
TEMPERATURE MONITORING STUDY PLAN

First Draft

**ROCKY REACH HYDROELECTRIC PROJECT
FERC Project No. 2145**

February 2, 2001



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

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SECTION 1: INTRODUCTION

1.1 General Description of the Region and Rocky Reach Project

The Rocky Reach hydroelectric project is located at river mile (RM) 473.7 on the Columbia River. This is downstream of Wells Dam and upstream from Rock Island Dam (Figure 1-1). It is one project in a series of five hydropower projects built by Chelan, Douglas and Grant County Public Utility Districts (PUDs) between RM 397.1 and RM 515.1 on the mainstem Columbia River. Rocky Reach Dam consists of 11 generating units, producing a total peak capacity of approximately 1,287 megawatts of power, and 12 gated spillway openings. The hydraulic capacity of the Rocky Reach powerhouse is 217,000 cfs (Chelan PUD 1991a). Rocky Reach, as a run-of-river project, has little pondage and no usable storage volume. The project has a small operating range and must pass inflow on a daily average basis.

The Columbia River and its tributaries drain an area of 219,000 square miles in seven western states and 39,500 square miles in British Columbia. In the United States, most of the basin is located in Washington, Oregon, Idaho and Montana. The Columbia River originates at Columbia Lake on the west slope of Rocky Mountain Range in British Columbia and flows west and south, eventually draining into the Pacific Ocean between Washington and Oregon. Total river length is 1,214 miles (Bonneville Power Administration [BPA] et al. 1994a). Rocky Reach Reservoir extends approximately 43 miles upstream to the tailrace of Wells dam. Rocky Reach Reservoir has a surface area of approximately 9,100 acres, a gross storage capacity of 382,000 acre-feet, a mean depth of 42 feet and a shoreline length of approximately 93 miles. The Entiat River is the primary tributary flowing into the reservoir.

The mid-Columbia River reach forms the boundary between the North Cascade Mountains to the west and the Columbia Plateau to the east. In the vicinity of the Rocky Reach Project, the river flows over mainly Paleozoic metamorphic and intrusive rocks. Further south, toward Rock Island Dam, the river passes into the Columbia basalt group (BPA et al. 1994b). In and around Rocky Reach, the Columbia River flows through a gorge interrupted by confluences with several tributary valleys. The Entiat River and a number of intermittent streams with deep "V" shaped valleys flow into the Columbia River from the west (Chelan PUD 1991b).

A wide variety of soils occur in the mid-Columbia reach including Camborthrids, Haploxerolls and Argixerolls. Soils range from light-colored soils, with thin "A" horizons poor in organic matter, and calcium accumulations high in the profile; to thick, very dark-brown to black soils with "A" horizons rich in organic matter, but with calcium carbonate accumulations that may be deep in the profile or absent. Soils with high accumulations of salt (Solonchak) and large amounts of exchangeable sodium (Natrargids or Solonetz) are also present (Franklin and Dyrness 1984).

Located in the rain shadow of the Cascade Range, the mid-Columbia region is classified as arid to semi-arid and experiences low precipitation, dry summers, with warm to hot temperatures, and relatively cold winters. Some marine influences are still felt, but continental-type climate

conditions prevail. Most of the Columbia basin receives less than 20 inches of precipitation annually, with much of this precipitation occurring in winter. Deep snow may accumulate over the mountainous areas, where water is held as natural storage until the runoff in the spring.

Vegetation in the mid-Columbia region consists mainly of steppe and shrub-steppe vegetation, and forest vegetation is generally confined to mountain slopes with sufficient precipitation (Franklin and Dyrness 1984). Much of the area has been cultivated with a variety of crops or is grazed by domestic and wild livestock. Natural vegetation communities in the plan area consist of a shrub layer dominated by artemesia (*Artemesia tridentata*) along with a variety of perennial grasses. Moister sites, such as areas along streams or rivers, may be inhabited by hawthorn/snowberry (*Crataegus douglasii/Symphoricarpos albus*) and hawthorn/cow parsnip (*Crategus douglasii/Heracleum lanatum*). Other habitats with distinct vegetation communities include those with gravelly or sandy soils, shallow, stony sites; and sand dunes near the Columbia River (Franklin and Dyrness 1984).

Land use in the mid-Columbia reach varies considerably from north to south. Rangeland predominates around Rufus Woods Lake, impounded by Chief Joseph Dam, while irrigated cropland and orchards are the principal land use along the river corridor around the Rocky Reach Project and Reservoir. Irrigated orchards and stable water levels in the lower Rocky Reach Reservoir have provided adequate soil moisture for establishment of a riparian corridor along much of the shoreline. Below Rock Island Dam, land cover is mostly rangeland, with irrigated cropland on the East side of the river. Land throughout the Project reach is predominantly in private ownership, although there are a number of public land units. Federal land in the mid-Columbia River includes the Colville Indian Reservation to the north, the Okanogan and Wenatchee National Forests in sections between Wells and Rocky Reach dams, and scattered tracts of U.S. Bureau of Land Management (BLM) land. There are also 13 state wildlife refuges and seven state parks in the mid-Columbia region (BPA et al. 1994b).

Orchards throughout the Project area, which area the mainstay of the local economy, are reliant upon a source of irrigation water for their existence. Within the Rocky Reach Project area, irrigation withdrawals constitute the largest segment of consumptive water use. The irrigation season begins in late March or April and continues through October. Peak irrigation withdrawals occur in July and august when regional temperatures are highest.

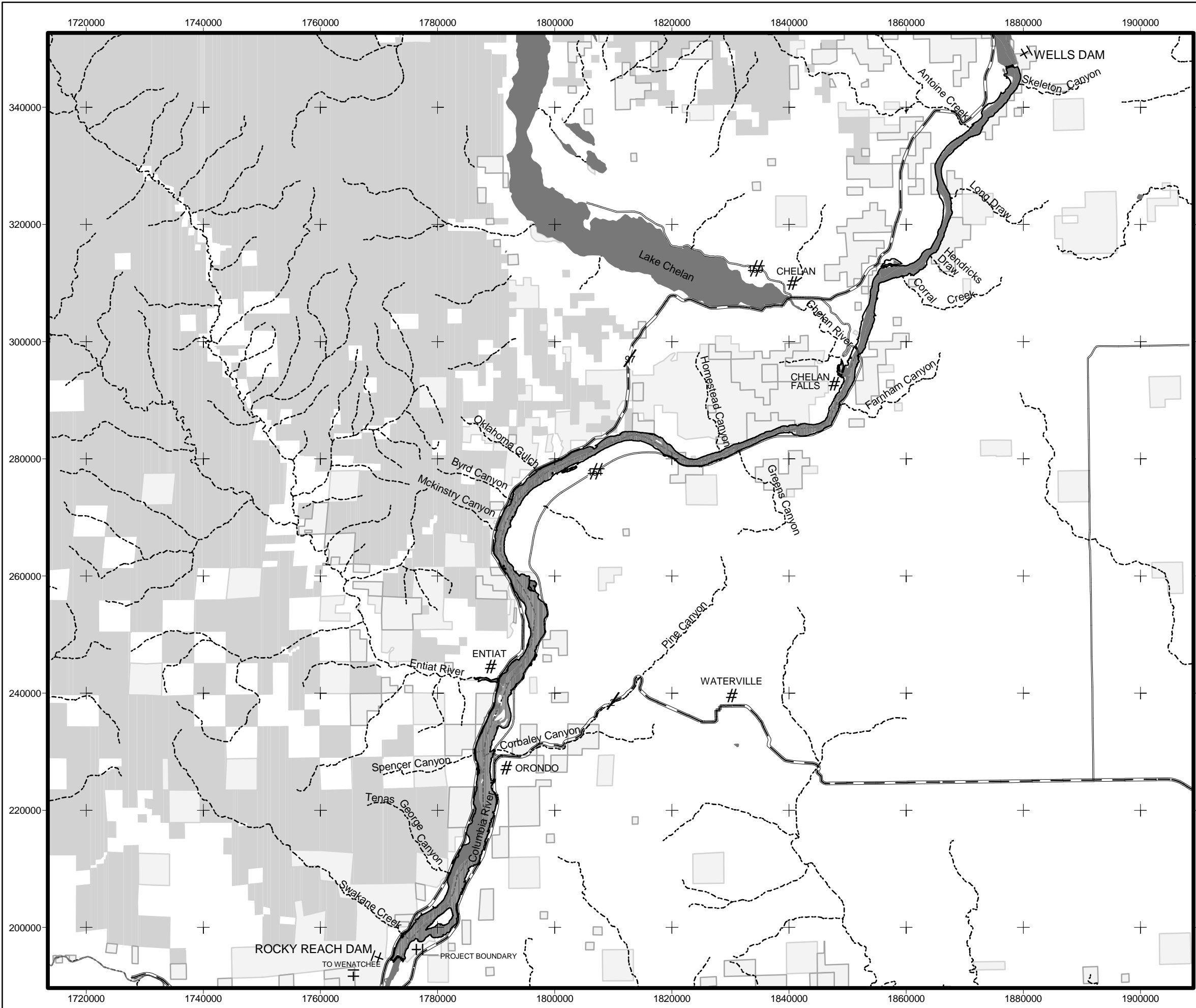
Annual irrigation water rights, administered by the State of Washington Department of Ecology (WDE), provide for withdrawal of up to 313 cubic feet per second (cfs) from Rocky Reach Reservoir. There is no practical means to measure the level to which these water rights may be exercised on a particular year. Because water rights represent maximum withdrawals, it is reasonable to assume that actual usage is less than established water rights.

Domestic water supply withdrawals from Project waters are limited. Available domestic water within the Project area is 64 cfs, according to the WDE. Water rights for other consumptive uses of waters that may be withdrawn from the Project area, on an annual basis, are 10.5 cfs for commercial/industrial use and 3 cfs for stock watering.

Anadromous salmonid fish species present in the Rocky Reach Project area include: spring, summer and fall chinook salmon (*Oncorhynchus tshawytscha*), sockeye salmon (*O. nerka*), summer steelhead (*O. mykiss*), and coho salmon (*O. kisutch*). Coho salmon were historically present, but the endemic stock was extirpated from the mid-Columbia region by the 1940's (Mullan 1984). Pacific lamprey is another non-salmonid anadromous fish species present in the project area.

Upper Columbia steelhead (*Oncorhynchus mykiss*) were listed as endangered by the National Marine Fisheries Service (NMFS) on August 18, 1997 (62 FR 43937). Upper Columbia Bull trout (*Salvelinus confluentus*) were listed as threatened on June 12, 1998 (63 FR 111 – pp. 31647-74). Upper Columbia spring chinook salmon were listed as endangered on March 16, 1999 (63 FR 11482). No other aquatic plant or animal species in the mid-Columbia River reach is currently listed as threatened or endangered under either the ESA or Washington State laws or regulations. Summer/fall chinook salmon in the mid-Columbia River were petitioned for listing in 1993. A listing was found to be not warranted by the NMFS in 1994 and reaffirmed in 1998, 63 FR 11482 (March 9, 1998). NMFS has determined that listing of the two sockeye ESUs in the mid-Columbia is also not warranted. The listing of any of these species could substantially affect operation of the Rocky Reach and other hydropower facilities throughout the basin.

Native resident fish species include white sturgeon, mountain whitefish, rainbow trout, bull trout, northern pikeminnow, peamouth chub, chiselmouth chub, largescale sucker, bridgelip sucker, redbside shiner, sculpins, and threespine stickleback. Common introduced resident species include carp, tench, largemouth and smallmouth bass, pumpkinseed sunfish, walleye, yellow perch, and brown bullhead.



PROJECT BOUNDARY & LOCATION MAP
 ROCKY REACH HYDROELECTRIC PROJECT

PUBLIC UTILITY DISTRICT NO. 1
 CHELAN COUNTY WENATCHEE, WASHINGTON

FERC PROJECT NO. 2145

MAY 27, 1999

LEGEND

- PROJECT BOUNDARY
- US HIGHWAY
- STATE HIGHWAY
- TRIBUTARIES
- STATE OF WASHINGTON
- BUREAU OF LAND MANAGEMENT
- US FOREST SERVICE
- CITY / TOWN



Miles

1:200,000



1.2 General Description of the Relicensing Process

The Public Utility District No. 1 of Chelan County (Chelan PUD) owns and operates the Rocky Reach Hydroelectric Project (Project). Chelan PUD is permitted to operate the Project according to terms and conditions contained in an existing Federal Energy Regulatory Commission (FERC) license, No. 2145, that was issued on July 12, 1956. On September 1, 1966, the Chelan PUD filed an application with the Federal Power Commission (FPC) to amend the Project license for the addition of four generating units. The FPC, later FERC, issued the license amendment on May 23, 1968. The existing license expires on June 30, 2006.

Chelan PUD intends to seek a new federal license to operate the Rocky Reach Project and has begun preparation for the process referred to as “relicensing.” The FERC relicensing process is based on laws and regulations that require years of extensive planning, including environmental studies, agency consensus and public involvement. The process to obtain a new license has changed considerably since the existing licensee was issued in 1956. The Federal Power Act (FPA) was amended in 1986 by the Electric Consumers Protection Act (ECPA). The amendment requires the FERC, in addition to power and development purposes, to give equal consideration to the purposes of enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

1.3 Need Statement

As part of the water quality-monitoring program for Rocky Reach Dam relicensing, the WDE has expressed interest in potential ongoing Project-related impacts on water temperature. The Chelan PUD monitors temperature within the forebay and tailrace of Rocky Reach Hydroelectric Project during the spring runoff and summer. To supplement this data, continuously recording thermographs were deployed at four locations in the Rocky Reach reservoir from mid-July through early September 2000. Additional temperature information is needed to determine whether Rocky Reach project operations affect water temperature.

Water quality standards for waters of the State of Washington are addressed in Chapter 173-201 of the Washington Administrative Code (WAC). General water use and criteria classes are established in this regulation. The Columbia River, which includes Rocky Reach Reservoir, has been classified as a “Class A” water. On a scale that ranges from “Class AA” (extraordinary) to “Class C” (fair), “Class A” waters are rated as excellent, meeting or exceeding the requirements for substantially all uses.

Table 1-1 is a comparison of the “Class A” water quality criteria, long-term monthly water quality data from the WDE Columbia River monitoring station located just downstream of Rock Island Dam (Chelan PUD 1991b) and water quality data collected in 1999-2000 specifically for the relicensing of Rocky Reach Dam (Parametrix 2000a). The WDE station, located approximately 20 miles downstream of Rocky Reach Dam, is the nearest mainstem data collection point with a long-term monitoring record that would document water quality pertinent to the Rocky Reach Project. WDE’s data is based on an average of all 133 monthly readings collected between October 1977 and January 1989. As illustrated in Table 1-1, on a yearly

average the water quality below both hydroelectric projects meets the “Class A” water quality standards. This average of monthly samples is appropriate to demonstrate that water quality standards are met for chemical and biological parameters, such as pH, dissolved oxygen, turbidity and fecal coliform contamination. But for the parameters of total dissolved gas and water temperature, which are dependent on the seasonal effects of river flow and weather, the average of monthly samples is not appropriate. The river temperature, during periods of hot weather, and the level of total dissolved gas, during periods of high river flows, can exceed the water quality standards for periods of time while the causal conditions persist. The water quality data collected in 1999-2000 gives a range of average monthly values for these parameters.

Table 1-1: Comparison of WDE Water Quality Standards and Average Water Quality Data From the WDE Rock Island Monitoring Station and Range of Monthly Data from Rocky Reach Reservoir

<u>Water Quality Criteria</u>	<u>Class A Standard</u>	<u>Rock Island Station</u>	<u>Rocky Reach Data</u>
Fecal Coliform Organisms	<100 organisms	40 organisms	1 – 10 organisms
	<10% exceed 200	6.8% exceed 200	0%
Dissolved Oxygen	>8.0 mg/L	12.2 mg/L	9.0 – 13.6 mg/L
pH	6.5<pH<8.5	8.0 pH	7.8 – 8.1 pH
Turbidity	<5 NTU	4.4 NTU	1.1 – 3.3 NTU
Toxic/Deleterious Material	Public Health Req.	Conforms	---
Aesthetic Values	Unimpaired	Unimpaired	---
Temperature	<18.0 ° C.	11.3 ° C.	3.2 – 18.2 ° C.
Total Dissolved Gas Tailrace Data	Not Exceed 110% saturation	109.9% (COE database)	100% - 113.4%

The issue of water temperatures in the Columbia River, which generally exceed 18 degrees C. in the lower river below the Snake River confluence, has received attention at a regional level. The Environmental Protection Agency (EPA) is currently entering into Memorandums of Agreement with the states of Washington, Idaho and Oregon to begin the process of establishing a TMDL (total daily maximum load) for point and non-point sources of thermal loading to the Columbia River watershed. The degree to which hydroelectric projects have affected thermal loading, through creation of reservoirs, is a factor that will likely be considered in establishment of the TMDL. Determination of actions that will be taken to bring water temperatures during the summer months into compliance with the water quality standard of 18.0 degrees C. may include changes to operations at some hydroelectric projects, particularly those with storage reservoirs.

The Rocky Reach Project is a run-of-river project, with little thermal stratification of water within the reservoir and a very rapid water exchange rate. Thus, there are few, if any, operational opportunities for the Rocky Reach Project to reduce water temperatures. However, the potential of the reservoir to increase thermal loading by its effect on the width-to-depth ratio of the river channel is a consideration in establishing the TMDL and in the WDE’s decision on 401 Water Quality Certification, required for relicensing of the project.

An evaluation of the effect of the Rocky Reach Project on thermal loading to the Columbia River is needed as baseline information for the Environmental Assessment. A modeling approach is the only practical way to evaluate thermal uptake in the Rocky Reach reservoir compared to the thermal loading that would occur in this section of the Columbia River if there were no Rocky Reach Project. The EPA is preparing to use a modeling approach to establish the TMDL and evaluate measures to improve water temperatures in the Columbia River. The EPA is currently considering using a one-dimensional model that they have developed. Other agencies (Corps of Engineers, BPA) have suggested that other standard, recognized temperature models, including two-dimensional models, may be better predictive tools. Data collection efforts at the Rocky Reach Project should be designed to support the requirements of the model selected by the EPA and WDE for use in the TMDL process.

SECTION 2: STUDY GOAL

The goal of this study is to supplement existing information as necessary to meet the requirements for submitting an application for 401 certification with the State of Washington. The primary objective is to compare the existing water temperatures with the state's standards and determine any ongoing Project-related impacts on water temperature. The water quality standard states that temperature shall not exceed 18°C due to human activities. When natural conditions exceed 18.0°C, no temperature increases will be allowed which will raise the receiving water temperature by greater than 0.3°C (WAC 173-201A-030). The TMDL process will further define the allowable temperature increase for individual hydroelectric projects. The objective of this study is to collect temperature data that will be adequate to support model assessments of the Rocky Reach Project's effect on thermal loading to the Columbia River.

SECTION 3: STUDY AREA

The study area will consist of the project boundary and areas likely to be impacted by project operations. The project boundary extends from the tailrace of Rocky Reach dam (River Mile – RM 473.5) upstream to the tailrace of Wells dam (RM 516.5). The project boundary varies in elevation along the Rocky Reach reservoir and corresponds to the water surface elevation associated with the probable maximum flood. (Rocky Reach Project Periodic Safety Inspection Report, 1997.)

SECTION 4: METHODOLOGY

The Rocky Reach Natural Sciences Working Group will approve the appropriate model to best determine the influence of the Rocky Reach project on water temperature. Data collection efforts will be formed based on the requirements of the model. Once a model is identified, data requirements will be attached to this study plan as an appendix.

It is likely that additional continuous temperature information will need to be collected at various locations in the project area. All sampling locations should be identified and mapped using GPS and GIS. Characteristics such as depth and flow of each monitoring location should be described in detail.

SECTION 5: TASK LIST

- Task 1 - Chelan PUD will recommend model to Natural Sciences Working Group
- Task 2 - Natural Sciences Working Group will approve appropriate model.
- Task 3 - Determine data needs of selected model and develop scope of work
- Task 4 - Develop detailed work plan
- Task 5 - Data collection – install thermographs by June 20
- Task 6 - Run model and report results.
- Task 7 - Prepare first draft report
- Task 8 - Prepare second draft report, if needed
- Task 9 - Prepare final Report

SECTION 6: ANALYSIS AND REPORTING

Sampling protocol, analytical techniques and reporting will be subject to quality assurance/quality control strategies developed in consultation with the agencies. Validity of results, measurement precision, detection limits and sources of error will be discussed for each sampling parameters. Where appropriate, spatial and temporal water quality patterns will be analyzed.

SECTION 7: STAFFING AND EQUIPMENT NEEDS

Chelan PUD will hire a consultant(s) to assist in conducting the data gathering efforts. Chelan PUD staff will oversee contracting and deliverable schedule for the selected consultant(s). Consultant(s) conducting the contracted investigations will be required to provide equipment and staff to conducted the contracted investigations with minimal field support from the PUD. PUD involvement will be primarily in the form of study plan development and implementation, project oversight, providing input to the consultant(s) regarding decisions made by parties involved in the relicensing process, and promoting discussion among stakeholders regarding study results.

SECTION 8: SCHEDULE

Task 1	Model selection	March 2001
Task 2	Determine data needs and develop scope of work	April 2001
Task 3	Develop detailed work plan	May 2001
Task 4	Field Studies.	July – September 2001
Task 5	Analysis (concurrent with field studies)	July – October 2001
Task 6	First Draft Report	October 15, 2001
Task 7	Based on comment, issue final report or second draft report, if needed	November 15, 2001
Task 8	Final Report	December 15, 2001

SECTION 9: BUDGET

To be determined based on contractor selection.

SECTION 10: NEXT STEPS

- Research models for data requirements and applicability and consult with working group on model selection.

SECTION 11: REFERENCES

Bonneville Power Administration, U.S. Army Corps of Engineers, U.S. Department of the Interior and Bureau of Reclamation. 1994a. Columbia River System Operation Review-Draft Environmental Impact Statement. SOR Draft EIS. DOE/EIS 0170. Bonneville Power Administration, Portland, OR. Main report, summary and appendices.

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