WDOE completed the first major overhaul of the state's water quality standards in a decade. A significant revision presented in the 2003 water quality standards classifies fresh water by actual use, rather than by class as was done in the 1997 standards. These revisions were adopted in order to make the 2003 standards less complicated to interpret and provide future flexibility as the uses of a water body evolve.

Congress passed the Clean Water Act in 1972, and designated the US Environmental Protection Agency (EPA) as the administering federal agency. This federal law requires that a state's water quality standards protect the surface waters of the US for beneficial uses, such as recreation, agriculture, domestic and industrial use, and habitat for aquatic life. State water quality standards, or amendments to these standards, do not take regulatory effect for the purposes of the Clean Water Act until they have been approved by EPA. EPA is currently reviewing the water quality standards adopted by the State of Washington in 2003 and partial approval has occurred. Full approval is expected before Douglas PUD files its license application (2010) and Section 401 certification is issued (2012). Due to this, the 2003 standards, as they apply to TDG in the Wells Project, will be used.

The new water quality standard for TDG for the Columbia River at a hydroelectric project is:

- Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.

However, as discussed in Section 4.0, an exception to the above standard is allowed through the issuance of a TDG waiver by WDOE. The information resulting from continued activities associated with TDG at Wells Dam will assist the Aquatic RWG in the development of licensing requirements through the 401 water certification process.

## **6.0 METHODOLOGY**

Given that TDG assessments at hydroelectric projects are often a multi-year, stepwise approach where future actions are based upon knowledge gained from past studies, Douglas PUD's future actions with regards to TDG production at Wells Dam will be dependent upon the information collected during the 2006 and 2007 spill studies. Based upon the results of these studies and based upon discussions with the Aquatic RWG, Douglas PUD will implement one or more of the following predetermined studies. Currently, there are several different studies that may be implemented pending the results of the 2006 and 2007 studies:

**Option 1** If results of the 2006 and 2007 studies show that Wells Dam can maintain TDG levels below the levels specified by the TDG waiver issued by WDOE at flow levels at and below the 7Q10 flow of 246 kcfs during the fish spill season (120% in the Wells Tailrace and 115% in the Rocky Reach forebay), given that incoming TDG levels are less than 115%, Douglas PUD will include this information in its 401 water quality certification application to demonstrate that it is able to meet the state water quality standard for TDG. In this case, it is expected that no additional TDG studies are needed to inform the development and approval of the 401 water quality certification (based on information presented elsewhere that it can meet the 110% standard during non-fish spill).

**Option 2** If the 2006 and 2007 study results show that Wells Dam cannot maintain TDG levels below the levels specified by the TDG waiver allowed under state law, during flow levels that are at or below the 7Q10 flow of 246 kcfs (120% in the Wells Tailrace and 115% in the Rocky Reach forebay), provided that incoming TDG levels are also at or below 115%, Douglas PUD, in cooperation with WDOE, will begin working on strategies, within an adaptive management framework, towards compliance of the TDG state standard. These adaptive management strategies will begin during the 2008-2009 relicensing study period and are expected to include:

2a. If results of the 2006 and 2007 studies show that during the fish spill season, specific Wells Dam operations at or below 7Q10 flows produce TDG levels within a reasonable deviation (120% + 2% in the Wells Tailrace and 115% in the Rocky Reach forebay) allowed under the state waiver, Douglas PUD, in cooperation with the Aquatic RWG and FERC, may conduct the following studies:

1. Develop a TDG model for the Wells Project. The model will be used to determine whether compliance with the water quality standard can be achieved through strictly operational means.

If the model shows that compliance can be achieved through operational means, Douglas PUD will initiate additional spill tests at the Project, utilizing lessons learned from the model, toward verifying compliance with the TDG standard.

If the model shows that compliance cannot be achieved through operational means, Douglas PUD will initiate activities specified in 2b.

2b. If results of the 2006 and 2007 studies show that specific Wells Dam operations at or below 7Q10 flows produce TDG levels that are above WDOE's TDG waiver by more than 2%, then Douglas PUD, in cooperation with the Aquatic RWG and FERC, is expected to conduct the following studies:

1. Develop and implement a hydraulic model(s) to address possible operational and/or structural solutions toward compliance with the TDG standard.

If the hydraulic model shows that compliance can be achieved through operational and/or structural solutions, Douglas PUD will conduct a feasibility analysis to evaluate the cost of the measures and the potential negative impact on existing fish passage and survival. If a reasonable and feasible measure is identified from this exercise, Douglas PUD will implement and test this measure toward compliance with meeting the standard.

If WDOE, in consultation with the other members of the Aquatic RWG, determines that there are no reasonable and feasible operational and/or structural modifications that can improve or meet TDG levels allowed under the state waiver, Douglas PUD may, in consultation with the Aquatic RWG and EPA, initiate work toward a Use Attainability Analysis (UAA) or site-specific study.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

Based upon results of the 2006 and 2007 TDG studies and based upon discussions with the Aquatic RWG regarding study design and study needs, Douglas PUD will begin acquiring the necessary field equipment and/or the assistance of consultant services to complete the study. Existing Wells Dam infrastructure and planned operational scenarios will also be necessary for study implementation and will be coordinated between consultants and Wells Project staff.

The technical skills necessary to complete the study are knowledge of water quality monitoring instrumentation, field techniques consistent with WDOE's preliminary guidance manual, motor boat operation and safety, TDG data acquisition and management, and the Washington State water quality standards and 401 certification process.

If biological monitoring is required, a take permit to sample and examine ESA listed species may be required. In this event, the consultants selected to implement the biological monitoring will work with Douglas PUD staff toward obtaining the necessary permits, in a timely manner.

## **8.0 BUDGET**

Study cost will be contingent upon which of the two adaptive management strategies is selected based upon the results of the 2006 study. Following the selection of the most appropriate strategy, a qualified consulting firm will be selected. This consultant will work with Douglas PUD to better refine the specific scope of work and budget for the 2007-2009 TDG study. Preliminary planning level costs for the three potential TDG study options can be found below:

### **Option 1:**

Should the results of the 2006 and 2007 study indicate that Option 1 is the preferred study option toward the development of information for the 401 certification, then Douglas PUD will focus on implementing its annual TDG compliance monitoring program at Wells Dam as described in Section 4.0. The total estimated hours for the implementation of the 2007-2009 TDG compliance monitoring is 420 person hours. These hours are specifically dedicated to the deployment and maintenance of TDG monitoring equipment and data management. Total planning level costs for Option 1, including equipment costs, is \$48,000.

#### Option 2a:

Should the results of the 2006 and 2007 study indicate that Option 2a is the preferred study option, then Douglas PUD will develop a TDG Model, conduct a one-year TDG Dynamics Study and conduct three years of the annual TDG compliance monitoring program. Preliminary planning level costs for the development of a TDG model is \$240,000. The development of a TDG model is expected to take one full year to develop, run and prepare a summary report. Planning level costs for the one-year TDG dynamics study is \$340,000 assuming that the scope of this study is similar to the study conducted in 2006 at Wells Dam. This study would take place after the results of the TDG Model were available and the operations suggested by the model were implemented at the Project. The costs associated with continuing the three year annual TDG compliance monitoring program remains as estimated above, \$48,000. Total planning level costs associated with Option 2a is \$628,000.

#### Option 2b:

Should the results of the 2006 and 2007 study indicate that Option 2b is the preferred study option, then Douglas PUD will focus on the development of a Hydraulic Model and will implement a Feasibility Analysis to evaluate the cost of the measures and the potential negative impact on existing fish passage and fish survival. The planning level costs for the development of a Hydraulic Model for TDG at Wells is expected to range from \$244,000 to \$350,000 depending upon whether the model is numeric or whether the model includes both numeric and physical modeling components. The planning level cost to complete the Feasibility Analysis is \$125,000. The costs associated with continuing the three year annual TDG compliance monitoring program remains as estimated above, \$48,000. Total planning level costs associated with Option 2b ranges from \$417,000 to \$523,000 depending upon the scope and scale of the Hydraulic Model.

## 9.0 SCHEDULE

The need for this study and the study scope, objectives, and timing are entirely dependent upon the results of the 2006 and 2007 TDG studies. Should Wells Dam be capable of meeting the standard then Option 1, Section 6.0 will be implemented (no additional studies needed for TDG).

However, should Wells Dam remain out of compliance with the standard, then one of the two study paths identified by Option 2, Section 6.0 will be implemented following FERC's issuance of the Study Plan Determination in October 2007. Results from the 2008 study will be provided in the form of an Initial Study Report in October 2008. A final report of all of the TDG related studies will be provided to FERC and the Aquatic RWG by October 2009.

## 10.0 REFERENCES

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**DEVELOPMENT OF A WATER TEMPERATURE MODEL  
RELATING PROJECT OPERATIONS TO COMPLIANCE WITH  
THE WASHINGTON STATE AND EPA WATER QUALITY  
STANDARDS (AQUATIC ISSUE 6.2.1.6)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington

For copies of this study plan, contact:

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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5). As part of the Wells Project relicensing process, Douglas PUD is required to obtain a water quality certificate in accordance with section 401 of the Clean Water Act. The Washington State Department of Ecology (WDOE) is responsible for the issuance of a 401 certificate as well as administering the state's Water Quality Standards. As part of the 401 certification process, WDOE must determine that the Wells Project is in compliance with state water quality standards for temperature.

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (including WDOE) and Douglas PUD staff, was formed for the purposes of identifying issues that may require study during Wells Project relicensing. The RWG has identified the need to develop a water temperature model relating project operations to compliance with the Washington State water quality standards.

The development of a water temperature model has been WDOE's preferred method for assessing project effects on water quality. In 2005, Douglas PUD began the initial steps for the development of a water quality model through the collection of detailed bathymetric, meteorological and water temperature data. With guidance from consultants with expertise in water quality modeling, Douglas PUD identified the CE-QUAL-W2 (W2 model) model as being appropriate for assessing temperature effects of the operation of the Wells Project. The W2 model is widely used to support the establishment of TMDLs for Washington waters and is the generally accepted model for evaluating the effects of hydroelectric projects on state waters. Therefore, the W2 model was considered the basis for making decisions regarding data needs and data archiving.

Starting in 2005, Douglas PUD conducted a data review and data gap analysis which resulted in the implementation of a data collection program to ensure that the appropriate model-specific parameters were being collected from within and adjacent to the Wells Project. Data collected during the new monitoring program are being archived in a format that is complementary to future water quality modeling efforts. This data collection program was initiated in 2006 and will continue through 2007 for use in model development during the ILP study period.

Methodologies for W2 model development consist of a data collection component and a model development/implementation component. The data collection component in W2 model development consists of activities such as site review and field reconnaissance, data gap analyses, preliminary data collection design and implementation of data collection programs. The model development/implementation component consists of model input data preparation, model development, hydrodynamic and temperature calibration, sensitivity analyses and hypothesis testing. Douglas PUD is currently (2005-2007) implementing the data collection component.

W2 model development and implementation will proceed in consultation with the Aquatic RWG. Model results will clarify the effects of Project operations as they relate to the state's narrative and/or numeric standards for temperature and will produce model output that will be important to the Wells Project 401 certification process.

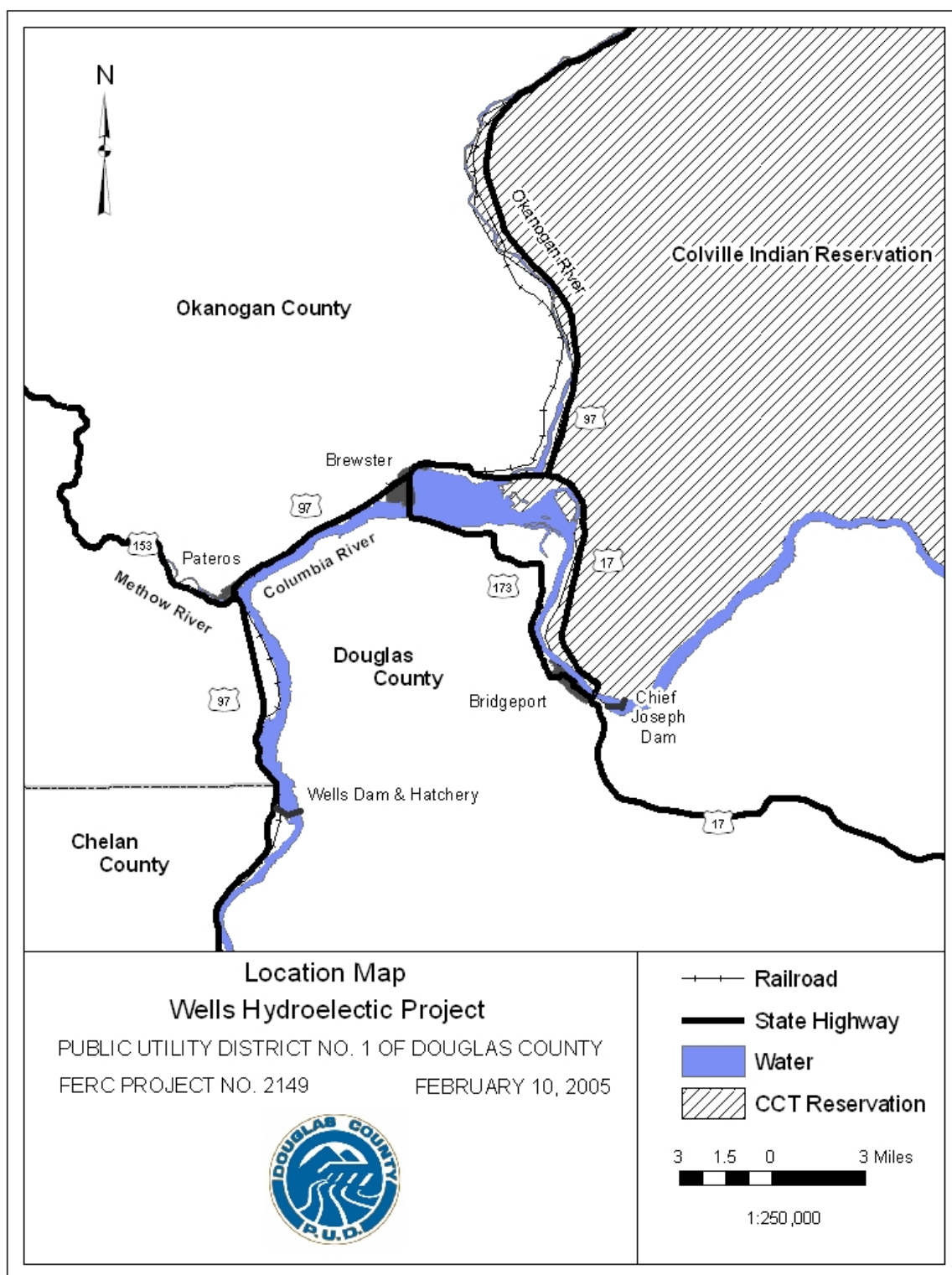
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**

## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The objective of the study is to develop a temperature model (e.g., CE-QUAL-W2) to assess the effects of Wells Project operations on water temperatures at Wells Dam and within the Wells Reservoir as they relate to compliance with the Washington State Water Quality Standards and the 401 certification process.

The Washington State Department of Ecology (WDOE) is the agency responsible for administering the State Water Quality Standards and for the issuance of 401 water quality certificates for hydroelectric relicensing processes in Washington. The information gathered from this modeling effort will assist WDOE in determining the extent to which a Project's operations affect water temperature in excess of the narrative and/or numeric criteria. This

determination will also assist WDOE in the development of an implementation schedule as it applies to the 401 certification process.

### **3.0 STUDY AREA**

The study area is defined as the waters within the Wells Reservoir. This consists of the mainstem Columbia River upstream of Wells Dam to the tailrace of Chief Joseph Dam, and the Okanogan (to RM 15.5) and Methow (to RM 1.5) rivers within Project boundary (Figure 1.1-1).

### **4.0 BACKGROUND AND EXISTING INFORMATION**

In preparation for the development of a temperature model, Douglas PUD assessed the suite of models available. The CE-QUAL-W2 (W2 model) model is widely used to support the establishment of TMDLs for Washington waters and is a generally accepted model for evaluating the effects of hydroelectric projects. Therefore, the W2 model was considered the basis for making decisions regarding data needs and data archiving. With guidance for consultants having expertise in water quality modeling, Douglas PUD conducted a review on the types of information being collected within the Wells Project and whether the data currently collected was sufficient and in a complimentary format to support W2 model development. In response to the data review, Douglas PUD modified existing monitoring programs and in some cases initiated new programs in order to collect the necessary types of information for the W2 model.

#### **Flow Data**

Water flowing into the Wells Project originates from Chief Joseph Dam, on the Columbia River, and from the Okanogan and Methow rivers. Continuous hourly flow data from Chief Joseph Dam, located upstream of Wells Dam, are available from the Columbia River Operational Hydromet Management System (CROHMS) database. A stream gage station located near the town of Malott, WA, measures flow in the Okanogan River (USGS Gage No. 12447200) several miles upstream of the location where the Okanogan River enters the Wells Project. A stream gage station located near Pateros measures flow in the Methow River (USGS Gage No. 12449950) at the point where the river enters the Wells Project. All three of the boundary water monitoring stations provide Douglas PUD with hourly flow data.

Water flowing out of the Wells Project must first pass through Wells Dam. Douglas PUD collects and records hourly flow data for the water passing through the turbines, spillways and adult fish ladders at Wells Dam. Additionally, there is a United States Geological Survey (USGS) gauging station downstream of Wells Dam that also collects river flow information and is reflective of water passing through Wells Dam.

#### **Temperature Data**

Beginning in 2001, an extensive water temperature monitoring effort was initiated in order to better understand the temperature dynamics throughout the Wells Reservoir. Temperature data were collected at four locations (RM 544, RM 532, RM 530, RM 516) in the Columbia River



and at one location in both the Methow (RM 1.5) and Okanogan rivers (RM 13). Data were collected hourly using Onset tidbit temperature loggers. Monitoring start and end dates varied from year to year but generally began in the spring and ended in late fall. Quality assurance and control prior to deploying and upon retrieving temperature loggers were implemented to ensure that data collected were accurate (Douglas PUD, 2005). Due to sensor loss or sensor malfunction in some years, the availability of data at some of these monitoring locations is sporadic.

An additional component of the water temperature monitoring effort launched in 2001 was to profile vertical temperatures at the RM 516 location in the Columbia River at the Wells Dam forebay. The temperature station was located along the east portion of the forebay, in what had been the original channel of the Columbia River prior to the construction of the Wells Project. Each year between 2001-2005, temperature loggers were deployed at 3 different depths between 5 and 90 feet and approximately 30 feet apart from one another. Results reflected the limited storage capacity of the Wells Reservoir and showed no measurable thermal stratification.

Starting in 2006 and following the completion of the data review and data gap analysis, Douglas PUD expanded the Wells Reservoir temperature monitoring season to cover the entire year and implemented a more frequent downloading schedule to avoid temperature data gaps. Douglas PUD also added additional monitoring stations at the mouths of the Okanogan (RM 0.5) and Methow (RM 0.1) rivers. This collective data, which documents incoming water temperatures to the Wells Project (boundary conditions), as well as other sites throughout the Wells Reservoir including the Wells Dam forebay, will be integral in the development of a W2 temperature model.

### **Meteorological Data Collection**

Site specific weather information is an integral component for the development of water temperature models which can be used to support 401 water quality certification. Weather information characteristic of the entire Wells Reservoir was unavailable up until 2005 when Douglas PUD began collecting site specific meteorological data. Douglas PUD identified three sites that would most effectively characterize weather trends in the Wells Reservoir.

These sites were Chief Joseph Dam (upper reservoir area), Bridgeport Bar (mid-reservoir area) and the Wells Project forebay (lower reservoir area). Since reliable meteorological information was already available near Chief Joseph Dam, NRG systems weather stations were erected at the other two identified sites in order to collect the suite of parameters that are required in support of water temperature modeling. The parameters collected were air temperature, relative humidity, dew point temperature, solar incidence, cloud cover, wind speed, and wind direction.

### **Bathymetric Data Collection**

In March 2005, Douglas PUD contracted with GeoEngineers to conduct a detailed bathymetric survey of the Wells Reservoir and tailrace using multibeam sonar and GPS technology. Contour maps of the reservoir bottom were produced at 1-foot contour intervals, and a digital elevation

model (DEM) was produced at a pixel resolution of 10-feet. The DEM provides a seamless representation of the riverbed surface.

## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these meetings and discussions, the Aquatic RWG is proposing to include a study plan into the Wells PAD which addresses the effect of Project operations on compliance with temperature standards in the Wells Project (6.2.1.6). The need for this study was agreed to by all of the members of the Aquatic RWG, including Douglas PUD. This study will help to inform future relicensing decisions and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Issue Statement (6.2.1.6)**

Project operations may affect compliance with temperature standards in the Wells Project.

### **Issue Determination Statement (6.2.1.6)**

The Wells Project can have an effect on compliance with the water temperature standard. The Aquatic Resource Work Group members agree that studies to address this issue are feasible and the results will be meaningful for the 401 Water Quality Certification Process. Douglas PUD is currently collecting temperature data throughout the Wells Project. Furthermore, Douglas PUD has established weather stations to collect meteorological data in key locations of the Wells Reservoir. These data sets will be utilized to develop a temperature model (i.e., CE-QUAL-W2) to assess the Wells Project's effect on water temperatures.

The Resource Work Group believes that a study to develop a temperature model is necessary to determine compliance with the state's water quality standards. The resource work group agrees that this study (development of specific water temperature models) should be implemented during the two-year ILP study period.

Toward this goal, Douglas PUD will continue to collect water temperature and meteorological data during 2006 and 2007 for use in the development of a temperature model to be used in 2008 and/or 2009. Data may continue to be collected in 2008 and 2009, if necessary.

## **5.0 PROJECT NEXUS**

The WDOE is responsible for the protection and restoration of the state's waters. WDOE has adopted standards that set water quality criteria for lakes, rivers, and marine waters in order to protect water quality and dependent uses. On July 1, 2003, WDOE completed the first major review and modification of the state's water quality standards in a decade. A significant revision presented in the 2003 water quality standards classifies fresh water by use, rather than by class as was done in the 1997 standards. These revisions were adopted in order to make the 2003 standards less complicated to interpret and provide greater flexibility as the uses of a water body evolve.

Congress passed the Clean Water Act in 1972, and designated the US Environmental Protection Agency (EPA) as the administering federal agency. This federal law requires that a state's water quality standards protect the surface waters of the US for beneficial uses, such as recreation, agriculture, domestic and industrial use, and habitat for aquatic life. State water quality standards, or amendments to these standards, do not take regulatory effect for the purposes of the Clean Water Act until they have been approved by EPA. EPA has completed an initial review of the water quality standards (WQS) adopted by the State of Washington in 2003 and has requested that WDOE revise some of the proposed WQS. Currently, WDOE is in the process of addressing EPA's comments and approval of the 2003 WQS is expected before Douglas PUD files its license application (2010) and Section 401 certification is issued (2012). Due to this, the 2003 standards as they apply to temperature in the Wells Project will be used.

The new WQS for water temperature within the Wells Project includes a number of numerical and narrative criteria. Those most pertinent to the Project are:

For the tributary reaches that are within the Wells Project boundary (Okanogan River from RM 0 to RM 15.5 and the Methow River from RM 0 to RM 1.5),

- Water temperature shall not exceed 17.5°C (63.5°F), where water temperature is measured by the 7-day average of the daily maximum temperatures (7-DADMax);
- When a water body's temperature is warmer than 17.5°C (or within 0.3°C (0.54°F) of 17.5°C) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F);
- When the natural condition of the water is cooler than 17.5°C the allowable rate of warming up to, but not exceeding, the numeric criteria (17.5°C) from human actions is restricted as follows:
  - Incremental temperature increases resulting from individual point source

activities must not, at any time, exceed  $28/(T.+5)$  as measured at the edge of a mixing zone boundary (where "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge);

- Incremental temperature increases resulting from the combined effect of all nonpoint source activities in the water body must not, at any time, exceed 2.8°C (5.04°F).

For the mainstem Columbia River that is within the Wells Project boundary,

- Water temperature shall not exceed 18.0°C (63.5°F), where water temperature is measured by the 7-day average of the daily maximum temperatures (7-DADMax);
- When a water body's temperature is warmer than 18.0°C (or within 0.3°C (0.54°F) of 18.0°C) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the 7-DADMax temperature of that water body to increase more than 0.3°C (0.54°F);
- When the natural condition of the water is cooler than 18.0°C the allowable rate of warming up to, but not exceeding, the numeric criteria (18.0°C) from human actions is restricted as follows:
  - Incremental temperature increases resulting from individual point source activities must not, at any time, exceed  $28/(T.+5)$  as measured at the edge of a mixing zone boundary (where "T" represents the background temperature as measured at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge);
  - Incremental temperature increases resulting from the combined effect of all nonpoint source activities in the water body must not, at any time, exceed 2.8°C (5.04°F).

The temperature of water flowing into and through the Wells Reservoir typically begins warming in March while reaching peak annual temperatures in August through early September. During this time period, incoming water into the Wells Project can exceed both the 7-DADMax numeric criteria of 17.5 °C and 18.0°C. A portion of the mainstem Columbia River encompassing Wells Dam is on the 2004 303(d) list as an impaired waterbody for temperature.

Water temperature is one of a multitude of environmental factors that may affect salmonid populations in the mid-Columbia River basin. Concerns have been raised that increasing temperature levels above a given threshold can begin to cause upstream migration delays, promote disease, and increase the probability of mortality for salmonids at all life history stages. Natural ambient water temperatures often exceed lethal tolerance levels for salmonids in the Lower Okanogan River (NMFS, 2002). Yet, the Okanogan watershed currently supports healthy

runs of anadromous summer/fall Chinook salmon and sockeye salmon, and smaller runs of steelhead (NMFS, 2002).

Currently, sufficient information is not available to examine the contribution of Wells Project operations to the warming of water temperatures above the conditions which would occur without the Project in place or with regard to the state's numeric criteria. The information resulting from a temperature model will assist the Aquatic RWG in the understanding of temperature effects due to Project operations as required by FERC's study criteria (18 CFR §5.9(b)(5)).

## **6.0 METHODOLOGY**

The W2 model is widely used to support the establishment of TMDLs for Washington waters and is a generally accepted model for evaluating the effects of hydroelectric projects on various water quality parameters (EES Consulting, 2006).

The development of a W2 model consists of two major components; data collection for model input and model development/implementation. The data collection component in W2 model development consists of activities such as site review and field reconnaissance, data gap analyses, preliminary data collection design and implementation of data collection programs. The model development/implementation component consists of model input data preparation, model development, hydrodynamic and temperature calibration, sensitivity analyses and hypothesis testing.

Douglas PUD has already begun and will continue activities associated with the data collection component as described in Section 4.0 in preparation for the development of a W2 model. The information collected by these activities was developed through guidance from consultants specializing in water quality modeling and with extensive W2 modeling experience. There are a suite of consulting firms that specialize in water quality model development and application within Washington State. Prior to the start of the 2-year ILP study period (2008-2009), Douglas PUD will secure the services of a qualified consultant to develop a W2 model for Wells Dam and the Wells Reservoir. Model development will generally not require access to Wells Project facilities; however, it may be necessary to grant access in order to clarify specific components of the modeling process. The W2 model will provide insight into whether the Wells Project is in compliance with the temperature criteria as specified in the Washington State water quality standards and provide useful information for the Wells Project 401 certification process.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

The equipment necessary to complete the data collection component of the W2 model has already been acquired by Douglas PUD. Cost and level of effort associated with the implementation and maintenance of data collection programs currently being implemented to support future W2 model development has been absorbed by Douglas PUD.

The technical skills necessary to complete the study are a strong knowledge of W2 model development, experimental design, and quantitative analyses and their applicability to the

Washington State water quality standards, 401 water quality certification, and hydroelectric relicensing processes.

Douglas PUD is currently engaged in the data collection component of the study. However, a contractor will be hired to conduct the model development/implementation component of the study. The persons or firms responsible for analysis are yet to be determined.

No permits will be required in order to complete this study.

## **8.0 BUDGET**

As mentioned in Section 4.0, field activities to begin collecting the necessary parameter data to develop a W2 temperature model are currently in progress. Total estimated hours for the implementation of these activities is approximately 250 person hours. These hours are all associated with deployment and maintenance of data logging equipment and is estimated to be \$12,500. Equipment costs and expenses related to field implementation (weather stations, temperature loggers, boat use, travel, etc.) is estimated to be \$15,000. Total costs for the data collection effort is approximately \$27,500.

The total estimated hours for the development of a W2 temperature model is approximately 1,021 person hours. The allocation of these hours is approximately 25 hours for study planning and site visit; 182 hours for preparation of model input data; 630 hours for model development, analysis, and compliance assessment; and 184 hours for reporting, meetings, and quality assurance/control processes. Total costs for model development are estimated to be \$100,000.

Total planning level cost for this effort is approximately \$127,500.

## **9.0 SCHEDULE**

Data collection of all the necessary parameters for the development of a W2 model began in 2006 and will continue through 2007. The development of a model integrating the information collected from 2006-2007 will take place after the issuance of FERC's Study Plan Determination in October 2007. It is expected that this effort will take most of 2008 and/or 2009 to complete. An Initial Study Report will be provided to the Aquatic RWG, stakeholders and FERC in October 2008 with a final report summarizing the processes of model development, analyses, and results by October 2009. The information provided in the final report will be useful in discussions related to the Wells Project relicensing and 401 certification process.

## **10.0 REFERENCES**

Douglas PUD (Public Utility District No.1 of Douglas County). 2005. Wells Dam Total Dissolved Gas Abatement Plan For 2005 and 2006. Prepared by Rick Klinge, Public Utility District No. 1 of Douglas County, East Wenatchee, WA.

EES Consulting (EES Consulting, Inc.). 2006. Comprehensive Limnological Investigation, Wells Hydroelectric Project, FERC NO. 2149. Prepared by EES Consulting Inc., Kirkland, WA for Public Utility District No. 1 of Douglas County, East Wenatchee, WA.

NMFS (National Marine Fisheries Service). 2002. Anadromous Fish Agreements and Habitat Conservation Plans: Final Environmental Impact Statement for the Wells, Rocky Reach, and Rock Island Hydroelectric Projects. U.S. Department of Commerce. National Oceanic and Atmospheric Administration. National Marine Fisheries Service.

**CONTINUED MONITORING OF DO, pH, AND TURBIDITY IN THE  
WELLS FOREBAY AND LOWER OKANOGAN RIVER  
(AQUATIC ISSUE 6.2.1.7)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington



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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5). As part of the Wells Project relicensing process, Douglas PUD is required to obtain a water quality certificate pertinent to section 401 of the Clean Water Act. The Washington State Department of Ecology (WDOE) is responsible for the issuance of a 401 certificate as well as administering the state's Water Quality Standards. As part of the 401 certification process, WDOE must determine that the Wells Project is in compliance with state water quality standards for dissolved oxygen (DO), pH, and turbidity.

The Aquatic Resource Work Group (RWG), which is composed of stakeholders (including WDOE) and Douglas PUD staff, was formed for the purposes of identifying issues and information gaps that may require study during the relicensing of the Wells Hydroelectric Project. The Aquatic RWG, through a series of technical meetings, is proposing a study to collect additional DO, pH, and turbidity data from within the Wells Project.

Douglas PUD and other state and federal agencies have monitoring programs in place that collect water quality information related to these parameters at various scopes and frequencies. This study will augment the established sampling regimes and will provide additional information related to DO, pH and turbidity from within the Wells Project.

Sampling locations for the study are the Lower Okanogan River within Project boundary and the Wells Dam forebay. Study implementation is planned for 2008 with sampling occurring during periods where the probability of exceedance with the water quality standard is highest (between mid-July and mid-September).

A technical summary of the monitoring study will be produced to assist the Aquatic RWG in determining whether the Wells Project is in compliance with the state's water quality standards for these parameters which are a necessary component of the 401 water quality certification process.

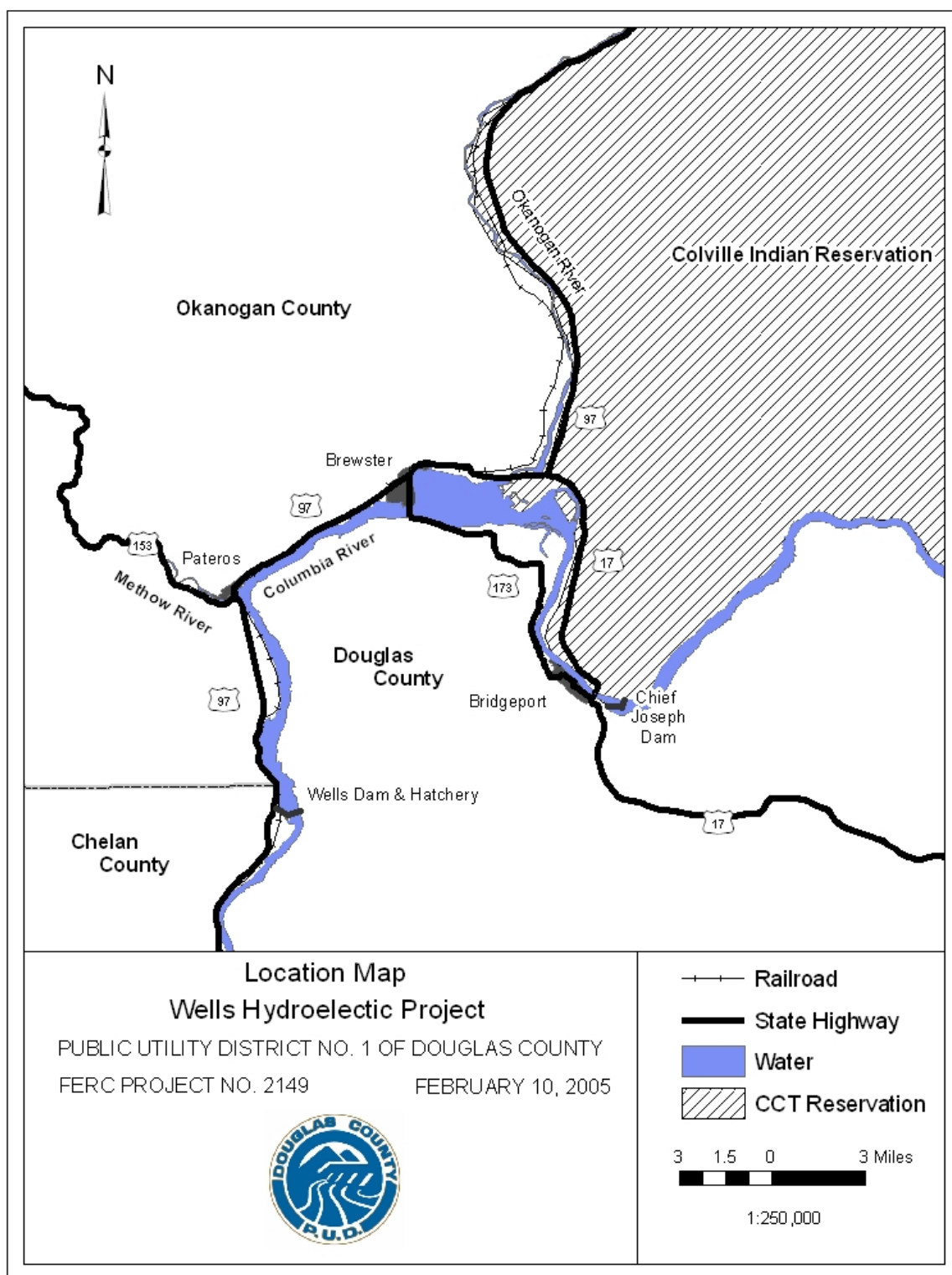
## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet (Figure 1.1-1).



**Figure 1.1-1      Location Map of the Wells Project**

## 1.2 Relicensing Process

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to Wells Project Relicensing. Any dispute over alternative study methods that cannot be reconciled with stakeholders will be decided by FERC.

## 2.0 GOALS AND OBJECTIVES

The objective of the study is to continue monitoring dissolved oxygen (DO), pH, and turbidity in the Wells Dam forebay and Lower Okanogan River within the Wells Project boundary.

The Washington State Department of Ecology (WDOE) is the agency responsible for administering the state Water Quality Standards and for the issuance of 401 water quality certificates for hydroelectric relicensing processes in Washington. The information gathered from this monitoring effort will assist WDOE in determining the extent to which Project operations have an affect on compliance with the specified numeric criteria for DO, pH and turbidity. This determination will also assist WDOE in the development of an implementation schedule as it applies to the 401 certification process.

### **3.0 STUDY AREA**

The study area consists of waters within the Wells Project with a particular emphasis on the Wells Forebay and the Lower Okanogan River from its confluence with the Columbia River up to river mile (RM) 15.5 (Figure 1.1-1).

### **4.0 BACKGROUND AND EXISTING INFORMATION**

WDOE has established water quality standards in an effort to protect the beneficial uses of state water and water bodies. The Washington standards include both numeric and narrative criteria. The narrative standards address beneficial uses that include, but are not limited to, the ecological significance of water quality to aquatic biota. The importance of water quality to the health of rare, threatened, and endangered populations is also described in the narrative standards.

DO levels are an extremely important variable for aquatic life and govern the chemical dynamics of a water body. DO levels are influenced by a suite of factors including the level of biological activity in the water, turbulence, and temperature (EES Consulting, 2006).

Turbidity is the measure of the light scattering from suspended particles in water. After light enters water, it is absorbed, reflected or refracted by dissolved organic substances, pigmented (phytoplankton) and colored particulates and by the water itself. Light is scattered by inorganic particulates. Turbidity is a good indicator of a waterbodies trophic status when combined with nutrient and chlorophyll data. Transparency also regulates primary productivity and trophic dynamics which ultimately can affect fish populations. There is a direct relationship between turbidity, water transparency and the depth at which macrophytes grow (EES Consulting, 2006).

The term pH is used to describe the acidity or hydrogen ion level of a liquid. Factors influencing the pH of a water body include the chemical composition of soils in the watershed, photosynthetic activity, pollutants, and respiration of organisms (EES Consulting, 2006). pH levels which are extremely acidic or basic can adversely impact aquatic life and may be representative of metals and other pollutants present within a watershed.

Factors and activities affecting water quality in the Wells Project include 1) nonpoint source pollution from agricultural runoff and irrigation return flow, 2) point source pollution from mines, municipal and industrial sources upstream and outside of the Wells Project boundary, 3) depletion of instream flows from water diversions and consumptive uses, 4) watershed management in the tributaries and Upper Columbia River above Wells Dam, 5) the operation of large water storage facilities located upstream of Wells Dam on the mainstem Columbia and in the Okanogan watershed, and 6) effects related to operations of the Wells Project.

Under section 303(d) of the 1972 Clean Water Act, states are required to list all water body segments that do not meet the state water quality standards. Within the Wells Project boundary, specific water reaches have been put on the state's 303(d) list in the past for various parameters. However, the lower Okanogan River within Project boundary as well as all other areas within the Wells Project is not on the 2002/2004 303(d) list with respects to the parameters of interest.

Douglas PUD and state and federal agencies have implemented monitoring programs to collect information within or adjacent to the Wells Project at various scopes and frequencies. The programs collect a variety of biological, chemical, and physical water quality parameters and typically include the three parameters of interest (DO, pH, and turbidity). Data collected from these monitoring activities suggest that waters within the Wells Project are generally in compliance with the state standards. During times when Wells Project waters are in exceedance of the stated numeric criteria for these parameters, waters entering the Wells Project are also out of compliance.

### **Douglas PUD Monitoring Activities**

In August, 2005, Douglas PUD began monitoring DO and pH in the Wells Dam forebay when the probability of low DO levels was highest. The results of this monitoring effort indicated that DO levels were not below 8.0 mg/L and pH levels were not outside of the specified range of 6.5 to 8.5, which are the state water quality numeric criteria (WAC 173-201A as amended July 1, 2003). In response to requests made by WDOE, Douglas PUD has continued implementing seasonal monitoring, for the summer months of 2006, for these parameters at the Wells Dam forebay. At Wells Dam, Secchi disk readings are taken to measure water transparency which is inversely correlated to turbidity. Sampling occurs daily during the adult fish passage assessment period of May 1<sup>st</sup> to November 15<sup>th</sup>. Measurements are recorded in feet of visibility and reliable information adhering to a standard protocol has been collected since 1998. During the monitoring period, Secchi disk readings ranged from 2 feet during spring run-off to 16 feet by late summer (Douglas PUD, 2006).

In 2005, Douglas PUD contracted with EES Consulting to conduct a comprehensive limnological investigation of Wells Project waters (EES Consulting, 2006). The year long study was conducted at nine sites (7 sites in the Columbia River and 1 site in the Methow and Okanogan rivers) in order to characterize water quality and seasonal trends in the Wells Project. Water quality sampling was scheduled seasonally with one sample event scheduled for each season. Spring sampling was conducted in May, fall monitoring was conducted in October, and winter sampling occurred in February (2006). Summer sampling was conducted more frequently when water quality exceedances were more likely and temporal changes more dynamic (July, August and September). Results of the study found DO levels at 1m depth in Wells Project waters increased from upriver to downriver at the sites sampled; the average difference (May through October) was 1.07 mg/L. All surface water measurements had DO values greater than 8.0 mg/L. pH for Wells Project waters generally varied between 7.5 and 8.25, which is slightly above neutral. There were no measured exceedances of the water quality standard for pH. Turbidity in the Wells Reservoir showed relatively little seasonal variation with an annual average of 0.98 Nephelometric Turbidity Units (NTU). Longitudinal variation in turbidity was also minimal. Low turbidity in the reservoir is partially due to the large upstream storage reservoir capacity that allows fines to settle out. Turbidity in the Okanogan River was consistently higher than in the Wells Reservoir. Turbidity in the Methow River was higher than in the Wells Reservoir in May (due to sediment load) and in August due to phytoplankton growth. The only turbidity reading over 5 NTU was in the Methow River during May (EES Consulting, 2006).

## WDOE Monitoring Activities

WDOE has conducted monthly water quality monitoring at locations on the Okanogan River near Malott (station 49A070) upstream of the Wells Project boundary at approximately RM 17 and on the Methow River near Pateros (station 48A070) upstream of the Wells Project boundary at approximately RM 5. Both stations are considered “long-term” stations by WDOE and provide the most reliable information for the quality of water entering the Wells Reservoir from tributary inflow. It is important to note that data collected from these stations are representative of water quality conditions outside of the Wells Project boundary. Data are typically collected as grab samples on a monthly basis. A variety of water quality parameters including DO, pH, and turbidity information as well as site compliance are available at [http://www.ecy.wa.gov/programs/eap/fw\\_riv/rv\\_main.html](http://www.ecy.wa.gov/programs/eap/fw_riv/rv_main.html). Table 4.0-1 provides the range of values for the parameters of interest observed at these two long-term monitoring stations since 2001.

Table 4.0-1. The range of DO, pH and turbidity values observed from monthly grab samples collected upstream of the Wells Project on the Okanogan (RM 17) and Methow rivers (RM 5). Data from WDOE long-term monitoring stations 2001-2005.

<b>Okanogan River (RM 17)</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
DO (mg/L)	7.32-13.87	8.8-13.63	8.32-13.3	8.16-14.08	7.24-14.11
pH	7.87-8.45	7.83-8.39	7.81-8.35	7.48-8.55	7.85-8.44
Turbidity (NTU)	0.8-5.5	1.0-19.0	0.8-22.0	0.9-75.0	0.8-7.8
<b>Methow River (RM 5)</b>					
DO (mg/L)	9.56-14.48	9.8-13.8	9.34-14.2	9.18-14.69	9.28-14.36
pH	8.04-8.74	7.46-8.53	7.71-8.48	7.73-8.58	7.78-8.38
Turbidity (NTU)	0.5-2.9	0.5-3.8	0.5-6.0	0.5-8.8	0.9-5.7

## United States Geological Survey (USGS) Monitoring Activities

The USGS studies surface-water quality in cooperation with local and state governments and with other federal agencies. Monitoring programs consist of collection, analysis and data archiving and dissemination of data and information describing the quality of surface water resources. Similar to WDOE, the USGS has monitoring stations on both the Okanogan (12447200) and Methow (122449950) rivers near Malott and Pateros, respectively; however, the data collected at these stations appear to be incomplete and therefore less reliable in providing representative data for tributary water quality than data furnished by WDOE (Douglas PUD, 2006). Data can be accessed via the Internet at: <http://nwis.waterdata.usgs.gov/wa/nwis/qwdata>



## **4.1 Aquatic Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established an Aquatic Resource Work Group (RWG) which began meeting informally in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included in the Wells Pre-Application Document (PAD).

Through a series of meetings, the Aquatic RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decisions. Agreed Upon Study Plans are the finished products of the informal RWG process.

Based upon these discussions, the Aquatic RWG is proposing to include a study plan into the Wells PAD which addresses the continued monitoring of DO, pH, and turbidity in the Wells Forebay and inundated portion of the Okanogan River. The need for this study was agreed to by all of the members of the Aquatic RWG, including Douglas PUD. This study will help to inform future relicensing decisions through the 401 water quality certification process and will fill data gaps that have been identified by the Aquatic RWG.

## **4.2 Issue Statement**

### **Issue Statement (6.2.1.7)**

Project operations may affect compliance with DO, pH and turbidity standards in the Wells Project.

### **Issue Determination Statement (6.2.1.7)**

The Wells Project may have an effect on compliance with the standards for DO, pH and turbidity. Currently, Douglas PUD has collected water quality data toward the evaluation of meeting the numeric criteria for these parameters. Initial data collected during the 2005 baseline limnological assessment indicates that Douglas PUD is in compliance with the Washington State Standard for these parameters. However, additional monitoring is required to make a final determination.

The resource work group agrees that a study during the two-year ILP study period is necessary. The study will focus on the collection of DO, pH and turbidity in the Wells Project especially focusing on data collection from the Okanogan River and at Wells Dam.

## 5.0 PROJECT NEXUS

The WDOE is responsible for the protection and restoration of the state's waters. WDOE has adopted water quality standards that set limits on pollution in lakes, rivers, and marine waters in order to protect water quality. On July 1, 2003, WDOE completed the first major overhaul of the state's water quality standards in a decade. A significant revision presented in the 2003 water quality standards classifies fresh water by actual use, rather than by class as was done in the 1997 standards. These revisions were adopted in order to make the 2003 standards less complicated to interpret and provide future flexibility as the uses of a water body evolve.

Congress passed the Clean Water Act in 1972, and designated the U.S. Environmental Protection Agency (EPA) as the administering federal agency. This federal law requires that a state's water quality standards protect the surface waters of the U.S. for beneficial uses, such as recreation, agriculture, domestic and industrial use, and habitat for aquatic life. State water quality standards, or amendments to these standards, do not take regulatory effect for the purposes of the Clean Water Act until they have been approved by EPA. EPA is currently reviewing the water quality standards adopted by the State of Washington in 2003 and partial approval has occurred. Full approval is expected before Douglas PUD files its license application (2010) and Section 401 certification is issued (2012). Due to this, the 2003 standards will be used for the purposes of this study.

The new water quality standards for DO, pH, and turbidity include a number of numerical and narrative criteria. Those most pertinent to the Wells Project are:

- Freshwater – dissolved oxygen shall exceed 8.0 mg/L in waters that have a designated aquatic life use of salmonid spawning, rearing and migration. Dissolved oxygen shall exceed 6.5 mg/L in waters that have a designated aquatic life use of salmonid rearing and migration only.
- pH shall be within the range of 6.5 to 8.5 (freshwater with human-caused variation within the above range of less than 0.5 units).
- Turbidity shall not exceed 5 NTU over background turbidity when the background turbidity is 50 NTU or less, or have more than a 10 percent increase in turbidity when the background turbidity is more than 50 NTU.

Whether it is by the reduction in the level of oxygen available for aquatic life, low pH levels indicative of heavily polluted waters, or increased sediment transport, which can reduce transparency and affect productivity at varying trophic levels, DO, pH, and turbidity are environmental variables critical to the health of a waterbody and therefore the aquatic life that live there.

The information resulting from continued monitoring of DO, pH, and turbidity will assist the Aquatic RWG in the development of licensing requirements through the 401 water certification process.

## 6.0 METHODOLOGY

In order to collect information that will be informative of the effects of Wells Project operations on the water quality parameters of interest and whether these parameters are in compliance with the Washington State water quality standards, sampling stations will be located in the following locations:

- Okanogan River at Project boundary (RM 15.5),
- Okanogan River near Monse (RM 5.0),
- Okanogan River upstream of the confluence with the Columbia River (RM 0.5),
- Wells Dam forebay (RM 516).

Data will also be available from the WDOE monitoring station (station 49A070) located near Malott on the Okanogan River (RM 17) to supplement the collected information. A review of the current Wells Forebay monitoring program will be conducted for its suitability to the study objectives. Any agreed upon modifications to this existing Wells Forebay monitoring program will be implemented during the first year of the 2-year ILP study period (2008).

Currently, WDOE is proposing to conduct continued DO monitoring in the Lower Okanogan River in 2008. Although study methodology is currently being developed, Douglas PUD will coordinate with WDOE in order to maintain consistent sampling practices so that DO information collected during this time period will be comparable between all sites where information is collected. Monitoring will occur between mid-July and mid-September when the probability of exceedances for these parameters is highest. Although WDOE is not proposing to monitor pH and turbidity during this time period, Douglas PUD will continue to monitor these parameters to meet Washington State's credible data criteria.

At each of the three stations located in the Lower Okanogan River and at the station in the Wells Dam forebay, dissolved oxygen (DO), pH, and turbidity will be measured continuously using a Hydrolab minisonde or other appropriate instrumentation. Instruments will be calibrated prior to each field visit according to the manufacturer's specifications. Winkler titrations will be performed at appropriate intervals to ensure the dissolved oxygen probe is functioning properly. The probe will be re-calibrated if the result of the Winkler titration and probe reading differed by more than 0.2 mg/L. At each monitoring site, instrumentation will be placed so as to best represent the overall river condition.

Quality assurance plans will meet state and Federal guidelines. Based upon the data collected and discussions with the Aquatic RWG, a determination will be made as to whether the information collected in 2008 is sufficient or whether a second year of data collection is necessary.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

Based upon discussions with the Aquatic RWG regarding study design and study needs, Douglas PUD will begin acquiring the necessary field equipment and/or the assistance of consultant services to complete the study.

The technical skills necessary to complete the study are knowledge of water quality monitoring instrumentation, field techniques consistent with WDOE's preliminary guidance manual, motor boat operation and safety, data acquisition and management, and Washington State water quality standards.

No permits will be required in order to complete this study.

## **8.0 BUDGET**

The total estimated hours for the implementation of the DO, pH, and turbidity monitoring study for 2008 is approximately 360 person hours. The allocation of these hours is approximately 20 hours for study plan development; 280 hours for field activities (deployment, servicing, retrieval); and 60 hours for data management, data analysis and reporting. Labor costs are estimated to be \$40,000. Equipment costs and expenses related to field implementation (travel, sensor rental, boat use, etc.) are estimated to be \$35,000. Total planning level cost for this effort is approximately \$75,000.

## **9.0 SCHEDULE**

Planning for this study will begin shortly after the issuance of FERC's Study Plan Determination in October 2007. Equipment will be purchased during 2007 depending upon FERC's Study Plan Determination. Preliminary results of monitoring in late 2007 and 2008 will be provided in an Initial Study Report and will be filed with FERC along with the Initial Study Report due in October 2008. A technical summary of the processes, data collected, and results will be produced for use by the Aquatic RWG in discussions related to the Wells Project relicensing and 401 certification process. A final study report detailing the results of the study will be provided by October 2009.

## **10.0 REFERENCES**

EES Consulting (EES Consulting, Inc.). 2006. Comprehensive Limnological Investigation, Wells Hydroelectric Project, FERC NO. 2149. Prepared by EES Consulting Inc., Kirkland, WA for Public Utility District No. 1 of Douglas County, East Wenatchee, WA.

**CULTURAL RESOURCES INVESTIGATION  
(CULTURAL RESOURCES 6.2.4.1)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
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## **ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Cultural Resources Work Group (CRWG), which is composed of stakeholders (resource agencies, tribes and FERC) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The CRWG, through a series of technical meetings, is proposing to conduct a Cultural Resources Investigation to resolve existing gaps in knowledge of cultural resources in the Area of Potential Effect (APE).

The Cultural Resource Investigation will identify and revisit all previously recorded historic properties within the APE, update the current location and condition of each site, update the site forms for each site, develop a prioritized list of sites and evaluate whether they are eligible for the National Register of Historic Places (NRHP), and evaluate the Project's effects on historic properties identified within the FERC Project Boundary.

The results of this study will be used to develop protection, mitigation, and enhancement (PME) measures for historic properties in the Wells Project APE. The PME measures will be incorporated into the Historic Properties Management Plan which will be filed with FERC along with the final license application in May, 2010.

## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). Construction of the Wells Project began in the fall of 1963 and commercial operation began on September 1, 1967. It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides of the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet mean sea level (MSL).

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781 MSL. The normal maximum water surface elevation of the reservoir is 781 feet. The Wells Project is licensed to operate between elevations 781 and 771 feet MSL. In the last 15 years, the Project has operated between 777 and 781 MSL 95% of the time.

### **1.2 Relicensing Process**

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;



- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## **2.0 GOALS AND OBJECTIVES**

The goal of this study is to establish sound baseline information about cultural resources within the Wells Project boundary for the development of a Historic Properties Management Plan.

Specific objectives for meeting this goal are as follows:

- Update the current location and condition of all known cultural resource locations within the Area of Potential Effects (APE);
- Update site forms for all sites identified within the APE;
- Determine whether or not localized intensive surveys are needed for portions of the APE;
- Develop a list of priority sites for Determinations of Eligibility (DOE);
- Complete DOEs for priority sites; and
- Evaluate the Project's effects on historic properties identified within the APE.

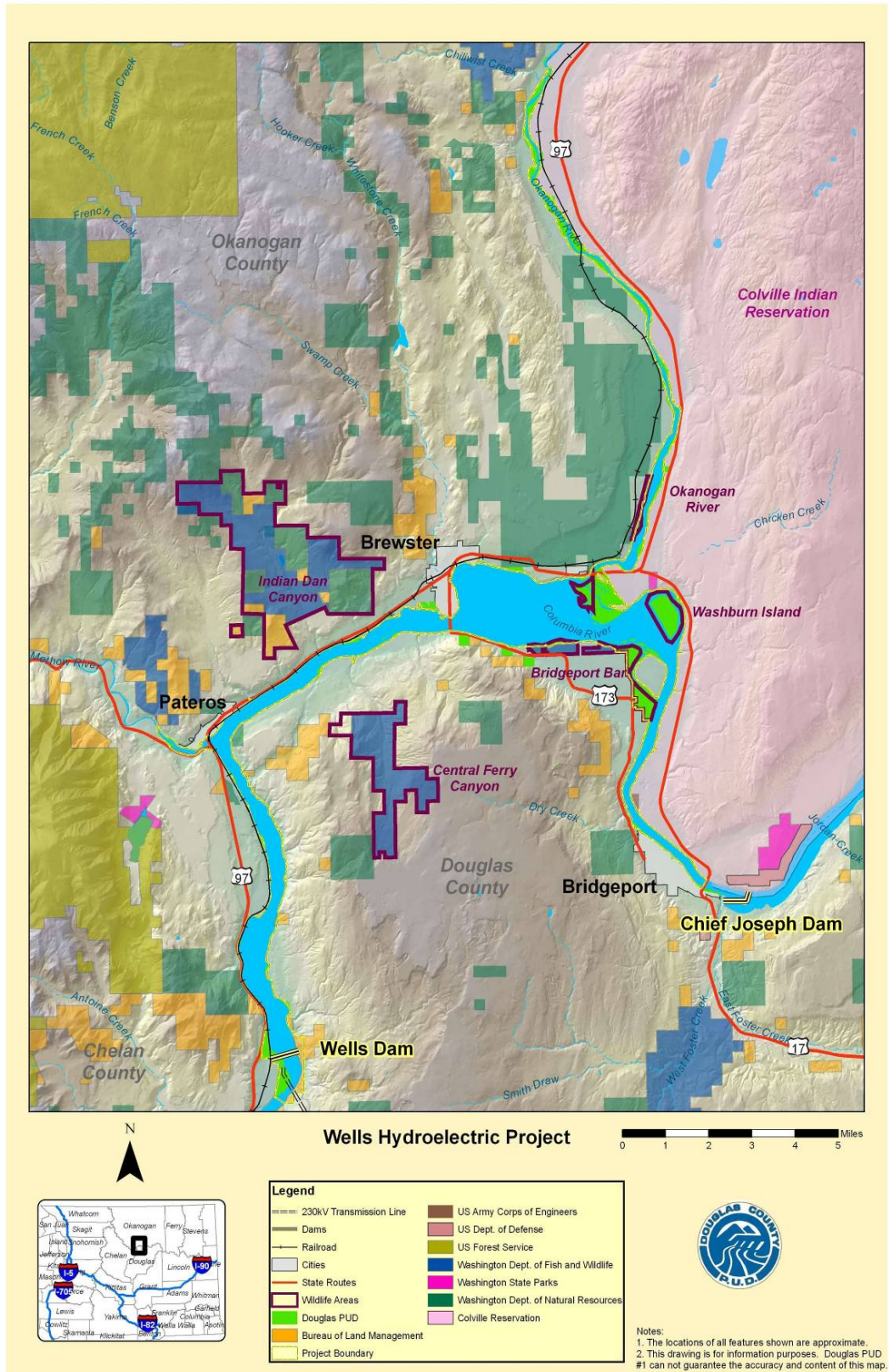
The results of the Confederated Tribes of the Colville Reservation Traditional Cultural Property (TCP) study will be incorporated into the above goals and objectives.

## **3.0 STUDY AREA**

The Wells Project APE was defined by the CRWG as follows:

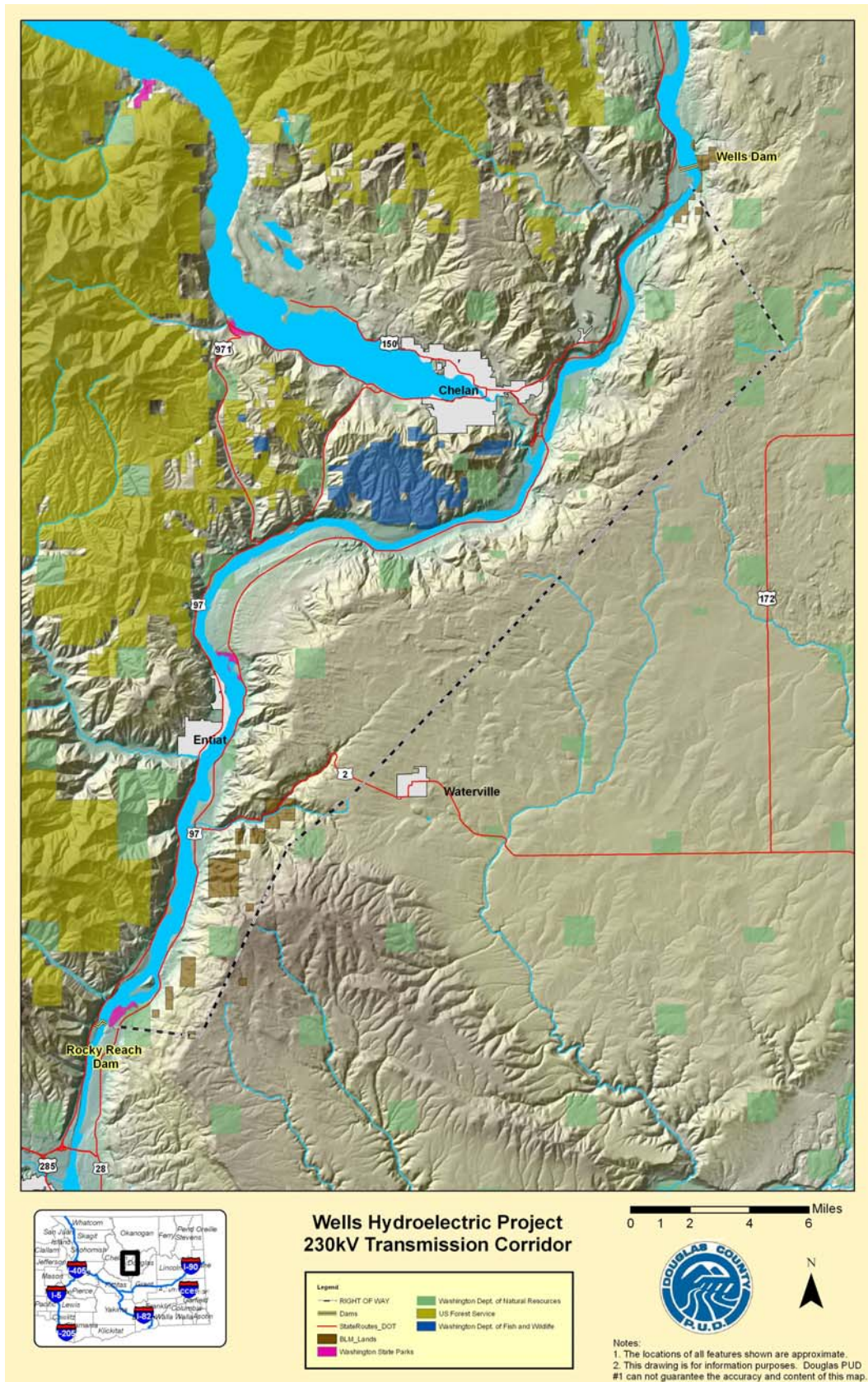
*The Wells Project area of potential effect (APE) includes all lands within the FERC Project boundary. The APE also includes any lands outside of the Project boundary where cultural resources may be affected by Project-related activities that are conducted in compliance with the FERC license (e.g. the Wells HCP Tributary Conservation Program).*

For the purposes of this study, the APE includes those lands within the FERC Project boundary. The Wells Project boundary extends from the tailrace of Wells Dam (River Mile [RM] 514.7) upstream to the tailrace of Chief Joseph Dam (RM 544.5). The boundary also extends to RM 15.5 on the Okanogan River and RM 1.5 on the Methow River (Figure 3.0-1). The Wells Project also includes a 41 mile 230kV transmission right of way which will be included as part of the APE in this study (Figure 3.0-2).



**Figure 3.0-1 Location Map of the Wells Project**





**Figure 3.0-2 Location Map of the 230kV Transmission Corridor**

## **4.0 BACKGROUND AND EXISTING INFORMATION**

### **4.1 Cultural Resource Work Group**

As part of the Wells Project relicensing, Douglas PUD established a Cultural Resource Work Group (CRWG) that began meeting in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to identify potential resource issues and to develop preliminary study plans to be included into the Wells Pre-Application Document (PAD).

Through a series of seven meetings, the CRWG identified resource issues that, in their judgment, matched with FERC's ILP study request criteria. The CRWG then reviewed the existing project information and determined that several of these issues require additional information.

Based upon these discussions and based upon agreement within the CRWG, Douglas PUD has included this study in the Wells PAD. This study will help to inform future relicensing decisions and will fill data gaps identified by the CRWG.

### **4.2 Issue Statement**

#### **Issue Statement (6.2.4.1)**

Continued operation of the Wells Project affects cultural resources that are listed or considered eligible for inclusion in the National Register of Historic Places.

#### **Issue Determination Statement (6.2.4.1)**

Section 106 of the National Historic Preservation Act requires federal agencies having the authority to license any undertaking to take into account the effect of the undertaking on historic properties. Because the Wells Project is licensed by FERC, the relicensing process is considered a federal undertaking and the National Historic Preservation Act (NHPA) and its implementing regulations are applicable.

There are a number of Project effects that might harm cultural resources. Erosion of the shoreline caused by Project operation could expose buried cultural resources or damage traditional cultural properties (TCPs). Other ground disturbing activities related to ongoing Project license compliance activities could also impact cultural resources.

Starting in early 2006, a cultural resource data review was implemented in an effort to understand what archeological and historical property information is currently available for the Wells Project. This effort is being conducted jointly by Douglas PUD, the Confederated Tribes of the Colville Reservation and Western Shore Heritage Services. Douglas PUD has also agreed to fund the Confederate Tribes of the Colville Reservation to conduct a TCP study starting in 2006.

The resource work group agrees that a study is needed during the two-year ILP study period to evaluate potential project related impacts to cultural resources. Most, if not all, of the Wells Project has been surveyed for cultural resources. Archaeological monitoring is conducted every three years. Additional archeological surveys may not be required. However, site forms need to be updated for existing sites, and some sites may need to be evaluated for National Register Eligibility.

### **4.3 Wells Cultural Resources Data Review (2006)**

Over the last 50 years, numerous archaeological investigations have been carried out within and adjacent to the Wells Project area. A total of 171 archaeological sites have been identified in the APE. One hundred sixty are pre contact sites, nine are historic, and two have historic and pre contact components. Because of the volume of information on cultural resources within the Wells Project, Douglas PUD hired Western Shore Heritage Services (WSHS) to conduct a cultural resources data review. With the assistance and guidance of the CRWG, WSHS reviewed archaeological site forms, reports of cultural resources investigations, ethnographic literature, and Indian Allotment data within and adjacent to the Wells Project area<sup>1</sup>. The draft report is currently being reviewed by the CRWG (WSHS, 2006 draft).

## **5.0 PROJECT NEXUS**

Section 106 of the National Historic Preservation Act requires federal agencies having the authority to license any undertaking to take into account the effect of the undertaking on historic properties. Because the Wells Project is licensed by FERC, the relicensing process is considered a federal undertaking and the NHPA and its implementing regulations are applicable.

There are a number of Project related activities that affect cultural resources. Erosion of the shoreline caused by Project operation could expose buried cultural resources or damage TCPs. Other ground disturbing activities related to ongoing Project license compliance activities may include issuance of permits for developments within Project boundary; construction of docks, parks, or roads; recreation; vandalism; and inundation and saturation of sites.

## **6.0 METHODOLOGY**

### **Step 1: Identify historic properties within the APE**

The Wells Project has been the subject of repeated cultural resources surveys, extensive testing and data recovery at several sites. Shoreline monitoring has taken place at many archaeological sites every three years since 1989. Monitoring of archeological site protection measures occurs annually. Monitoring surveys also examined new shoreline exposures for archaeological deposits. Therefore, the nature and geographic distribution of archaeological sites within the Project is well documented; and, it is not probable that an archaeological inventory of the entire Project would identify many new, previously unrecorded sites. However, because the quality of site inventory information within the Project APE is variable, sites in the APE where information

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<sup>1</sup> The term “Wells Project area” or “project area” refers to locations both within and adjacent to the FERC Project boundary (APE).

is lacking will be revisited to update locational information, to assess site condition, and to identify project impacts.

## **Step 2: Identify those portions of the APE where cultural resources inventories may be needed**

The CRWG will evaluate previously conducted cultural resource surveys and monitoring efforts to determine the need for additional inventory within the APE, or portions of the APE. The evaluation process will include field visits for interested CRWG members to assess the current conditions and ongoing processes that may have the potential to affect cultural resources. The CRWG will use this information to make recommendations on where additional survey efforts may be necessary within the APE. The rationale for the CRWG recommendations will be documented in the study report.

## **Step 3: Update Site Forms, Site Condition and Locations**

Consistent baseline data are not currently available for each archaeological site in the APE. For example, information for 68 sites has not been updated since the sites were first recorded in the 1950s and 1960s. It is possible not all previously recorded sites in the APE (approximately 171) are still extant; some sites have been inundated or may have lost integrity. In addition, comprehensive up-to-date data about the kinds and degree of effects of the Wells Project on archaeological sites is not currently available. Site revisits will provide a comprehensive data set to document site conditions and location. Locations will be updated using Global Positioning System (GPS) as well as orthophotographic field maps, and will be incorporated into a revised Geographical Information System (GIS) database. The updated data set will be used to update the site forms.

## **Step 4: Development of a Prioritized List of Sites**

Based on the results of Steps 1 and 2, the contractor will propose and the CRWG will refine and recommend a list of priority sites that will be evaluated further to determine their potential eligibility for the NRHP or whether they are contributing elements to the Wells Archaeological District. Priority sites will be those that are near areas of erosion, recreation sites, or other locations that have a high probability of being adversely impacted.

## **Step 5: Site Evaluations and Determinations of Eligibility**

The identification effort will assemble currently available data for each site in the APE and identify which sites could be recommended as NRHP-eligible based on existing information. Sufficient information for a portion of the known sites may exist to develop DOEs, or to determine if they are contributing elements to the Lake Pateros Archaeological District. The PUD will develop DOEs for those sites for which sufficient information is available to support the determination. This effort would follow site revisits and probably could be accomplished during the remainder of the 2008 field season or during the spring of 2009.

Accurate site boundaries presently are not available for most archaeological sites. And, most of the sites in the APE have not been formally evaluated for NRHP eligibility. The CRWG will develop a prioritized list of sites that will require additional work in order to prepare DOEs. This effort would follow site revisits and might be accomplished during the remainder of the 2008 field season or during the spring of 2009.

### **Step 6: Evaluate Project Effects**

Once all sites have been revisited and a determination of eligibility developed, it will be possible to identify project effects on historic properties determined to be eligible. The nature and degree of effects will be consistently documented using a series of protocols developed in concert with the Wells CRWG. Information regarding project effects on historic properties would be used in developing PMEs. The information collected from the above steps will be used in developing a Historic Properties Management Plan that will be issued with the Draft License Application which will be filed in December of 2009.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

Cultural resources investigations for this study will be conducted by professional archaeologists who meet the standards issued by the U. S. Department of the Interior through the National Park Service (Code of Federal Regulations, 36 CFR Part 61; Secretary of the Interior's Standards and Guidelines, Federal Register, Vol. 48, No. 190, Thursday, Sept. 29, 1983, pp. 44738-39).

The field component of this study will require a small survey crew and a boat. This study requires no other specialized equipment.

## **8.0 BUDGET**

Based on presently available information, this study is estimated to cost between \$140,000 and \$180,000. This budget includes field time to visit all existing sites, assumes some minimal field survey, time to prepare DOE assessments and documentation for all sites, and participation in the CRWG.

## **9.0 SCHEDULE**

### October 2007 – February 2008:

Identify sites to revisit and areas requiring resurvey (Steps 1 and 2).

### March 2008 – August 2008:

Visit priority sites, conduct survey, and update site forms (Step 3).

### September 2008 – November 2008:

Develop list of priority sites for NRHP evaluation (Step 4).

### October 15, 2008:

ILP deadline for Initial Study Report



November 2007:

Traditional Cultural Properties Study complete

December 2008 – July 2009:

Complete any additional site testing, DOEs, and determine Project effects (Step 5 and 6).

October 15, 2009:

ILP deadline for Final Study Report

December 31, 2009:

Draft Historic Properties Management Plan due with Preliminary License Proposal or draft License Application

## **10.0 REFERENCES**

Hartmann, Glenn. D. and M. Berger. 2006. Cultural Resources Data Review for the Wells Relicensing Project, Douglas and Okanogan Counties, Washington. Western Shore Heritage Services, Inc.

**EVALUATION OF PUBLIC ACCESS TO AND USE OF WELLS  
RESERVOIR AS IT RELATES TO RESERVOIR FLUCTUATIONS,  
AQUATIC PLANTS AND SUBSTRATE BUILDUP  
(RECREATION AND LAND USE ISSUES 6.2.2.1, 6.2.2.2, 6.2.2.3)**

**WELLS HYDROELECTRIC PROJECT**

**FERC NO. 2149**

December, 2006

Prepared by:  
Public Utility District No. 1 of Douglas County  
East Wenatchee, Washington

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**ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Recreation and Land Use Resource Work Group (RWG), which is composed of stakeholders (resource agencies and tribes) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The RWG, through a series of technical meetings, is proposing a study intended to evaluate whether the Wells Project recreation facilities such as docks, boat launches and swimming areas, can be reasonably accessed under various reservoir operating scenarios. The study will analyze accessibility to boat docks and launches during low reservoir elevations, evaluate how reservoir elevations affect on-water boating experiences and will evaluate whether aquatic plant growth and substrate buildup at public access sites are restricting public use of Project waters.

The results of this study will be used to help Douglas PUD and recreation management entities identify existing access issues that should be addressed during the development of protection, mitigation and enhancement measures.

## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Hydroelectric Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides of the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project Boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet.

### **1.2 Relicensing Process**

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required seven FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;

- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;
- (5) Explain any nexus between project operation and effects (direct, indirect and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements;
- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

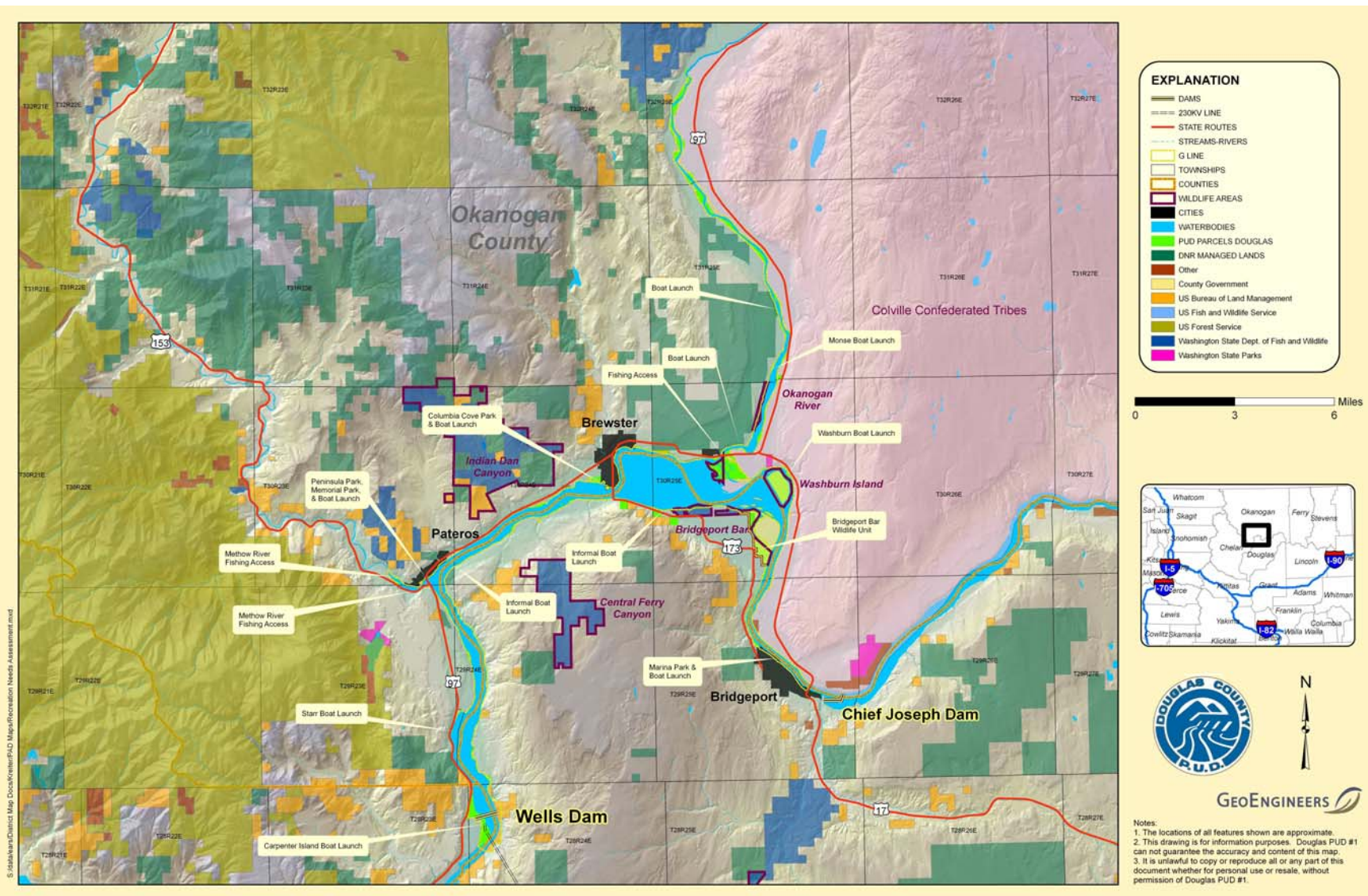
## **2.0 GOALS AND OBJECTIVES**

The goal of this study is to evaluate whether Wells Project recreation facilities (public access facilities) such as docks, boat launches and swimming areas, can be reasonably utilized under various reservoir operating scenarios and conditions. Specific objectives include:

- Evaluate accessibility to boat docks and launches during low reservoir elevations.
- Evaluate how reservoir elevations affect on-water boating experiences.
- Evaluate the effect of aquatic plant growth on accessibility to boat docks, launches and designated swimming areas within the Wells Project (reservoir and tailrace).
- Evaluate whether river substrate is restricting access to boat docks, boat launches and designated swimming areas within the Wells Project (reservoir and tailrace).
- Develop a map showing general types of aquatic plants and where they occur.
- Develop a map showing areas of the reservoir that may be inaccessible during low reservoir elevations.
- Identify measures to improve boat docks and launches and swimming areas as they relate to reservoir fluctuations, aquatic plants and substrate buildup.

## **3.0 STUDY AREA**

The study area includes water oriented access facilities and areas within the Wells Project boundary. This includes the Wells Reservoir which extends from Wells Dam (River Mile [RM] 515.8) upstream to the tailrace of Chief Joseph Dam (RM 544.5) and includes the lower 1.5 miles of the Methow River and the lower 15.5 miles of the Okanogan River. This also includes the Wells Tailrace which extends from the base of Wells Dam to a point 1.2 miles downstream (RM 515.8 – 514.6). Public recreation and access areas include boat launches and boat docks along the Wells Reservoir and Wells Tailrace (Figure 3.0-1).



**Figure 3.0-1 Wells Reservoir access sites**

## **4.0 BACKGROUND AND EXISTING INFORMATION**

### **4.1 Recreation and Land Use Resource Work Group**

As part of the preparation for the relicensing of the Wells Project, Douglas PUD established a Recreation and Land Use Resource Work Group (RWG) which began meeting in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to collaboratively identify potential resource issues related to Project operations and relevant to relicensing, and to develop preliminary study plans to be included into the Wells Pre-Application Document (PAD).

Through a series of meetings, the Recreation and Land Use RWG cooperatively developed a list of Issue Statements, Issue Determination Statements and Agreed Upon Study Plans. An Issue Statement is an agreed upon definition of a resource issue raised by a stakeholder. An Issue Determination Statement reflects the RWG's efforts to review the existing project information and to determine whether an issue matches with FERC's seven criteria and would be useful in making future relicensing decision. Agreed Upon Study Plans are the finished projects of the informal RWG process.

Based upon these meetings and discussions, the Recreation and Land Use RWG is proposing to include a study plan into the Wells PAD which addresses the need to evaluate whether reservoir fluctuations, aquatic plant growth or substrate buildup limits access and recreational use of the waters contained within the Wells Project. This study will also help to identify whether site specific measures are needed to improve public access to the Wells Reservoir and Douglas PUD-funded recreation facilities.

### **4.2 Issue Statements**

#### **Issue Statement (6.2.2.1)**

Reservoir fluctuations during high recreation use days may limit access and use of the reservoir and recreation facilities.

#### **Issue Determination Statement (6.2.2.1)**

There may be some scenarios where Project operations, notably reservoir fluctuations, affect access to and use of public boat launches and docks. The work group recommends that a site evaluation study be completed to determine which recreation facilities are rendered inaccessible at various reservoir elevations. The study should provide options for improving access to public boat launches and docks. The study should also evaluate how reservoir elevations affect on-water boating experiences (e.g. motorboats vs. man-powered boats).

The resource work group agrees that a site evaluation study should be completed during the two-year ILP study period. This study will help to determine whether new measures are needed to address this issue for the term of the next license.



#### **Issue Statement (6.2.2.2)**

The reservoir may have resulted in the growth of aquatic vegetation at recreation sites, which may restrict access and use of the reservoir.

#### **Issue Determination Statement (6.2.2.2)**

The Wells Project may have enhanced the growth of aquatic vegetation in the Wells Reservoir. Douglas PUD has completed baseline assessments of macrophyte distribution in the reservoir. Results of the baseline assessments indicated that most of the aquatic vegetation in the reservoir is native vegetation which may provide important fish habitat and waterfowl forage.

The resource work group agrees that a site evaluation study should be completed during the two-year ILP study period to determine where and to what degree public access to and use of the reservoir is restricted by aquatic vegetation. The proposed site evaluation study should include a map showing where macrophytes occur and focus on identifying where macrophytes restrict or discourage access to public recreation facilities. The study should also include options to address the issue should it be determined that aquatic vegetation is impacting access to and use of the reservoir. The study will help identify measures to address this issue for the term of the next license.

#### **Issue Statement (6.2.2.3)**

The reservoir and Project operations may affect sediment transport and deposition, which may restrict access to and use of the reservoir.

#### **Issue Determination Statement (6.2.2.3)**

The resource work group agrees that a study is not needed during the ILP two-year study period. Sediment conditions at public recreation sites will be considered during the site evaluation study discussed in issues above. The resource work group agrees that it is important to continue monitoring the sediment conditions at Wells Project access sites along the Methow and Okanogan rivers.

### **4.3 Recreation Visitor Use Assessment**

Douglas PUD conducted a Recreation Visitor Use Assessment during May to December of 2005 in an effort to collect information related to visitor use at Wells Project recreation sites (DTA, 2006). The primary goals of this study were to assist in the preparation of the PAD and to describe use levels, preferences, attitudes and characteristics of the Wells Project's primary recreation user groups. Specific objectives included:

- Describing recreation respondents' characteristics;
- Describing user preferences for recreation settings and facilities;
- Identifying possible recreation conflicts, crowding, or personal safety issues;
- Describing users' attitudes toward management actions;

- Describing recreation respondents' activities; and
- Identifying the amount, activity type and spatial and temporal distribution of existing recreation use.

A stratified systematic sampling strategy was chosen for the Recreation Visitor Use Assessment. To ensure diversity in types of recreation users and variation in type of days visited, sampling was conducted at designated recreation sites and on the Wells Reservoir from May 24, 2005 through December 13, 2005; months that together account for the majority of use.

#### **4.4 Recreation Action Plan**

Ongoing recreation needs within the Wells Project are addressed through the Wells Recreation Action Planning process. The Wells Recreation Plan (1967), Wells Recreation Plan Supplement (1974), Public Use Plan (1982) and Recreation Action Plans (1987, 1992, 1997 and 2002) were established as part of compliance with Article 44 of the FERC license. This long-term and ongoing planning and implementation process has helped in the development and maintenance of the recreation sites along the Wells Reservoir.

Following a two-foot pool raise amendment in 1982, Douglas PUD developed a Public Use Plan for the Wells Project. The plan analyzed the types of public recreation facilities that the Wells Reservoir can reasonably accommodate and discusses how those facilities can be developed and maintained. The information presented in the 1982 Public Use Plan included an analysis of recreation facilities within a 100-mile radius of the Wells Project.

In response to the 1982 Public Use Plan, the National Park Service (NPS) and State Parks recommended periodic updates (every five years) to the 1982 Public Use Plan. By FERC Order dated August 12, 1987, 40 FERC 62,157, this recommendation was made part of the Wells Project license resulting in updates to the 1982 Public Use Plan every five years. Douglas PUD's 1987 Recreation Action Plan, which is a supplement to the 1982 Public Use Plan, was supported by the NPS, Washington State Parks and Recreation Commission and the cities of Pateros, Brewster and Bridgeport. Douglas PUD has published subsequent updates to the 1982 Public Use Plan in 1992, 1997 and 2002. The next update is scheduled to be completed in 2007.

#### **4.5 Aquatic Macrophyte Identification and Distribution Study**

In August and September of 2005, Douglas PUD conducted a study to address the species composition, relative abundance and spatial distribution of macrophyte beds within the waters of the Wells Project. The estimated location of aquatic plant beds were mapped using a Geographic Information System (GIS). The study found that in general, macrophyte communities in the Wells Project were patchy and were distributed by depth.

In general, macrophyte communities did not recruit to depths of less than 4 feet in the Wells Project. Depths between 5 and 15 feet were characterized by a species composition where native species were dominant. In locations where Eurasian water milfoil was present, this species was most often sub-dominant and present at relatively low densities (less than 10% milfoil). From depths of 15 to 24 feet, species composition consisted exclusively of native species. From 24

feet to 30 feet, macrophyte communities were absent most likely due to the limited availability of light at these depths. Overall, the study identified a total of 2,379 acres of macrophyte beds out of a total surface area of 9,740 acres.

## **4.6 Bathymetric Mapping**

In March of 2005, Douglas PUD contracted with GeoEngineers to conduct a detailed bathymetric survey of the Wells Reservoir and tailrace using multibeam sonar and GPS technology. Contour maps of the reservoir bottom were produced at 1-foot contour intervals. The bathymetry provides a seamless representation of the riverbed surface. The bathymetric mapping can be used to identify potential shallow areas within the Wells Reservoir when its elevation is lowered.

## **5.0 PROJECT NEXUS**

The Wells Project and its operations may affect access to boat launches and boat docks located along the Wells Reservoir. Fluctuations of the Wells Reservoir may render portions of the reservoir and some of the public access sites along the reservoir inaccessible. Additionally, the Wells Project may enhance the growth of aquatic vegetation in the Wells Reservoir and also affect sediment transport and deposition. Aquatic vegetation growth and buildup of substrates near boat launches, boat docks and swimming areas could restrict access to and from the Wells Reservoir. The results of this study will help Douglas PUD and the RWG members determine whether new measures are needed to address this issue for the term of the next license.

## **6.0 METHODOLOGY**

### **6.1 Evaluate Access Related to Reservoir Fluctuations**

The Wells Project is a “run-of-the-river” hydroelectric project meaning that on average, daily inflow to the Wells Reservoir equals daily outflow. The limited active storage capacity of the Wells Project is only sufficient to regulate flow on a daily basis. Wells Reservoir fluctuations and power generation are largely driven by the discharge of water from Chief Joseph Dam and Grand Coulee Dam. The Wells Project is authorized to maintain its reservoir level between elevation 781 and 771 feet. It is important to determine whether reservoir elevations, specifically low elevations, affect access to the Wells Reservoir. To evaluate access related to reservoir fluctuations, Douglas PUD will perform the steps described below:

- Step 1: Analyze Wells Reservoir elevations from 2001 to 2005  
Review and summarize hourly elevation data from the Wells Forebay to determine how often fluctuations occur in the Wells Reservoir. Develop headwater duration curves for the years 2001-2005 to better understand the relationship between reservoir fluctuations and elapsed time.

- Step 2: Document access sites at various Wells Reservoir elevations  
Document and evaluate accessibility to boat docks and launches. Measure depths at boat launches and docks to determine at what elevations access sites could become inaccessible due to low water or buildup of substrates.
- Step 3: Develop a map showing areas of the Wells Reservoir that may be inaccessible during low reservoir elevations  
Using GIS and the existing reservoir bathymetry data, identify potential shallow areas during low reservoir operations. Utilize these maps to evaluate how reservoir fluctuations may affect on-water boating experiences.

## **6.2 Evaluate Access Related to Substrate Buildup**

Active bed load movement, erosion and the deposition of suspended material can limit the usability of public access facilities located along the Methow and Okanogan rivers. The proposed reservoir access study will evaluate whether public access facilities around the Wells Reservoir are being impacted by the build up of substrate. Examples might include substrate filling in a boat launch or swimming area. The evaluation of the effects of substrate on access to the reservoir and water related public facilities in these areas will be conducted in connection with steps 1-3 found in Section 6.1 (above).

## **6.3 Evaluate Access Related to Aquatic Plants**

Douglas PUD's Aquatic Macrophyte Identification and Distribution Study conducted in 2005 found a varying amount of aquatic macrophyte communities present near the boat launches and docks along the Wells Reservoir. Most of the aquatic macrophyte communities in the Wells Reservoir are comprised of native vegetation, which provides a source of important fish and waterfowl habitat. However, aquatic plant growth near boat launches and docks may affect accessibility to the Wells Reservoir for recreational purposes. To evaluate access related to aquatic plants, Douglas PUD will perform the steps described below:

- Step 1: Review aquatic macrophyte communities and substrate near access areas  
Conduct a field survey to evaluate the density and distribution of aquatic plants in relation to specific sites to determine if aquatic plants in these areas adversely impact access to the Wells Reservoir. Assess how aquatic plant growth impacts the use of public use sites.
- Step 2: Identify measures for addressing plant growth at public access sites  
If results from Step 1 indicate that aquatic plants in certain areas are restricting access to the Wells Reservoir, identify and describe potential options to improve access.

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

The access study will be conducted by Douglas PUD staff with assistance at various stages by consultants. Measurements related to access at various reservoir elevations will be collected by professional surveyors.

Bathymetric maps and detailed macrophyte inventories, at public access sites, will be collected and analyzed by Douglas PUD staff utilizing a Douglas PUD boat.

No permits will be needed to conduct the study.

## **8.0 BUDGET**

As discussed in Section 6.0, activities associated with this study involve evaluating access to the Wells Reservoir related to reservoir fluctuations, substrate buildup and aquatic plants. Total estimated hours for implementation of these activities is approximately 720 person hours. These hours are associated with conducting field work (240 hours), analyzing reservoir elevation data (80), creating GIS/bathymetric maps (80 hours), identifying possible options to improve access (160 hours) and drafting and formatting final report (160 hours). Staff costs are approximately \$50,000. Equipment costs and expenses related to field implementation (boat use, travel, etc.) are estimated to be \$30,000.

Total planning level cost for this effort is approximately \$80,000.

## **9.0 SCHEDULE**

Planning for the access study will begin shortly after the issuance of FERC's Study Plan Determination in October 2007. Field measurements at boat launches and access sites will take place during the spring of 2008. An Initial Study Report will be filed in October 2008. The draft report for all three components of the access study will be completed by April 2009. The final report will be available by October 2009.

## **10.0 REFERENCES**

BioAnalysts, Inc. 2005. Aquatic Macroinvertebrate Inventory. Wells Hydroelectric Project, FERC No. 2149. Prepared for Public Utility District No. 1 of Douglas County, East Wenatchee, WA.

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Johnson, A. R. 1974. Wells Recreation Plan Supplement. Prepared by A. R. Johnson for Public Utility District No. 1 of Douglas County, East Wenatchee, Washington.

**AN EVALUATION OF RECREATIONAL NEEDS WITHIN THE  
WELLS PROJECT  
(RECREATION AND LAND USE ISSUES 6.2.2.4, 6.2.2.5, 6.2.2.6, 6.2.2.7)**

**WELLS HYDROELECTRIC PROJECT**

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**ABSTRACT:**

The current Wells Hydroelectric Project (Wells Project) license will expire on May 31, 2012. The Public Utility District No. 1 of Douglas County (Douglas PUD) owns and operates the Wells Project and is using the Integrated Licensing Process (ILP) for relicensing as promulgated by Federal Energy Regulatory Commission (FERC) regulations issued July 23, 2003 (18 CFR Part 5).

The Recreation and Land Use Resource Work Group (RWG), which is composed of stakeholders (resource agencies and tribes) and Douglas PUD staff, was formed for the purpose of identifying issues and information gaps that may require study during the relicensing of the Wells Project. The Recreation RWG, through a series of technical meetings, is proposing an analysis of future recreation needs associated with operation of the Wells Project.

The purpose of the Recreation Needs Analysis is to evaluate recreational use information and identify current and future recreation needs within the Wells Project boundary. The needs analysis will identify recreation needs within the Project that recreation resource managers should strive to address during the term of the new license.

The needs analysis will evaluate existing recreation use data, assess the current condition of existing facilities, and identify potential enhancements to meet current and future recreation needs. The results of this study will be used to help Douglas PUD identify existing and future recreation needs so that protection, mitigation, and enhancement measures can be developed for the new license term.

## **1.0 INTRODUCTION**

### **1.1 General Description of the Wells Hydroelectric Project**

The Wells Hydroelectric Project (Wells Project) is located at river mile (RM) 515.8 on the Columbia River in the State of Washington. Wells Dam is located approximately 30 river miles downstream from the Chief Joseph Project, owned and operated by the United States Army Corps of Engineers (COE), and 42 miles upstream from the Rocky Reach Hydroelectric Project owned and operated by Public Utility District No. 1 of Chelan County (Chelan PUD). The nearest town is Pateros, Washington, which is located approximately 8 miles upstream from the Wells Dam.

The Wells Project is the chief generating resource for Public Utility District No. 1 of Douglas County (Douglas PUD). It includes ten generating units with a nameplate rating of 774,300 kW and a peaking capacity of approximately 840,000 kW. The design of the Wells Project is unique in that the generating units, spillways, switchyard, and fish passage facilities were combined into a single structure referred to as the hydrocombine. Fish passage facilities reside on both sides of the hydrocombine, which is 1,130 feet long, 168 feet wide, with a crest elevation of 795 feet in height.

The Wells Reservoir is approximately 30 miles long. The Methow and Okanogan rivers are tributaries of the Columbia River within the Wells Reservoir. The Wells Project boundary extends approximately 1.5 miles up the Methow River and approximately 15.5 miles up the Okanogan River. The normal maximum surface area of the reservoir is 9,740 acres with a gross storage capacity of 331,200 acre-feet and usable storage of 97,985 acre feet at elevation of 781. The normal maximum water surface elevation of the reservoir is 781 feet.

### **1.2 Relicensing Process**

The current Wells Project license will expire on May 31, 2012. Douglas PUD is using the Integrated Licensing Process (ILP) as promulgated by FERC regulations issued July 23, 2003 (18 CFR Part 5). Various state and federal agencies, tribes, local governments, non-governmental organizations and the general public will participate in the Wells Project ILP. During the ILP, information needs related to the relicensing of the Wells Project will be identified. All study plans intended to meet these information needs will be prepared in a manner that addresses each of the required FERC criteria described in 18 CFR § 5.9(b).

18 CFR § 5.9(b) Content of study request. Any information or study request must:

- (1) Describe the goals and objectives of each study and the information to be obtained;
- (2) If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied;
- (3) If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study;
- (4) Describe existing information concerning the subject of the study proposal, and the need for additional information;

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- (6) Explain how any proposed study methodology is consistent with generally accepted practices in the scientific community or, as appropriate, considers relevant tribal values and knowledge. This includes any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration;
- (7) Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.

All study plans submitted to FERC will be reviewed by Douglas PUD and the applicable Resource Work Group(s) to determine if studies proposed will fill the information needs related to the Wells Project Relicensing. Any dispute over alternative study methods, that cannot be reconciled with stakeholders, will be decided by FERC.

## **2.0 GOALS AND OBJECTIVES**

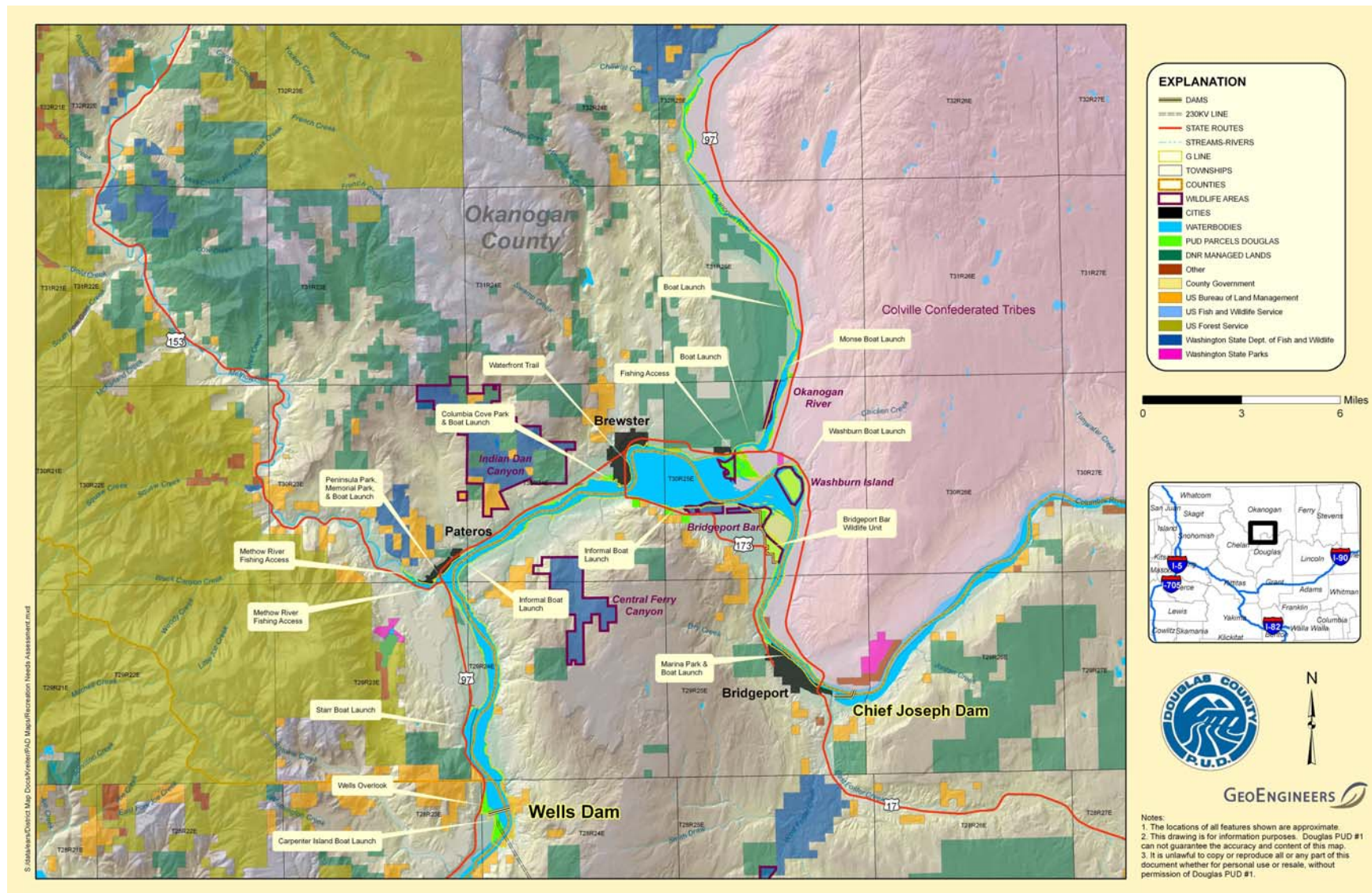
The goal of this study is to research, describe, and quantify recreation and access needs in the Wells Project that should be addressed over the term of the next 50-year FERC license. Specific objectives include:

- Summarize study findings to evaluate recreational use and demand within the Wells Project. This summary will be based on results of the 2005 Wells Project Recreation Visitor Use Assessment and existing information from FERC Form 80s for the Wells Project, Interagency Committee for Outdoor Recreation outdoor recreation participation survey, WDFW fisherman surveys, WDFW hunter surveys, City of Bridgeport's Marina Park information and other relevant recreational survey information.
- Assess the adequacy of existing Wells Project recreation facilities to accommodate current and future recreation demand.
- Assess the adequacy of public access and safety at Wells Project recreation facilities.
- Assess the adequacy of operations and maintenance at Wells Project recreation facilities.
- Develop a prioritized list of potential actions to address Wells Project recreation issues. The list should include criteria such as demand, effectiveness, feasibility and cost.

The needs analysis should provide information to Douglas PUD, as well as recreation resource managers, for making decisions regarding recreation planning in the Wells Project.

## **3.0 STUDY AREA**

The study area includes recreation and access facilities within and adjacent to the Wells Project boundary. The Wells Project boundary extends from the tailrace of Wells Dam (River Mile [RM] 514.7) upstream to the tailrace of Chief Joseph Dam (RM 544.5). The boundary also extends to RM 15.5 on the Okanogan River and RM 1.5 on the Methow River. Recreation and access facilities within the Project boundary include parks, boat launches, trails, parking areas, fishing access sites, and wildlife lands access sites (Figure 3.0-1).



**Figure 3.0-1 Location Map of the Wells Project**

## **4.0 BACKGROUND AND EXISTING INFORMATION**

### **4.1 Recreation and Land Use Resource Work Group**

As part of the Wells Project relicensing, Douglas PUD established a Recreation and Land Use Resource Work Group (RWG) which began meeting in November, 2005. This voluntary effort was initiated to provide stakeholders with information about the Wells Project, to identify potential resource issues and to develop preliminary study plans to be included into the Wells Pre-Application Document (PAD).

Through a series of meetings, the RWG identified a set of resource issues that, in their judgment, matched with FERC's ILP study request criteria. The RWG then reviewed the existing project information and determined that several of these issues require additional information.

Based upon these discussions, the RWG is proposing to include two studies into the Wells PAD. These two studies will help to inform future relicensing decisions and will fill data gaps identified by the RWG. The two studies proposed by the RWG include: 1) An Evaluation of Access to the Wells Reservoir as it Relates to Reservoir Fluctuations, Aquatic Plants and Sedimentation and 2) An Evaluation of Recreation Needs within the Wells Project. The proposed Recreation Needs Assessment will focus on collecting information pertinent to Issues 6.2.2.4, 6.2.2.5, 6.2.2.6 and 6.2.2.7 identified by the RWG.

### **4.2 Issue Statements**

#### **Issue Statement (6.2.2.4)**

Recreation proposals under the license need to consider Endangered Species Act (ESA), Americans with Disabilities Act (ADA), Electric Consumers' Protection Act (ECPA), State Comprehensive Outdoor Recreation Plan (SCORP), County Shoreline Master Programs as well as local ordinances, laws, regulations and comprehensive plans.

#### **Issue Determination Statement (6.2.2.4)**

Douglas PUD agrees that proposals under the new license need to consider all of the above-mentioned laws, plans and regulations. These should be applied at existing and future recreation sites. The resource work group agrees that additional information is needed and a study is recommended during the two-year ILP study period. An evaluation of ADA compliance and other regulations will be considered in the Recreation Needs Assessment.

#### **Issue Statement (6.2.2.5)**

Existing recreation facilities may not meet future recreation needs through the duration of the next license term. Recreation plans under the new license should consider recreation trends and an analysis of the condition and capacity at recreation facilities.

### **Issue Determination Statement (6.2.2.5)**

Douglas PUD completed a Recreation Visitor Use Assessment for the Wells Project conducted in 2005. This assessment will be useful in answering questions related to the current use of existing recreation facilities.

The existing Wells Project recreation sites were developed under the original license to provide safe and efficient access to Project lands and waters. Safe and efficient access to Project land and waters is a requirement of the original FERC license and is expected to be a requirement under the new long-term FERC license. Enhancements to existing facilities or the installation of new sites/facilities will be considered based upon projected use and capacity ratings, consistent with FERC recreation policies.

The current condition of existing recreation facilities and their ability to meet future needs is unknown. The resource work group agrees that additional information is needed and that a Recreational Needs Assessment should be conducted during the two-year ILP study period. This study should assess the condition of existing facilities and evaluate the ability of existing facilities to meet future recreation demands within the Wells Project. The Recreation Needs Assessment should also consider results from the Interagency Committee for Outdoor Recreation's (IAC) statewide outdoor recreation participation survey and the WDFW fishermen survey and additional recreation information from the Project area

### **Issue Statement (6.2.2.6)**

The new license should consider new facilities or enhancements to existing facilities (e.g. Chief Joe Hatchery, Fort Okanogan State Park and Interpretive Center, Fort Okanogan Overlook Site, Wells Visitor Center, Pateros Visitor Center, Alta Lake State Park and Wells Tracts off Pit Road) and should consider trails and trail linkages between communities.

### **Issue Determination Statement (6.2.2.6)**

The resource work group agrees that a Recreational Needs Assessment is considered necessary during the two-year ILP study period. The results of this study will help identify potential enhancements to meet current, future and potential recreation needs within the Project, including the possibility of trails and trail linkages between communities. The study will help to determine whether adequate demand exists to justify the construction of new recreation facilities and will consider existing and future plans for recreation sites in the Project vicinity. Enhancements to existing facilities outside the Project will be considered if recreation needs cannot be met within the Project boundary.

### **Issue Statement (6.2.2.7)**

Wells Dam may be a hindrance to river travel.

### **Issue Determination Statement (6.2.2.7)**

Douglas PUD is not aware of an ongoing need for human river travel past Wells Dam. Wells Dam operators have identified only three instances where the public has requested portage either upstream or downstream of the dam in the past five years. In each instance, Douglas PUD has been able to adequately accommodate these individuals and transport their equipment. This issue may have a tie to the Project if a significant need is identified in the future.

The resource work group agrees that a study is not needed during the two-year ILP study period. An evaluation of portage options to address this issue should be considered in the Recreation Needs Assessment.

## **4.3 Recreation Visitor Use Assessment (2005)**

Douglas PUD completed a Recreation Visitor Use Assessment during May to December of 2005 in an effort to collect information related to visitor use at Wells Project recreation sites (DTA, 2006). The primary goals of this study were to assist in the preparation of the PAD and to describe use levels, preferences, attitudes and characteristics of the Wells Project's primary recreation user groups. Specific objectives included:

- Describing recreation respondents' characteristics;
- Describing user preferences for recreation settings and facilities;
- Identifying possible recreation conflicts, crowding, or personal safety issues;
- Describing users' attitudes toward management actions;
- Describing recreation respondents' activities; and
- Identifying the amount, activity type and spatial and temporal distribution of existing recreation use.

A stratified systematic sampling strategy was chosen for the Recreation Visitor Use Assessment. To ensure that diversity in types of recreation users and variation in type of days visited, sampling was conducted at designated recreation sites and on the Wells Reservoir from May 24, 2005 through December 13, 2005, months that together account for the majority of use.

## **4.4 Recreation Action Plan**

Ongoing recreation needs within the Wells Project are addressed through the Wells Recreation Action Planning process. The Wells Recreation Plan (1967), Wells Recreation Plan Supplement (1974), Public Use Plan (1982) and Recreation Action Plans (1987, 1992, 1997 and 2002) were established as part of compliance with Article 44 of the original FERC license. This long-term and ongoing planning and implementation process has helped in the development and maintenance of the sites previously described.



Following a two-foot pool raise amendment in 1982, Douglas PUD developed a Public Use Plan for the Wells Project. The plan analyzed the types of public recreation facilities that the Wells Reservoir can reasonably accommodate and discussed how those facilities can be developed and maintained. The information presented in the 1982 Public Use Plan included an analysis of recreation facilities within a 100-mile radius of the Wells Project.

In response to the 1982 Public Use Plan, the National Park Service (NPS) and State Parks recommended periodic updates (every five years) to the 1982 Public Use Plan. By FERC Order dated August 12, 1987, 40 FERC 62,157, this recommendation was made part of the Wells Project license resulting in updates to the 1982 Public Use Plan every five years. Douglas PUD's 1987 Recreation Action Plan, which is a supplement to the 1982 Public Use Plan, was supported by the NPS, Washington State Parks and Recreation Commission and the cities of Pateros, Brewster and Bridgeport. Douglas PUD has also published subsequent updates to the 1982 Public Use Plan in 1992, 1997 and 2002. The next update is scheduled to be completed in 2007.

#### **4.5 FERC Form 80**

The FERC Form 80, "Licensed Hydropower Development Recreation Report" is a brief summary of the existing recreation conditions and facilities associated with the Wells Project. Based on FERC regulations, the forms were submitted every two years from 1967 – 1984, every four years from 1984 – 1996 and every six years since 1996. The most recent Form 80 was submitted to FERC in 2002.

FERC's Form No. 80 is used to gather information necessary for the Commission and other agencies to know what recreational facilities are located at licensed projects, whether public recreational needs are being accommodated by the facilities, and where additional efforts could be made to meet future needs.

#### **5.0 PROJECT NEXUS**

The Wells Project has direct and indirect effects on recreation activities within the Project boundary. The effects include providing public access to Project lands and waters, and the potential effects of Wells Project operations on recreational activities.

Douglas PUD has developed and provides major maintenance at numerous public recreation facilities along the Wells Reservoir. These facilities were developed to provide safe and reasonable access to Project lands and waters. Access to the Project will continue to be needed under the new license and this proposed study will help to determine whether additional facilities are needed to meet the demand in recreational use. In addition, Project recreation facilities may not currently be ADA compliant which could limit access for public use. It is unknown whether the existing facilities, in their current condition, can continue to adequately fulfill the expected level of recreation demand during the next license term.



The results of this study will be used to help identify existing and future recreation needs and will be useful during the development of protection, mitigation, and enhancement measures for the new long-term FERC license to operate Wells Dam.

## **6.0 METHODOLOGY**

### **Assess Existing Unmet Demand**

Existing recreation use does not always represent the total existing recreation demand because there may be constraints that limit participation. While there are many potential constraints on recreation use (e.g., lack of free time, cost, geographic distance, lack of skills or equipment), a subset of participation constraints may be closely associated with site-specific management (e.g., limited access to lands or water, use limits or full occupancies at facilities, Project operations that diminish the quality of opportunities, or the lack of information about available recreation opportunities). To assess the general level of unmet demand for Project recreation resources, Douglas PUD will perform the steps described below:

- Step 1: Assess statewide and regional unmet recreation demand information  
Review and summarize relevant information from the 2002-2007 SCORP and other relevant local recreation data. In addition, a review of the SCORP Local Government Survey results, Interagency Committee for Outdoor Recreation's (IAC) statewide outdoor recreation participation survey, which include regionalized recreation issues and needs from local agencies involved in outdoor recreation management, will be reviewed.
- If available, other sources of Project area and region information will be reviewed. The focus of this assessment will be to identify possible recreation activities with substantial unmet demand with a qualitative discussion of participation constraints and whether these constraints are likely affected by Project operations.
- Step 2: Collect unmet Project Area recreation demand information from visitor surveys  
Douglas PUD will utilize additional unmet demand information from the Recreation Visitor Use Assessment survey, conducted in 2005. These surveys asked visitors if there are any reservoir or river recreation activities they are interested in participating in, but cannot because of some form of barrier.
- Step 3: Identify potential activities with high unmet demand within the Project area  
Based on the review of unmet demand information derived from the Washington SCORP, the 2005 Recreation Use Assessment, and Project monitoring data, Interagency Committee for Outdoor Recreation's (IAC) statewide outdoor recreation participation survey, potential activities with high unmet demand at the Project will be identified. The analysis will also

attempt to identify likely barriers or constraints on participation, and whether those are related to Project operations or recreation management decisions.

### **Assess Future Recreation Demand**

This element of the study will project future recreation use at the Project over the estimated period of the new license (30 to 50 years). Obviously, projecting the future is a speculative activity, especially over a 30 to 50 year period. These projections, though, can be useful for general planning purposes to identify potential management issues that may occur in the future. This approach will include the following steps:

- Step 1: Review existing recreation use trends  
Past use often helps predict future use. Douglas PUD will review trends of actual Project recreation use from Project monitoring reports for Wells Reservoir, Interagency Committee for Outdoor Recreation's (IAC) statewide outdoor recreation participation survey, WDFW fishermen survey, Washington fishing license sales, ORV green stickers and boating vessel registrations for the counties where the majority of Project visitors originate from; local fishing guide activity; and recreation equipment sales.
- Step 2: Review existing population and recreation activity participation projections  
Douglas PUD will summarize existing information on future projections from the Washington Office of Financial Management on population growth rates for the counties where the majority of the Project visitors originate; U. S. Census statistics for growth within and adjacent to the Project and other appropriate state sources on existing and future population growth.
- Step 3: Review reasonably foreseeable events that may influence future use  
Reasonably foreseeable events in the watershed may be expected to influence recreation use in the watershed over the license period. If an event is determined to be reasonably foreseeable, a qualitative assessment will be made of its potential affect on future recreation use.
- Step 4: Estimate future recreation use over the License Period  
Based on historical trends, future growth projections, and likely foreseeable actions in the watershed, professional judgment will be used to estimate recreation use and facility utilization over the expected term of the new license (i.e. 30 to 50 years). These estimates must be considered very speculative and will only provide a general indication of how recreation use is expected to change over the license period.

## Regional Uniqueness and Significance Assessment

The following steps are focused on an assessment of regional uniqueness of the Project's primary recreation opportunities in three steps.

- Step 1: Review results of visitor questionnaires  
Douglas PUD will review the results of the recreation visitor use assessment to confirm the Project's primary recreation activities. It is anticipated that fishing, boating, hiking, picnicking and swimming will likely be among the top water-related recreation activities in the Project area.
- Step 2: Identify regional recreational opportunities  
Douglas PUD will identify the geographic draw of the Project's top primary recreation opportunities. This will be done by assessing the geographic extent of visitors' origins and location of the alternative recreation resource areas where visitors participate in their primary recreation activities.
- Step 3: Assess uniqueness of the Project-related recreation opportunities  
For the Project's most popular primary recreation activities, Douglas PUD will identify if these recreation opportunities are of local, regional or state significance. In addition, text will describe what is unique and special about the most popular recreation opportunities based on information from regional resource information.

## Public Access Analysis

Access to public use areas within the Project by both land and water will be assessed. Existing access features will be rated as high, medium, or low quality. Opportunities and constraints within the Project will also be identified, including compatibility with ADA. Public access (land and water) in the Project area will be identified and assessed by:

- Reviewing ownership maps, topographic maps, and aerial photography;
- Boating to dispersed sites and use sites along the shoreline, driving roads to access sites, and walking formal and informal user trails on lands designated as Project access sites or wildlife areas;
- Defining existing water trail routes along the reservoir, current shoreline watercraft launch sites, constraints to watercraft access along the reservoir, and overnight stop-over sites, and;
- Displaying public access sites and routes within the Project on GIS maps.

The final analysis will include tables and maps summarizing locations where: 1) current facilities for access to the Project are safe and efficient; 2) access is highly constrained; 3) future improvements could be implemented. Viable options for potential new or enhanced public access will be identified for further consideration.

## Needs Assessment

The needs assessment will provide a qualitative assessment, utilizing professional judgment, of the recreation needs based on integrating the findings from the other recreation components of this study and other related studies. The assessment will involve a four-step process in which relevant Project recreation opportunities are described, relevant Project recreation issues are identified, potential actions to address Project-related issues identified, and PME measures are proposed, if appropriate. These steps are discussed below.

- Step 1: Summarize Project-related recreation opportunities at recreation resource areas  
The first step in the needs assessment is to integrate recreation study findings into a summary of Project-related recreation opportunities at recreation resource areas. The existing condition of the recreation opportunity as well as the likely condition of the opportunity over the license term will be described. Parameters likely discussed include such items as activity participation rates, satisfaction levels, facility needs, regional significance, resource impacts, and existing and likely future capacity availability.
- Step 2: Summarize major recreation issues for each recreation resource area  
Based on the projected license term and the conditions of recreation opportunities within recreation resource areas, the recreation issues within the recreation resource area will be confirmed. This may include such items such as crowding, conflicts between user groups, likely facility needs over the license term, or various types of impacts resulting from recreation use. Recreation needs issues will be assessed by comparing recreation supply and demand study results.
- Step 3: Develop a list of actions to address Project-related issues  
A list of prioritized actions that address Project-related recreation issues will be developed for consideration. In some cases, several alternative actions are likely to be developed to address the same issue. Effectiveness, feasibility and costs will be used to identify actions and to prioritize these actions.
- Step 4: Identify appropriate additional recreation measures for the Project  
The last step of the process is to consult with relicensing participants to review study results and to identify Project mitigation and enhancement measures to be included with the new FERC license.

Assessing existing recreation use through a combination of observation and questionnaire surveys is a common practice for large geographic areas that contain multiple accesses to desired recreation use areas (Malvestuto 1996, Pollock et. al. 1994). In addition, assessing future recreation demand through an evaluation of existing use, demographic data and participation trends and projections in the region is common practice (Kelly & Warnick, 1999).

Integrating study results, comparing supply and demand study findings, and identifying resource impacts is standard practice on many relicensing processes. The proposed methods are also consistent with assessing needs approaches utilizing visitor frameworks such as the Visitor Impact Management (Graefe, Kuss, & Vaske, 1990) and Limits of Acceptable Change processes. In addition, the proposed methods incorporate concepts from the Recreation Opportunity Spectrum (ROS) (Clark and Stankey, 1979), and subsequent Water Recreation Opportunity Spectrum (WROS) frameworks (Haas, Aukerman, Lovejoy, & Welch, 2004).

## **7.0 STAFFING AND EQUIPMENT REQUIREMENTS**

No special equipment is needed to conduct this study. Staff time required to complete this study is estimated to be approximately 612 person hours.

The consultants hired to conduct this study must have prior experience in conducting Recreation Needs Assessments and should be well versed in recreation issues and planning.

Several trips to the Project area will be required.

## **8.0 BUDGET**

The total estimated hours for conducting the Evaluation of Recreational Needs within the Wells Project (needs assessment) study is approximately 612 person hours with a total estimated cost of \$83,000. The needs assessment includes two phases. The first phase is estimated to require 412 person hours, which includes travel, site visits and data collection. The estimated cost of this phase is \$53,000. The second phase of the needs assessment is estimated to require 200 person hours. The estimated cost of this phase is \$30,000, which includes data analysis and reporting, a data summary visit, and one presentation visit.

## **9.0 SCHEDULE**

The proposed study plan will take into account data collected during 2005 and 2006 during baseline studies.

Planning for the recreation needs analysis will begin in late 2007, shortly after the issuance of FERC's Study Plan Determination in October 2007. Field efforts will take place during the spring and summer of 2008 with an Initial Study Report due to stakeholders by October 2008. An initial study report will be filed with FERC in October 2008.

Data analysis and a draft report for the study will be completed by January 2008. A final report will be provided to FERC and the stakeholders by October 2009.

## **10.0 REFERENCES**

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