DRAFT ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

Hydro Battery Pearl Hill Pumped Storage Project

FERC Project No. 14795-002

Washington

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, DC 20426

U.S. Army Corps of Engineers

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ACRONYMS AND ABBREVIATIONS

7-DADMax	7-day average of the daily maximum temperatures
Advisory Council	Advisory Council on Historic Preservation
AF	acre-feet
APE	area of potential effect
ARMP	Aquatic Resources Management Plan
ATV	all-terrain vehicle
°C	Celsius
certification	water quality certification
cfs	cubic feet per second
Commerce	U.S. Department of Commerce
Commission	Federal Energy Regulatory Commission
Corps	U.S. Army Corps of Engineers
CTCR	Confederated Tribes of the Colville Reservation
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dBA	A-weighted decibel
DO	dissolved oxygen
DPS	distinct population segment
EA	environmental assessment
EAP	Emergency Action Plan
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
°F	degree Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
GMU	Game Management Unit
HPMP	Historic Properties Management Plan
IPaC	Information, Planning, and Conservation System
IPM	Integrated Pest Management
Interior	U.S. Department of the Interior
KOP	key observation point
kW	kilowatt
MDMZ	Mule Deer Management Zone
mg/L	milligrams per liter
M_L	local magnitude scale
MW	megawatt
MWh	megawatt-hours
National Register	National Register of Historic Places
NAV88	North American Vertical Datum of 1988
NERC	North American Electric Reliability Corporation

NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NPCC	Northwest Power and Conservation Council
ntu	Nephelometric Turbidity Unit
NWI	National Wetland Inventory
NWPP	Northwest Power Pool, United States area
ORV	off-road vehicle
PA	programmatic agreement
PAC	Priority Area of Conservation
PAD	Pre-Application Document
PHS	Priority Habitats and Species
project	Battery Hill Pearl Hill Pumped Storage Project
RM	river mile
SD1	Scoping Document 1
SD2	Scoping Document 2
Shell	Shell Energy North America (US), L.P.
SHPO	State Historic Preservation Officer
SWPPP	Stormwater Pollution Prevention Plan
TCP	Traditional Cultural Property
TDG	total dissolved gases
THPO	Tribal Historic Preservation Officer
TLP	Traditional Licensing Process
TMDL	Total Maximum Daily Load
TRMP	Terrestrial Resources Management Plan
Washington DFW	Washington Department of Fish and Wildlife
Washington DNR	Washington Department of Natural Resources
Washington DOE	Washington Department of Ecology
Washington SPRC	Washington State Parks and Recreation Commission

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HYDRO BATTERY PEARL HILL PUMPED STORAGE PROJECT
Project No. 14795-002 - Washington

1.0 INTRODUCTION

1.1 APPLICATION

On November 1, 2017, Shell Energy North America (US), L.P (Shell), filed an application with the Federal Energy Regulatory Commission (Commission or FERC) for a license to construct and operate the Hydro Battery Pearl Hill Pumped Storage Project (Pearl Hill Project or project). The 5-megawatt (MW) project would be located on Rufus Woods Lake, near Bridgeport, Douglas County, Washington (figure 1). Rufus Woods Lake, a reservoir impounded by the U.S. Army Corps of Engineers' (Corps) Chief Joseph Dam on the Columbia River, would serve as the project's lower reservoir and the source of water for project operation. The project's upper reservoir, penstock and power platform would be located on state land. The Corps, a cooperating agency for the preparation of this environmental assessment (EA), is reviewing Shell's project for permits it would issue under Sections 10 and 14 of the Rivers and Harbors act of 1899 and Section 404 of the Clean Water Act.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Pearl Hill Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue an original license to Shell for the Pearl Hill Project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood

control, irrigation, and water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a license for the Pearl Hill Project would allow Shell to generate electricity at the project for the term of the new license, making electric power from a renewable resource available to the regional grid.

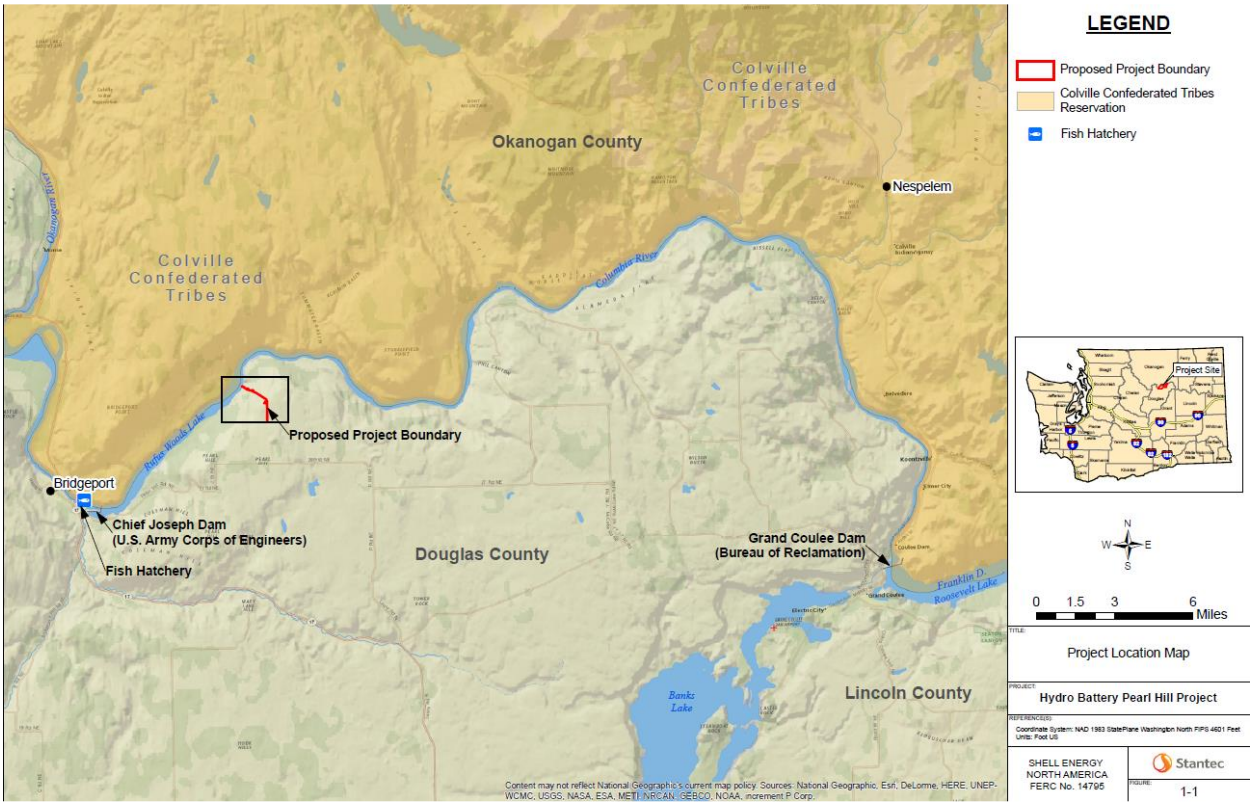

Figure 1. Location of the Pearl Hill Project (source: application).

This draft environmental assessment (DEA) has been prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 to assess the effects associated with construction and operation of the proposed project and alternatives to the proposed project. In this DEA, staff evaluates the effects of Shell's proposed action and recommends conditions for any license issued. In addition to Shell's proposed action, the DEA considers: (1) Shell's proposal with additional staff-recommended measures (staff alternative); and (2) a no-action alternative.

1.2.2 Need for Power

The project would provide hydroelectric generation to meet part of Washington's power requirements, resource diversity, and capacity needs. The project would use surplus renewable power to pump water from the lower-elevation reservoir to the higher reservoir during low demand periods, and generate power for up to 6 hours when more energy is needed to balance sudden drops in solar or wind production. The project would have an installed capacity of 5 MW and generate up to 24,000 megawatt-hours (MWh) per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Pearl Hill Project is located within the jurisdiction of the Northwest Power Pool (NWPP), a sub-region of the Western Electricity Coordinating Council, a region of the NERC. According to NERC's 2018 forecast, average annual demand requirements for the NWPP sub-region are projected to grow at an average rate of 1.1 percent from 2019 through 2028. NERC projects that resource capacity margins (generating capacity in excess of demand) will range between 22.0 percent and 27.6 percent of firm peak demand during the 10-year forecast period, including estimated new capacity additions.[1]

However, the main purpose of the Hydro Battery Pearl Hill facility is to provide regulation and spinning reserve to support of grid reliability in the region. Thus, power from the Pearl Hill Project would help meet a need for load balancing services that would support renewable generation in the NWPP sub-region, which in turn could displace non-renewable, fossil-fired generation and contribute to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any new license for the project would be subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the

[1] Over the next 10 years, NERC estimates that about 3,075 MW of additional capacity will be brought on line.

Secretaries of the U.S. Department of Commerce (Commerce) or the U.S. Department of the Interior (Interior). Interior, by letter dated December 17, 2018, requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

1.3.1.2 Section 4(e) Conditions

Section 4(e) of the FPA provides that any license issued by the Commission for a project within a federal reservation shall be subject to and contain such conditions as the Secretary of the responsible federal land management agency deems necessary for the adequate protection and use of the reservation. The Corps has not filed Section 4(e) conditions for the proposed Pearl Hill project.

1.3.1.3 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions, unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

On December 17, 2018, the Department of the Interior, on behalf of the U.S. Fish and Wildlife Service (FWS), and, on December 18, 2018, the Washington Department of Fish and Wildlife (Washington DFW) filed timely recommendations under section 10(j). These recommendations are summarized in table 11, and discussed in section 5.3, *Fish and Wildlife Agency Recommendations*. In section 5.3, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401(a)(1) of the Clean Water Act (CWA), 33 U.S.C. § 1341(a)(1), a license applicant must obtain either a water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the CWA, or a waiver of such certification. A waiver occurs if the state agency does not act on a request for certification within a reasonable period of time, not to exceed 1 year, after receipt of such request.

On November 27, 2017, Shell applied to the Washington Department of Ecology (Washington DOE) for section 401 certification for the Pearl Hill Project. Washington DOE received this request on the same day. In an email dated October 2, 2018, and filed

on October 12, 2018, Washington DOE recommended that Shell withdraw its application for certification and refile it prior to November 27, 2018, because the Commission had not yet issued its environmental assessment. On November 16, 2018, Shell withdrew and refiled its certification application, which Washington DOE received on the same day. Washington DOE has not yet acted on the application.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of such species.

On June 5, 2019, staff accessed FWS's Information, Planning, and Conservation (IPaC) System to determine which federally listed species occur in the project vicinity. According to the IPaC database, the following species potentially occur in the project area: the threatened bull trout and the threatened yellow-billed cuckoo. No designated critical habitat for either species occurs within the project boundary.

Our analysis of project impacts on the bull trout and the yellow-billed cuckoo is presented in section 3.3.3.2, *Threatened and Endangered Species*. Based on available information, we conclude that licensing the project would have no effect on the bull trout nor on the yellow-billed cuckoo.

Although IPaC did not identify the threatened Ute ladies'-tresses as occurring in the project area, Interior recommended that the project area be surveyed for Ute ladies'-tresses. Shell agreed to survey for the species prior to commencing construction and take steps to avoid any identified plants if possible. Because existing habitat at the project is not likely to support Ute-ladies tresses and Shell's proposed survey would confirm their absence or identify steps needed to minimize adversely affecting the plants, we conclude that licensing the project would not be likely to adversely affect the Ute ladies'-tresses and we will seek FWS's concurrence.

1.3.4 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 (CZMA), as amended, requires review of a project's consistency with a state's Coastal Management Program for projects within or affecting the coastal zone. Under section 307(c)(3)(A) of the CZMA, 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state's CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA Program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The project is not located within the state-designated Coastal Management Zone, which only consists of the state's coastal counties, and the project would not affect Washington's coastal resources. By e-mail dated October 2, 2018, Washington DOE states that the project is not subject to Washington coastal zone program review and no consistency certification is needed.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, requires that a federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register). Construction and operation of the proposed project would have an adverse effect on historic properties eligible for listing on the National Register. This includes effects on the Pearl Hill Traditional Cultural Property District (Pearl Hill TCP District) and its individual components within the project's area of potential effects (APE). To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the construction, operation, and maintenance of the proposed project. The terms of the PA would ensure that Shell addresses and treats all historic properties identified within the project's APE through the preparation of a Historic Properties Management Plan (HPMP).

1.3.6 Pacific Northwest Power Planning and Conservation Act

Under section 4(h) of the Pacific Northwest Power Planning and Conservation Act, the Northwest Power and Conservation Council (NPCC) developed the Columbia River Basin Fish and Wildlife Program to protect, mitigate, and enhance the operation of the hydroelectric projects within the Columbia River Basin. Section 4(h) states that responsible federal and state agencies should provide equitable treatment for fish and wildlife resources, in addition to other purposes for which hydropower is developed, and that these agencies shall take into account, to the fullest extent practicable, the program adopted under the Pacific Northwest Power Planning and Conservation Act. As part of the Program, NPCC has designated over 40,000 miles of river in the Pacific Northwest region as not being suitable for hydroelectric development ("protected area"). The project is not located within a protected area.

The program directs project proponents to consult with federal and state fish and wildlife agencies, appropriate Indian tribes, and NPCC during the study, design, construction, and operation of any hydroelectric development in the basin. At the time the application was filed, our regulations required the applicant to consult with the appropriate federal and state fish and wildlife agencies and tribes before filing, and after

filing, to provide these groups with opportunities to review and comment on the application. Shell has followed this consultation process, and the relevant federal and state fish and wildlife agencies and tribes have reviewed and commented on the application.

To mitigate harm to fish and wildlife resources, NPCC has adopted specific provisions to be considered in the licensing or relicensing of non-federal hydropower projects (Appendix F of the Program). The specific provisions that apply to the proposed project call for: (1) specific plans for fish facilities prior to construction; (2) assurance that the project will not degrade fish habitat or reduce numbers of fish; (3) assurance that all fish protection measures are fully operational at the time the project begins operation; and (4) replacing vegetation if natural vegetation is disturbed.

Our recommendations in this EA (section 3.3.2 and 3.3.3) are consistent with the applicable provisions of the program, listed above. Further, a condition of any license issued would reserve to the Commission the authority to require future alterations in project structures and operations to take into account, to the fullest extent practicable, the applicable provisions of the program.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 C.F.R. § 4.38) require applicants to consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act (16 U.S.C. §§ 661-667e), the ESA, the NHPA, and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

Licensing of the project was formally initiated October 3, 2016, when Shell filed with the Commission a Pre-Application Document (PAD), a Notice of Intent (NOI), and a request to use the Traditional Licensing Process (TLP) to license the project. The Commission issued a public notice of the filing and approved the use of the TLP on November 9, 2016.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. Scoping Document 1 (SD1) was issued on February 5, 2018. Scoping meetings were held in Pateros, Washington, on March 7, 2018, to request comments on the project. A court reporter recorded all comments made at the scoping meetings, and these are part of the Commission's public record for the project. An environmental site review was held on March 8, 2018.

On April 6, 2018, the Confederated Tribes of the Colville Reservation (CTCR) filed comments on SD1 and the PAD.

A revised Scoping Document (SD2), addressing these comments, was issued on May 15, 2018.

1.4.2 Interventions

On December 26, 2017, the Commission issued a notice accepting the application and setting February 26, 2018, as the deadline for filing protests and motions to intervene. The following entities filed motions to intervene:

Intervenors	Date Filed
Public Citizen, Inc.	January 2, 2018
Washington DFW	January 8, 2018
CTCR	January 17, 2018
Bonneville Power Administration	February 2, 2018
Washington DOE	February 15, 2018
U.S. Department of the Interior	February 23, 2018

CTCR also filed a protest on February 13, 2018.

1.4.3 Comments on the Application

A notice requesting comments, recommendations, and preliminary terms and conditions was issued on October 18, 2018. The following entities responded:

Commenting Entity	Date Filed
U.S. Department of Interior	December 6, 2018
CTCR	December 17, 2018
U.S. Department of the Interior	December 17, 2018[2]
Washington DFW	December 18, 2018
U.S. Environmental Protection Agency (EPA)	December 20, 2018
EPA	January 2, 2019[3]
CTCR	January 15, 2019

[2] Interior's December 17, 2018, letter is meant to supersede its letter filed on December 6, 2018.

[3] EPA's January 2, 2019, filing consists of the final page omitted from its letter filed on December 20, 2018.

2.0 PROPOSED ACTION AND ALTERNATIVES

This EA assesses the environmental and economic effects of constructing, operating, and maintaining the project: (1) as proposed by Shell; and (2) as proposed by Shell with staff's recommended measures (staff alternative). It also considers the effects of the no-action alternative.

2.1 NO ACTION ALTERNATIVE

The no-action alternative is license denial. Under the no-action alternative, the project would not be built and environmental resources in the project area would not be affected. This is the baseline against which the action alternatives are compared.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

The proposed pumped storage project would utilize the Corps' existing Rufus Woods Lake Reservoir as its lower reservoir, which has an approximate storage capacity of 518,000 acre-feet (AF) and a surface area of 8,000 acres. The project would consist of the following new facilities: an upper reservoir, a penstock to convey flow between the upper and the lower reservoir, a power platform with generating/pumping facilities, pump intakes, a transmission line, an access road, and accompanying facilities (Figure 2). The upper reservoir would consist of a 300-foot-diameter, 20-foot-tall lined corrugated steel tank with a total storage capacity of 29 acre-feet and an operating volume of 26.5 acre-feet and fitted with a floating roof. A 6,276-foot long, 3-foot-diameter, steel penstock, of which 2,828 feet would be buried[4], would convey flow from the upper reservoir to a 77-foot-long, 77-foot-wide structural steel power platform located on the shore of Rufus Woods Lake. The power platform would be anchored to the shore using pilings and concrete foundations with rock anchors. Five 2,400 horsepower vertical turbine pumps, one 5-MW twin-jet Pelton turbine and synchronous generator, and accompanying electrical equipment would be mounted on the power platform as modules. Five vertical turbine pump intakes, each fitted with a 27-inch-diameter by 94-inch-long T-style fish screen, would be used to withdraw water from the Rufus Woods Lake Reservoir to fill the upper reservoir. Generating flows would discharge through a 42-inch-diameter half pipe containing seven baffles that transitions to a full pipe that then discharges flows through a multi-port velocity diffuser at a depth of about 20 feet. Access from County Road L to the upper reservoir would be provided through a new 12-foot-wide,

[4] *See* telephone conversation memorandum between Commission staff and J. T. Steenkamp, Project Manager, Shell, filed in the record on June 4, 2019.

approximately 3,847-foot-long new gravel road. The power platform would be accessed by watercraft or on foot.

Power generated by the project would be transmitted from the powerhouse through a 2,500-foot-long, 24.9-kilovolt transmission line that would be partially buried and partially affixed to the penstock and would interconnect with an existing non-project transmission line. The project is estimated to generate up to 24,000 MWh annually.

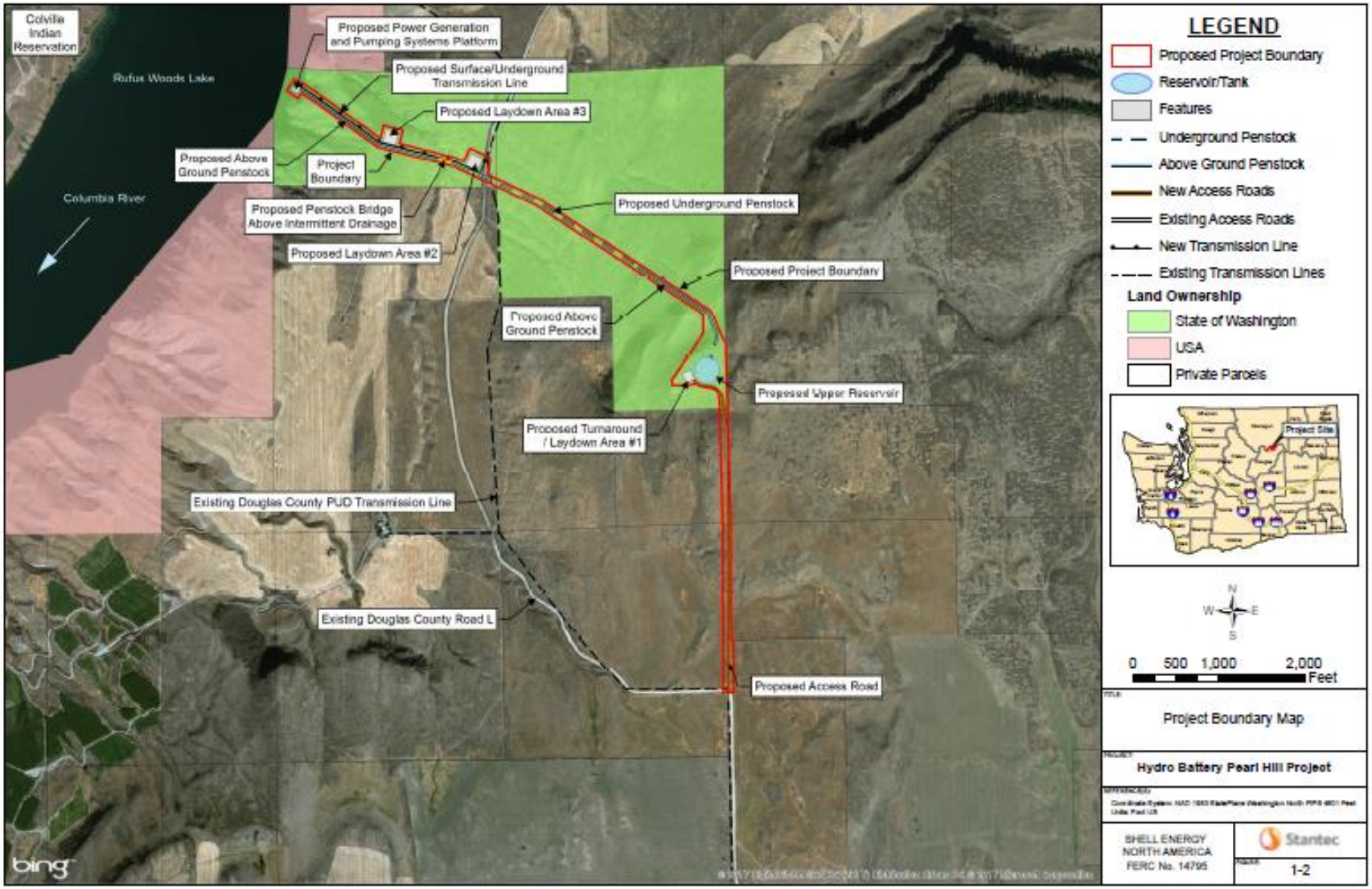

Figure 2. Pearl Hill Project facilities (source: application).

2.2.2 Project Boundary

The proposed project boundary encloses the facilities described above (figure 2), with the exception of the lower reservoir. The proposed project boundary encompasses approximately 28.8 acres of land. All land within the project boundary is owned by the Washington Department of Natural Resources (Washington DNR).

2.2.3 Project Safety

As part of the licensing process, the Commission will review the adequacy of the proposed project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would inspect the licensed project both during and after construction. Inspection during construction would concentrate on adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.4 Project Operation

Shell would fill the upper reservoir by pumping water from the lower reservoir, Rufus Wood Lake, to the upper reservoir, the steel tank, at times when energy is in excess or in low demand. When energy is needed, water would be released from the upper reservoir through the penstock to the power platform to generate electricity. This would occur based on on-peak/off-peak power considerations, the need to augment the production of renewable wind and solar power generation, or to provide ancillary power services.[5]

Each of the vertical turbine pumps could withdraw water from the lake at a rate of 12.6 cubic feet per second (cfs) for a total maximum of 63 cfs if all five pumps are operating. The project could generate with flows between 5 and 53.1 cfs. At maximum flow, the project could generate for about six hours.

[5] Ancillary services help balance the transmission system as electricity is moved from generating sources to ultimate consumers and are necessary for proper grid operation. Ancillary services include: load following, reactive power-voltage regulation, system protective services, loss compensation service, system control, load dispatch services, and energy imbalance services.

2.2.5 Operation and Environmental Measures

Shell proposes the following measures to protect environmental and cultural resources:

- Develop a soil and sediment erosion control plan (ESCP) to prevent soil and sediment from entering Rufus Woods Lake during project construction.

- Develop a storm water pollution prevention plan (SWPPP) to contain runoff from construction sites.

- Develop a waste management plan to prevent construction wastes from entering Rufus Woods Lake.

- Minimize dust emissions from County Road L, the project access road, and parking and construction laydown areas by applying suppressants when necessary.

- Avoid all in-water construction between April 1 and June 15 to protect spawning or incubating salmonids.

- Develop an aquatic resources management plan (ARMP) that includes: (1) monitoring water temperatures and total dissolved gasses (TDG) in the upper reservoir tank, the power generation system, and upstream and downstream of the discharge point and use active temperature control (e.g. cycling or release of water), if needed, to reduce water temperature or TDG levels in the project discharge; (2) installing bird perching exclusion devices on all potential perch sites on the power platform to reduce the possibility of bird predation on fish; (3) inspecting in-water pilings and other equipment for the presence of invasive species and clean underwater support structures seasonally; (4) installing a fish screen on the project intake that meets National Marine Fisheries Service (NMFS) requirements for protection of salmonids; and (5) installing a bubbler system on the fish screen to clean debris and protect fish from impingement.

- Allow a neighboring rancher to use up to 29 AF of water from the upper reservoir annually to water livestock and permit local emergency responders to use the tank water to fight wildfires.

- Develop a construction timeline and methods, as well as operational practices, to minimize disturbance to wildlife and protect sensitive species.

- Develop and implement a terrestrial resources management plan (TRMP) that includes provisions to: (1) conduct pre-construction surveys to identify sensitive plants including plants of cultural and spiritual importance to CTCR; (2) revegetate all disturbed areas with native plant species; (3) monitor revegetated areas annually for 5-10 years to ensure successful revegetation; (4) evaluate the potential for establishing fast-growing native shade trees along Rufus Woods Lake; (5) control noxious weeds within the disturbed areas; (6) mark the 840 feet of existing fence to minimize risk of grouse collisions; (7) install bird perching exclusion devices on tank rim to minimize the potential for predation on grouse by predatory birds; (8) implement fire suppression measures to control wildfires; (9) provide wildlife crossings over or under the above-ground penstock; and (10) install escape ramps in the reservoir tank to prevent wildlife entrapment.

- Contract with CTCR to assist in revegetation, any final surveys, and recovery of native plant resources in the project construction area.

- Provide $50,000 to Washington DFW for wildlife enhancement measures at Washburn Island, located approximately 13 miles downstream of the proposed project, to off-set any project-related adverse effects to wildlife.

- Allow public access to project lands for hunting, fishing, and wildlife viewing, except during construction and to the shoreline facilities (power platform) during project operation.

- Provide signage and public notifications to inform boaters and hunters of construction activity, temporary closures, and alternate access routes around construction areas to maintain public safety.

- Install safety lights and a floating exclusion barrier to keep boats a safe distance from shore-based facilities during project operation.

- Contract with CTCR to provide staff for monitoring construction and to train construction workers on cultural resources sensitivities and avoidance of sensitive areas.

- Contribute $50,000 to CTCR to evaluate the relationship between the cultural resources found within the Pearl Hill TCP District and the Rufus Woods Lake Archaeological District as mitigation for the loss of the cultural site at the upper reservoir tank.

- Develop and implement an HPMP to protect cultural resources in the project area.

- Paint above ground project facilities in natural brown and/or grey colors to reduce the contrast of the facilities with the surrounding landscape; and round cut and fill slopes of the proposed access roads to better blend with the rolling character of the surrounding landscape.

- Plant vegetation around the upper reservoir tank and parking lot to screen these facilities from view.

- Test noise levels of project generating and pumping equipment at the beginning of project operation and deploy baffling or noise attenuation measures if sound levels exceed 70 A-weighted decibels (dBA).

In addition, as an off-license measure, Shell proposes to provide $50,000 toward removal of defunct aquaculture net pens from Rufus Woods Lake.[6] Shell would work with NMFS, Washington DFW, and CTCR on implementation of this measure.

2.3 STAFF ALTERNATIVE

The staff alternative includes the measures proposed by Shell, except for: (1) providing $50,000 to the Washington DFW for wildlife enhancement measures at Washburn Island; (2) establishing vegetation screening using native shrubs and trees around the tank and parking areas; (3) evaluating the potential for establishing fast-growing shade trees along the lake; (4) installing escape ramps in the reservoir tank; and (5) developing a construction timeline and methods, as well as operational practices, to minimize disturbance to wildlife and protect sensitive species.

The staff alternative also includes some modifications to Shell's proposed measures as follows:

- To protect aquatic resources, modify the ARMP to specify: (1) the proposed locations of the temperature and TDG gages; (2) how real-time water temperatures and TDG levels in the tank and in Rufus Woods Lake will be monitored; (3) the protocol/criteria for deciding when to release water back to Rufus Woods Lake to avoid temperature exceedances; (4) the methods and schedule for inspecting and removing algae and invasive species from project

[6] *See* telephone memo filed in the record on June 20, 2019.

structures; and (5) a reporting schedule for temperature and TDG data and the discovery of any invasive species.

- To protect deer, grouse, and sensitive plants, modify the TRMP to include: (1) an additional wildlife underpass to aid mule deer movement across the lower sections of the above-ground penstock, if such crossings do not naturally exist; (2) a provision for agency involvement in the preconstruction surveys for sensitive plants; (3) pre-construction surveys for Ute ladies'-tresses between August 1 and 31; and (4) installation of additional bird perching exclusion devices on the elevated portions of the penstock within suitable grouse habitat to minimize increased bird predation on grouse.

- To protect cultural resources to the extent practicable, develop a HPMP, in consultation with the Washington State Historic Preservation Officer (Washington SHPO), Corps, and CTCR that includes: (1) an identification and evaluation of all cultural resources that occur within the APE, (2) a description of measures to avoid, reduce, or mitigate any project-related adverse effects on cultural resources, including a site-specific data recovery plan, (3) a plan for studying the importance of the Pearl Hill TCP District in relation to the Rufus Woods Lake Archaeological District; and (4) specific protocols and procedures for evaluating cultural resources in the project area, monitoring construction activities, consulting with the above-named entities, addressing any newly-discovered cultural resources, and protecting cultural resources during future construction and operation activities.

3.0 ENVIRONMENTAL ANALYSIS

This section includes: (1) a general description of the project vicinity, (2) an explanation of the scope of cumulative effects analysis, and (3) our analysis of the proposed action and recommended environmental measures. Sections are organized by resource area (aquatic, recreation, etc.). Historic and current conditions are described under each resource area. The existing conditions are the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of the proposed protection, mitigation, and enhancement measures. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[7]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The proposed project would be located in Douglas County, Washington on the south bank of the Columbia River between river miles (RM) 552 and 553 (Figure 1). This portion of the Columbia River is impounded by Chief Joseph Dam located at RM 545.1. Grand Coulee Dam is located at RM 596.6 on the upstream end of the impoundment.

Chief Joseph Dam is operated by the Corps as a re-regulating facility passing water released from Grand Coulee Dam either by generating power or spilling water, resulting in variable water levels in Rufus Woods Lake. The lake elevation at maximum pool is 962.1 feet (North America Vertical Datum of 1988 (NAVD88)). Normal full pool is 958.9 feet, and minimum pool is 955.5 feet.

The Pearl Hill Project would be situated on land owned by the state of Washington and managed by Washington DNR (Figure 2). The parcel is currently undeveloped and actively grazed. Some of the land adjacent to the project boundary is private, while other portions is federal land administered by the Corps.

The average annual temperature at Chief Joseph Dam is 50.4° F, with July being the warmest month (73.5° F mean temperature) and January being the coldest (26.7° F mean temperature). Most of the precipitation occurs during the winter months. The average annual rainfall for the area is 10.25 inches, while the average annual snowfall is approximately 25 inches.

[7] Unless otherwise indicated, our information is taken from the application for license filed by Shell on November 1, 2017, and responses to requests for additional information filed on December 18, 2017, April 3, 2018, June 13, 2018, July 5, 2018, August 2, 2018 and September 20, 2018.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 C.F.R. § 1508.7), a cumulative effect is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we have not identified any resource areas that could be cumulatively affected by the proposed construction and operation of the Pearl Hill Project in combination with other hydroelectric projects and other activities occurring in the Rufus Woods Lake basin.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the project-specific effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure project effects. We then discuss and analyze the site-specific environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA. Based on this, we have determined that geology and soils, aquatic resources, terrestrial resources, threatened and endangered species, recreation and land use, cultural resources, aesthetic resources, and socioeconomic resources may be affected by the proposed action and alternatives. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geology and Soil Resources

3.3.1.1 Affected Environment

The proposed project would be located in the Columbia River Valley, which has been modified over time by the deposition of glaciofluvial[8] and alluvial[9] material including gravel, sand, cobbles, boulders, and layers of silt and clay deposited by lakes

[8] Deposits from streams deriving much or all of their water from glaciers.

[9] Deposits from running water.

and streams. Specifically, the project is located along the southern bank of the Columbia River in the region known as the Columbia Plateau, which is characterized by incised rivers, extensive plateaus, and ridges that rise to 4,000 feet. In this region, the river serves as the boundary between the Okanagan and Selkirk Highlands to the north and the Columbia Plateau to the south.

The basin is underlain with volcanic rocks of the Columbia River Basalt Group, interbedded volcaniclastic sedimentary rocks,[10] and covered by unconsolidated sediments including glacial, fluvial, eolian and catastrophic flood deposits. The Columbia River Basalt Group appears to have formed between 17.5 and 6 million years ago and includes four basic formations. These include Imnaha Basalt, Grande Ronde Basalt, Wanapum Basalt, and Saddle Mountain Basalts with Wanapum Basalts being the most common formation found in the project area.

Soil types within the project area range from sandy loam to some moderate clay content, with most containing a mixture of gravel and cobbles. All soil types within the project area are well drained with moderate to rapid permeability and soil pH ranges from neutral to slightly alkaline. Slopes in project area range from flat to quite steep, with the portions of the project closest to Rufus Woods Lake reaching a steepness of approximately 50%. Slope along the proposed penstock route varies between 0 and 30 degrees.

Geologic Hazards

Shell conducted a general site reconnaissance level mapping effort along the project alignment to identify potential variables related to geologic hazards including seismicity, landslides, and mass wasting.

Seismicity

Shell found that seismic hazard in the project area is influenced by the Cascadia Subduction Zone as well as crustal faults. The closest potentially Quaternary active faults[11] mapped by the USGS are the Frenchman Hills and Saddle Mountains fault, located 74 and 83 miles south of the site, respectively. Both faults trend east-west with an approximate surface length of 40 to 50 miles. The north-south trending Straight Creek

[10] Rocks and grains derived from the breakdown of larger sedimentary rocks caused by volcanic activity.

[11] Quaternary active faults are faults with documented movement within the last 1.6 million years.

fault is mapped approximately 83 miles west of the site, with a mapped surface trace of approximately 75 miles.

One large historic earthquake that occurred in 1872 was identified in the nearby North Cascades, but the exact location, depth, and magnitude of the event have not been conclusively determined. Sparsely observed seismic activity has also been reported by the USGS within 25 miles of the project location with magnitude ranging from 3.0 to 4.6. The largest historic recorded event in the area was recorded in 1965 with M_l of 6.9 and an epicenter mapped approximately 135 miles west-southwest of the project site.

Other Geologic Hazards

The applicant's assessment identified four locations with potential instability concerns: a landslide that would be located beneath the portion of the penstock between proposed laydown area 2 and the upper reservoir; jointed Miocene Basalts over an unconsolidated glacial deposit below the upper reservoir; a discontinuous interbedded sedimentary subunit below the upper reservoir; and a mile-long gully that would be crossed by the penstock in its lower reach. Neither the gully nor the landslide show signs of current activity. Shell's slope stability analysis indicates that the overall slope stability hazard for the site is low, except across the landslide where it is low to medium.

If a license were to be issued for the project, the Commission's Division of Dam Safety and Inspections would review geotechnical studies provided in support of the project's final design to ensure that project features are designed to safely withstand all credible loading conditions and ensure safe operating conditions. Furthermore, if deemed necessary by the FERC Division of Dam Safety and Inspections, an independent Board of Consultants would perform a peer-review of the final project design. The Board of Consultants would consist of qualified professionals with expertise in the design and construction of pumped storage projects. The Board of Consultants would review the geology of the project site and surroundings, the project design, and the plans and specifications and would oversee construction of the project. The Commission would not allow construction to begin until the project facilities satisfactorily meet the criteria of the Commission's Engineering Guidelines and the designs are shown to be safe and adequate.

3.3.1.2 Environmental Effects

Construction and Operation Effects on Soil Resources and Erosion

Construction of the proposed the upper reservoir, penstock, power platform, access roads, and transmission line would require vegetation clearing and ground disturbance making the areas susceptible to erosion. Materials excavated and temporarily

stored also would be susceptible to erosion. Installation of pilings in Rufus Woods Lake that would support the power platform would cause minor sediment disturbance, temporarily increasing turbidity downstream of the proposed Project.

The applicant proposes to develop a comprehensive soil and sediment erosion control plan prior to construction in consultation with relevant stakeholders that would include construction methods to prevent soil erosion and to address any erosion that does occur. Additionally, the applicant proposes to incorporate best management practices (BMPs) to help address any adverse effects on geologic and soil resources as a result of erosion. Specific examples of BMPs proposed by the applicant include:

- Adherence to standard erosion control practices (e.g., silt curtains, rock fall controls) around sensitive areas and the lake shore;
- Apply dust control on sections of County Road L leading to the project site, access road, parking areas, and the construction laydown area;
- Restore and revegetate impacted areas and monitor over a period of five years after construction; and
- Minimize the area of disturbance by using County Road L for site preparation and construction to the extent possible.

Washington DFW and Interior recommend pursuant to section 10(j) that Shell follow its proposed measures to minimize rock excavations for the platform footings and penstock anchors, and install the footings and anchors using hydraulic equipment (hydraulic hammer) to break and systematically loosen the rock with minimal fall back so as to lessen nearshore habitat impacts.

Our Analysis

About 9 acres of land would be disturbed during the burial of the penstock, installation of the above-ground segments of the penstock and the upper reservoir tank, and anchoring of the power platform to the shore. These activities would occur in areas with soils susceptible to erosion, which could lead to the sediment entering Rufus Woods Lake.

Shell's proposal would limit the amount of disturbed ground. The use of silt bales and curtains, dust suppressants, and quickly revegetating disturbed areas are commonly accepted BMPs for controlling soil erosion and sedimentation and should be sufficient in controlling erosion if properly designed, implemented and maintained. However, detailed erosion control plans should be based on site-specific conditions and final design of project features.

Shell's proposal to use rock fall controls during the construction of the power platform and anchors would prevent any rock that is removed from entering Rufus Woods Lake and disrupting aquatic habitat.

Effects of Seismic Activity in the Project Vicinity

Shell has adopted a conservative basis of a 475-year return period[12] for seismic events to design its project facilities. Based on a Hazard Identification and Hazard Operation analysis Shell identified potential failure mechanisms, likely impacts to project facilities, and the appropriate responses if a major seismic event causes a rupture in the tank or penstock. In the case of penstock rupture, operators would remotely close the tank isolation valve to prevent further flow into the penstock. Similarly, if the upper reservoir were to rupture, operators would remotely open the tank isolation valve to quickly empty the tank through the penstock back into the reservoir. Shell states that in neither of these cases would water run down the riverbank, scour soil, or deposit sediment into Rufus Woods Lake because water would either remain in the upper reservoir during the penstock failure scenario or drain through the penstock into Rufus Woods Lake.

CTCR is concerned that a catastrophic failure of the project could lead to the water in the upper reservoir tank being released in an uncontrolled manner. If that were to occur, CTCR states that the water would run down the riverbank scouring the soil and depositing it into Rufus Woods Lake. CTCR recommends that Shell be required to develop a response and contingency plan in the case of catastrophic events.

Our Analysis

Available data suggests that seismic events are unlikely and present a limited risk of damage to project structures. The penstock and upper reservoir would be designed to absorb seismic movement through its foundations and joints likely preventing a major breach or failure. In the unlikely event of such a failure, the operating procedures would prevent large uncontrolled flows from scouring the soil and depositing it in the lake. In addition, the Commission requires that all licensees file an Emergency Action Plan (EAP) for approval that is developed in consultation with the appropriate federal, tribal, and state agencies. An EAP would serve the same purpose as a response and contingency plan recommended by CTCR.

[12] A return period is the average number of years between seismic events expected to exceed a given intensity.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

Rufus Woods Lake is a large reservoir with a gross capacity of 518,000 AF. Water in Rufus Woods Lake is used for hydropower generation at Chief Joseph Dam, irrigation, protection of fish and wildlife, stock watering, recreational uses, and other instream uses. Mean annual flows in the Columbia River, as measured at Chief Joseph Dam are presented in Table 1.

Table 1. Mean Flows in the Columbia River as Measured at Chief Joseph Dam (1953-2015) (source: application).

Minimum		Maximum		Mean	
cfs	AFY[1]	cfs	AFY	cfs	AFY
75,870	54,963,864	146,700	106,276,510	108,792	78,814,299

[1] acre-feet per year

A portion of the water in Rufus Woods Lake is currently appropriated for irrigation. Washington DOE reported that, in 2012, water from Rufus Woods Lake irrigated 8,180.6 acres of farmland in Washington. Washington DOE expects that the demand on this water will increase in the future due to population growth, declining groundwater levels, and climate change effects.

The Washington Administrative Code requires a minimum flow to be present in the river below Chief Joseph Dam to protect fish and wildlife, stock watering, recreational uses, and other instream uses. These minimum instream flows are presented in Table 2.

Table 2. Minimum Average Weekly Instream Flows Required for the Columbia River at Chief Joseph Dam (source: application).

Time Frame	Minimum Flow (cfs)
January	30,000
February	30,000
March	30,000
April 1-15	50,000
April 16-30	60,000
May	100,000
June 1-15	80,000
June 16-30	60,000
July 1-15	60,000
July 16-31	90,000
August	85,000
September	40,000
October 1-15	30,000
October 16-31	30,000
November	30,000
December	30,000

Water Quality

Washington DOE's designated beneficial uses that support its water quality standards for the Columbia River in the project area include: aquatic life (salmonid spawning and rearing), primary contact recreation, water supply uses (domestic, industrial, agricultural, and stock), and miscellaneous uses (wildlife habitat, harvesting, commerce and navigation, boating, and aesthetics).

CTCR also designates standards to protect the quality of all surface and groundwater within the boundaries of the Colville Indian Reservation, and specifies that they "shall be protected to insure the health, economic, aesthetic and cultural wellbeing of all people residing upon the Colville Indian Reservation." The CTCR water quality standards designate the Columbia River as a Class I (Extraordinary) water body.

Washington DOE's and CTCR's criteria for temperature, TDG, dissolved oxygen, pH, turbidity, and fecal coliform are provided in Table 3.

Table 3. Washington DOE and CTCR water quality standards for the Columbia River in the project area (source: application).

Parameter	**Washington DOE**	**CTCR**

Temperature	shall not exceed the highest 7-day average of the daily maximum temperature (7-DADMax) of 17.5°C due to human activities. When natural conditions exceed a 7-DADMax of 17.5°C, no temperature increase will be allowed which will raise the receiving water temperature by greater than 0.3°C; nor shall such temperature increases, at any time, exceed 0.3°C due to any single source or due to all such activities combined	shall not exceed 16.0ºC due to human activities; shall not, at any time, exceed t=23/(T+5) where "t" represents the permissive temperature change across the dilution zone, and "T" represents the highest existing temperature in this water classification outside of any dilution zone
Total dissolved gasses (TDG)	shall not exceed 110 percent of saturation at any point of sample collection	shall not exceed 110 percent of saturation at any point of sample collection
Dissolved oxygen (DO)	shall exceed lowest 1- Day Minimum of 8.0 mg/L. When a water body's DO is lower than the criteria (or within 0.2 mg/L of the criteria) and that condition is due to natural conditions, then human actions considered cumulatively may not cause the DO of that water body to decrease more than 0.2 mg/L	shall exceed 9.5 mg/L
pH	shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units	between 6.5 and 8.5
Turbidity	shall not exceed 10 NTU (nephelometric turbidity units) over background when	less than 5 NTU over background turbidity when background turbidity is less

	the background is 50 NTU or less; or a 20 percent increase in turbidity when the background turbidity is more than 50 NTU	than or equal to 50 NTU, or no more than a 10 percent increase when background turbidity is greater than 50 NTU
Fecal coliform	must not exceed a geometric mean value of 100 colonies /100 mL, with not more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 200 colonies /100 mL (for primary contact recreation areas)	geometric mean value of less than 50 organisms/100 mL, with not more than 10 percent of samples exceeding 100 organisms/100 mL

Currently, the Columbia River is listed by the state of Washington as impaired for temperature (Category 5) and total dissolved gases (Category 4A) in the area of the proposed intake.

Temperature

Hourly data from the Chief Joseph forebay is available from March 2005 to the present with some gaps. The monthly averages are presented in Table 4.

Table 4. Monthly Average Water Temperatures (°C) in Chief Joseph Dam Forebay from March 2005 to 2016 (source: application).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Max[1]	Summer[2]
2005			4.4	5.9	9.8	13.4	16.2	18.7	18.8	16.7	14.7		19.4	17.9
2006			3.8	5.7	10.1	13.3	16.6	19.0	19.1	16.9	13.2		19.6	18.2
2007			4.3	6.2	9.6	12.8	15.9	18.6	18.7	16.9			19.8	17.7
2008				5.9	9.1	12.3	15.7	18.3	18.4	17.4			19.1	17.4
2009			2.7	4.5	8.5	13.1	16.0	17.8	18.6	17.8			19.0	17.4
2010			4.8	5.9	8.9	12.3	15.5	17.8	18.4	17.0	13.4	8.8	18.8	17.2
2011	4.2	2.7	3.1	5.5	8.8	11.9	14.9	17.5	18.3	17.2	13.5	9.0	18.6	16.9
2012	4.7	3.8	3.9	5.7	9.8	12.2	14.9	17.3	17.8	16.8	14.4	9.2	18.1	16.7
2013	5.2	4.2	4.6	6.2	10.1	13.2	16.5	18.9	19.4	16.8	12.4	7.6	20.0	18.2
2014	3.8	2.5	2.9	5.7	10.1	13.4	16.3	18.8	18.8	17.7	14.5	9.2	19.4	17.9
2015	5.2	4.2	5.0	7.1	10.7	14.6	17.5	19.3	18.2	15.9	13.1	8.7	19.7	18.4
2016	5.1	3.9	4.9	7.9	11.9	14.4	16.4	18.1	18.3	16.9	13.1	8.1	18.7	17.6
Avg	4.4	3.3	4.0	6.0	9.7	13.1	16.0	18.3	18.6	17.0	13.6	8.7		17.6

[1] Maximum daily average temperature recorded for that year.
[2] Average temperature for July, August, and September.

The average water temperature ranges from approximately 3ºC in February to almost 19ºC in September. Variations in the average monthly temperatures over the data record are typically within 1ºC of the average. Maximum water temperatures typically occur in September but can occasionally occur in August. Water temperatures typically exceed the 16ºC temperature criteria from July to October.

Shell compared the water temperature data collected from the forebay of Chief Joseph Dam to similar data collected at the Grand Coulee Dam located approximately 37 miles upstream of the Pearl Hill Project location. This comparison showed a strong correlation between the two locations suggesting that the water temperature in Rufus Woods Lake is essentially homogenous. This is likely the result of a short residence time within Rufus Woods Lake that provides very little opportunity for heating or cooling to occur.

Total Dissolved Gases

The operation of spillways and turbines at large hydroelectric facilities on the Columbia River system are known to cause TDG concentrations greater than 130% of saturation. Operation of the Grand Coulee Dam, 37 miles upstream of the project location, contributes to dissolved gas saturation by entraining air bubbles. When air bubbles sink in the dam's stilling basin, higher pressure forces air from the bubbles into solution, which results in supersaturation of water with dissolved nitrogen, oxygen, and the other gaseous constituents of air. Aquatic organisms can experience negative effects when TDG levels exceed 110% saturation. The state of Washington developed a total maximum daily load (TMDL) for TDG in the Mid-Columbia River, which was approved

by U.S. EPA in July 2004. The TMDL specifies that 110% of TDG saturation should not to be exceeded at any point of measurement.

While there is no TDG data available for the immediate project vicinity, hourly measurements are available for the forebay of Chief Joseph Dam from April 2005 to May 2017 with the exception of winter months (November through February). Figure 3 shows that the TDG concentrations typically range from 95% of saturation in the winter to exceedance of the 110% saturation criteria from May to August. In May and June of 2011, TDG values peaked exceeding 130% of saturation. These peaks correspond to an extended period of high flow at Chief Joseph Dam.

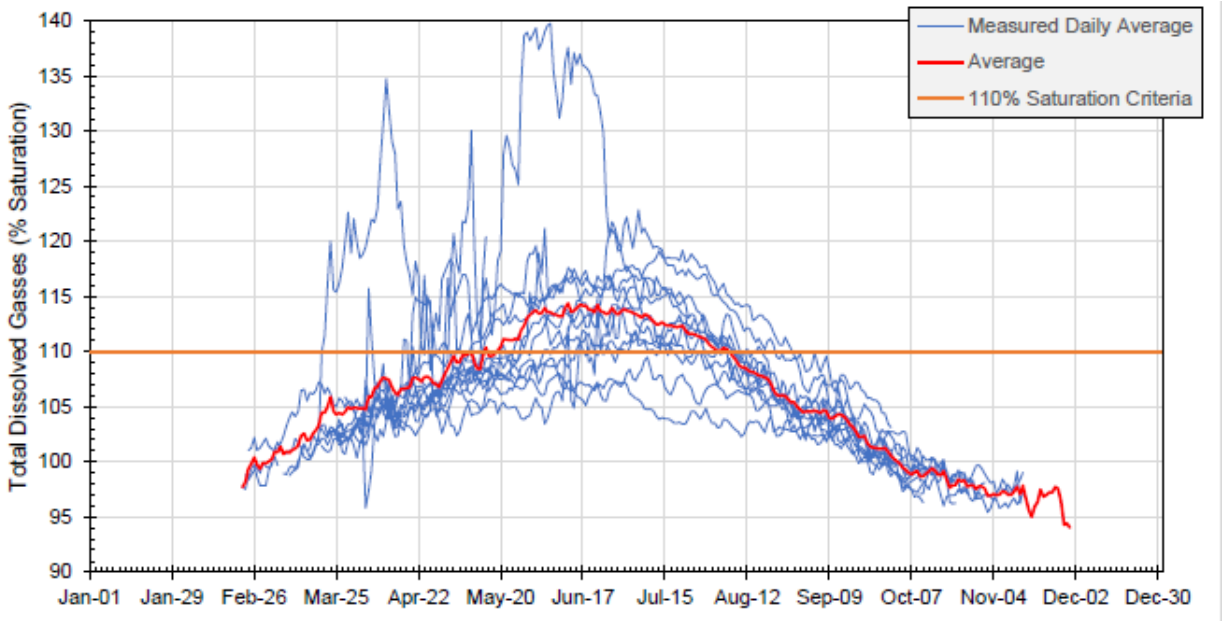

Figure 3. Average daily TDG measured at Chief Joseph Forebay (source: application).

Fish Community

Rufus Woods Lake supports numerous game fish and other aquatic species. Construction of Chief Joseph Dam in 1958 blocked the upstream migration of adult salmon, resulting in extirpation of anadromous fish from the Rufus Woods Lake basin and a shifting of the fish assemblage to non-native species. The salmonids found in Rufus Woods Lake consist of those fish migrating downstream through Grand Coulee Dam from Lake Roosevelt. The FWS (2015) Mid-Columbia Recovery Unit Implementation Plan for Bull Trout states that bull trout have not been recently observed in Rufus Woods Lake and observation data is sporadic and anecdotal. Table 5 lists the current assemblage of fish, as identified during surveys in 1999 and 2004.

Table 5. Fish Species in Rufus Woods Lake (source: application).

Common name	**Scientific name**
white sturgeon	*Acipenser transmontanus*
bridgelip sucker	*Catostomus columbianus*
largescale sucker	*Catostomus marcrocheilus*
longnose sucker	*Catostomus*
black crappie	*Pomoxis nigromaculatus*
largemouth bass	*Micropterus salmoides*
pumpkinseed	*Lepomis gibbosus*
smallmouth bass	*Micropterus dolomieu*
mottled sculpin	*Cottus bairdii*
prickly sculpin	*Cottus asper*
torrent sculpin	*Cottus rhotheus*
carp	*Cyprinus carpio*
Chiselmouth	*Acrocheilus alutaceus*
longnose dace	*Rhinichthys cataractae*
northern pikeminnow	*Ptychocheilus oregonensis*
Peamouth	*Mylocheilus caurinus*
redside shiner	*Rhichardsonius balteatus*
speckled dace	*Rhinichthys osculus*
Tench	*Tinca*
Burbot	*Lota*
three-spined stickleback	*Gasterosteus aculeatus*
black bullhead	*Ameiurus melas*
brown bullhead	*Ameiurus nebulosus*
walleye	*Sander vitreus*
yellow perch	*Perca flavescens*
brook trout	*Salvelinus fontinalis*
brown trout	*Salmo trutta*
Chinook salmon	*Oncorhynchus tshawytscha*
cutthroat trout	*Oncorhynchus clarkii*
Dolly Varden trout	*Salvelinus malma*
kokanee salmon	*Oncorhynchus nerka*
lake whitefish	*Coregonus clupeaformis*
mountain whitefish	*Prosopium williamsoni*
rainbow/steelhead/redband trout	*Oncorhynchus mykiss*

Shell performed a site survey to document the aquatic habitat conditions in the proposed project area. Aquatic habitat in the vicinity of the project consists of steep shoreline with little to no littoral zone. Small pockets of gravel and cobble are found sporadically and mostly concentrated upstream of the project area. In general, the

shoreline consists of fragmented, exposed rock with little shoreline vegetation. Underwater substrate mimics the rocky conditions seen along the upland shoreline.

Re-introduction of Anadromous Fish

CTCR is part of a coalition of tribes that is working on a four-phase approach to reintroduce anadromous salmonids above Chief Joseph Dam (Columbia Basin Tribes and First Nations 2015). The four phases are:

Phase I: Pre-assessment planning for reintroduction and fish passage.

Phase II: Experimental, pilot-scale salmon reintroductions and interim passage facilities.

Phase III: Construct permanent juvenile and adult passage facilities and supporting propagation facilities. Implement priority habitat improvements.

Phase IV: Monitoring, evaluation, and adaptive management. Continue needed habitat improvements.

CTCR and the other tribes are actively involved in fulfilling several of the tasks for Phase 1 including a habitat assessment, donor stock and risk assessment, life cycle modeling, and an evaluation of high head dam passage options. On June 13, 2019, the Upper Columbia Tribes presented a report to NPCC as a part of Phase I that stated the reaches of the Columbia River upstream of Chief Joseph and Grand Coulee dams could support over 17,000 spawning Chinook salmon and steelhead trout and a higher number of sockeye salmon. The results included in this report will guide implementation of Phase 2, which will include experimental releases of anadromous salmonids.[13] CTCR also intends to re-introduce lamprey to Rufus Woods Lake at some point in the future.

The NPCC is working on a similar phased approach as described in its 2014 amendments to the Columbia River Basin Fish and Wildlife Program.

[13] *See* Letter from CTCR filed with the Commission on December 17, 2018.

3.3.2.2 Environmental Effects

Water Quantity

During scoping several entities expressed concern that project operation would affect water availability and reservoir levels in Rufus Woods Lake. The project would pump as much as 29 AF of water from the Columbia River to the upper storage reservoir when power demand is low and release that water back to the river to generate power when demand is high. At times of high power demand, the project could repeat this cycle up to four times daily. At times of low power demand, the project may store water in the upper reservoir for days or weeks at a time.

Shell also proposes to allow a neighboring rancher to remove up to 29 AF (9.45 million gallons) annually via hose or water truck to be used as stock water. Additionally, Shell proposes to allow local authorities access to water in the reservoir tank for emergency response in case of wildfires. Shell states that both proposals provide benefits and show Shell's willingness to work for the betterment of the local community. CTCR states that FERC should prohibit the use of project water for stock watering because it confers a benefit on a single individual at the public's expense.

Our Analysis

On an average day in a normal water year, Rufus Woods Lake contains 215,930 AF of water. On an average day in a low water year, the reservoir contains 150,586 AF of water[14]. The project would require approximately 29 AF of water to fill the upper tank, which represents 0.0001% to 0.0002% of the available water in the lake. Thus, project operation would result in an undetectable change in the water level of Rufus Woods Lake or available flows. In addition, any loss of water would be temporary. The water would be returned to the river as quickly as 6 hours after removal or possibly as slowly as a few weeks after removal, depending on the power demands of the region.

Shell's proposal to allow a neighboring rancher to access 29 AF of project water per year for stock watering purposes would result in a small consumptive use of water from Rufus Woods Lake. This consumptive use would represent a loss of 0.0001% of the water in Rufus Woods Lake during a normal water year and 0.0002% during a low water year. It is unlikely that the rancher would withdraw all the water at one time. The environmental effect of the water removal would be imperceptible. The use of project water to fight local wildfires may represent a larger consumptive loss depending on the effort required to fight wildfires, but we would not expect this usage to affect

[14] These volumes were calculated by dividing the average and minimum flow volume of Rufus Woods Lake by 365.

environmental resources on Rufus Woods Lake due to its large volume. Both proposals would result in lost generation.

Any license issued for the project would contain a standard article that establishes the conditions under which licensees may grant permission for certain types of use and occupancy of project lands and waters (such as non-commercial piers, landings, and boat docks) and may convey certain minor interests in project lands and waters without prior Commission approval. We do so because in our experience requiring a licensee to obtain prior Commission approval for every use or occupancy of project land would be unduly burdensome and such authorization would result in insignificant effects on environmental resources and power generation. The standard article gives licensees the authority to allow non-project use of project water for up to one million gallons per day without requesting Commission approval. Daily non-project uses of less than one million gallons per day are within the discretion of a license holder. It is likely that the stock watering and firefighting efforts would fall well below these authorized limits.

Water Quality

Storm Water, Erosion and Sediment Control, and Waste Management

Shell proposes to prepare and implement a storm water pollution prevention plan (SWPPP), a comprehensive erosion and sediment control plan, and a waste management plan in consultation with resource agencies. The plans would include BMPs to prevent erosion and sediment, pollutants, and construction waste from entering Rufus Woods Lake and degrading water quality and aquatic habitats.

Our Analysis

Storm water runoff can alter the natural hydrology of the land by increasing the volume, velocity, and temperature of runoff and by decreasing its infiltration capacity. Increasing the volume and velocity of storm water runoff can cause severe stream bank erosion and degradation of the biological habitat of near-shore areas of Rufus Woods Lake. In addition, as storm water runoff moves across surfaces, it picks up trash, debris, and pollutants such as sediment, oil and grease, pesticides and other toxics. Changes in ambient water temperature, sediment, and pollutants from storm water runoff can be detrimental to aquatic life and wildlife habitat. Excess sediment can cloud water reducing the amount of sunlight reaching aquatic plants, have negative impacts on aquatic habitat and spawning areas, and impede navigation.

Well-designed storm water management controls, erosion and sediment controls, waste management, and inspection and maintenance programs would work together to reduce pollution at the construction site before it can cause environmental problems.

Shell does not describe what BMPs it would implement but could include routing flows to retention ponds to control flow, the use of dust control, straw bales, silt curtains, temporary erosion and rockfall controls to trap sediment, and installation of trash receptacles and schedule for routine maintenance to ensure proper containment and collection of construction waste. These measures are often dependent on final design and site topography considerations.

Temperature

Water stored in the upper reservoir storage tank would be exposed to the sun's radiant heating and atmospheric heating and cooling. The degree of heating and cooling would depend on the length of exposure (a few hours to a few weeks) and ambient air conditions. The primary concern raised during scoping was releasing water with potentially elevated temperatures that could be harmful to aquatic biota and that would exceed water quality criteria, particularly considering water temperatures in Rufus Woods Lake sometimes exceeds temperature criteria from July through October (table 4). Washington DOE standards dictate that human actions may not raise the water temperature more than 0.3°C when ambient water temperature is above 17.5°C, while CTCR's standard applies when ambient water temperature exceeds 16°C.

To reduce the potential for elevated temperatures in its discharges, Shell proposes as part of its ARMP to: (1) monitor water temperatures in the upper reservoir tank, the power generation system, and upstream and downstream of the discharge point; and (2) use active temperature control (e.g. cycling or release of water), if needed to reduce water temperature in the project discharge. CTCR, FWS, and Washington DFW recommend that Shell develop and implement an ARMP with the proposed temperature measures.

Our Analysis

Shell modeled potential increases in water temperature in the tank based on the total thermal energy that would be absorbed: (1) through the floating tank roof, (2) through the tank walls, and (3) from the ground. The model allowed for both heat gains (warming) as well as losses (cooling) depending on the conditions. The modeling results show that the heating of stored water would be primarily controlled by the ambient air temperature and to a lesser extent by direct solar radiation. The model results indicated that, the water could be stored for an extended period (i.e., several weeks) with minimal risk of exceeding the 0.3ºC temperature increase criteria established by Washington DOE water quality standards (figure 4). Only during the later summer months (August to September) do water temperatures in the lake begin to reach levels that could exceed state standards with prolonged storage in the tank (figure 4).

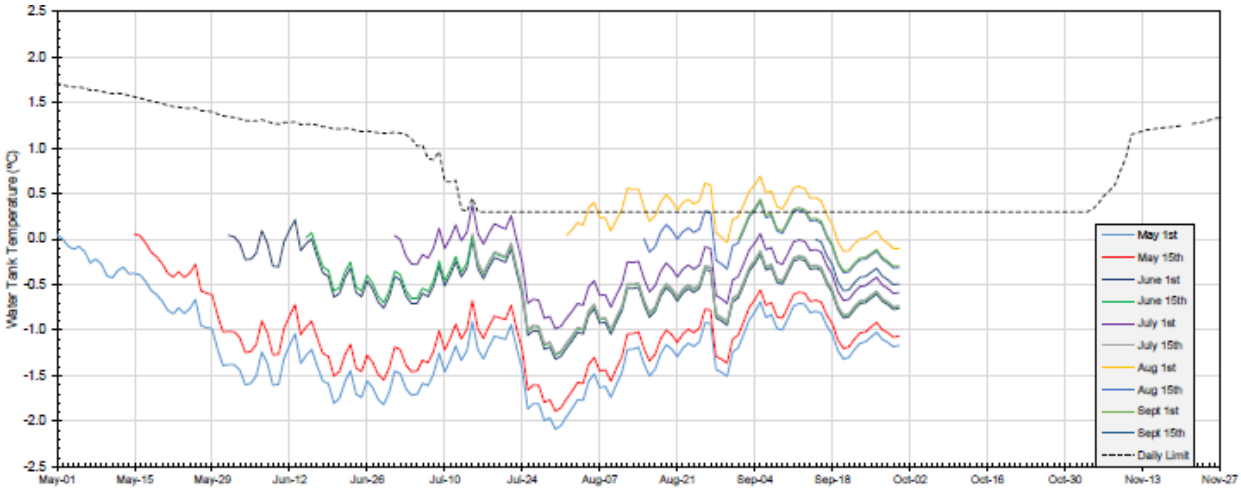

Figure 4. Predicted water tank temperature increases over lake temperature for various start dates (source: application).

While modeling indicates that temperature increases of greater than 0.3ºC would be rare, *in situ* continuous temperature monitoring as proposed by Shell would verify the modeling results and allow Shell to take corrective steps when temperatures are likely to become too high. When the temperature monitoring shows that water in the storage tank is approaching 0.3ºC higher than the water temperature in Rufus Woods Lake, Shell would release the stored water back to Rufus Woods Lake, regardless of the need for electrical generation. This would effectively ensure that project operations would not result in releases of water that are more than 0.3ºC warmer than natural conditions, thus preventing any exceedance of the water quality standards for temperature.

Although Shell proposes to monitor water temperatures in the upper reservoir tank, the power generation system, and upstream and downstream of the discharge point, Shell has not described how it would do so. An effective monitoring plan would typically include: (1) the exact locations of the temperature gages; (2) a description of how real-time water temperatures in the tank and in Rufus Woods Lake would be monitored; and (3) the protocol for deciding when to release water back to Rufus Woods Lake to avoid temperature exceedances.

Total Dissolved Gases

Interior, CTCR, and Washington DFW are concerned that the project generation could increase TDG levels in Rufus Woods Lake, which already experiences elevated TDG levels. They hypothesize that the release of high-energy water through the Pelton turbine into the low-energy environment of the lake could cause super-saturation of dissolved gasses in the water. Aquatic organisms can experience negative effects when TDG levels exceed 110% saturation. The state of Washington developed a TMDL for

TDG in the Mid-Columbia River, which was approved by EPA in July 2004. The TMDL specifies that 110% of TDG saturation should not to be exceeded at any point of measurement.

To minimize TDG levels, Shell designed the project to discharge water through a trough below the turbine that would contain 7 baffles spaced out equally over a seven foot drop. The baffles would increase turbulence and promote degassing of the project water before it re-enters Rufus Woods Lake. To verify that the project is not causing elevated TDG levels, Shell proposes to monitor TDG in the upper reservoir tank, the power generation system, and upstream and downstream of the discharge point. CTCR, FWS, and Washington DFW recommend that Shell develop and implement an ARMP with the proposed TDG monitoring.

Our Analysis

Increasing turbulence by passing discharges through baffles has been shown to decrease TDG levels (Myers and Parkinson 2002). Shell's modeling efforts indicate that TDG levels during the summer months can be reduced from about 140% saturation to below 110% by passing flows over the 7 baffles (table 6). In so doing, project operations are expected to meet the water quality standards.

Table 6. % TDG saturation in project discharge with different numbers of baffles (source: application).

TDG % Saturation					
	Month	**March**	**June**	**September**	**December**
Anticipated discharge temperature		4.3° C	13.4° C	18.9° C	9.0° C
Approximate initial TDG		140	140	140	140
# of baffles	1	132	130	129	131
	2	126	123	121	125
	3	121	117	115	119
	4	117	113	111	115
	5	114	110	108	111
	6	111	107	106	109
	7	109	106	104	107

Shell's proposed monitoring would allow it to verify that project operations are not elevating TDG levels and to determine if potential modifications to project operations or other measures are warranted to meet TDG concentrations.

Shell did not specify how TDG would be monitored. An effective monitoring program would typically include: (1) the exact locations of all TDG measuring devices; and (2) a description of how real-time TDG levels in the tank, the project discharge water, and in Rufus Woods Lake would be monitored.

Turbidity

When the project generates power, it would release flows between 5 and 53.1 cfs. These flows could disturb sediments in the lake bottom, resulting in re-occurring sediment plumes downstream of the outflow pipe. High levels of turbidity can interfere with the ability of aquatic plants to carry out photosynthesis, clog the gills of fish, interfere with their ability to find food, and bury bottom dwelling organisms and fish eggs.

To minimize disturbing sediments in the lake bottom during project operation (sedimentation resulting from project construction is discussed in Section 3.3.1.2), Shell designed the project outflow to diffuse the water over a large surface area. The project outflow would consist of a vertical, 42-inch-diameter pipe perforated with 80 diffuser holes (Figure 5), each 6 inches in diameter and spaced equally throughout its length. The pipe would be at least 28 feet from the shoreline and extend to a depth of 20 feet at the minimum reservoir elevation. The pipe would be fitted with baffles to ensure that discharge water is relatively evenly distributed among the ports, spreading the discharge evenly over the length and diameter of the pipe.

CTCR, FWS, and Washington DFW recommend that Shell utilize this design.

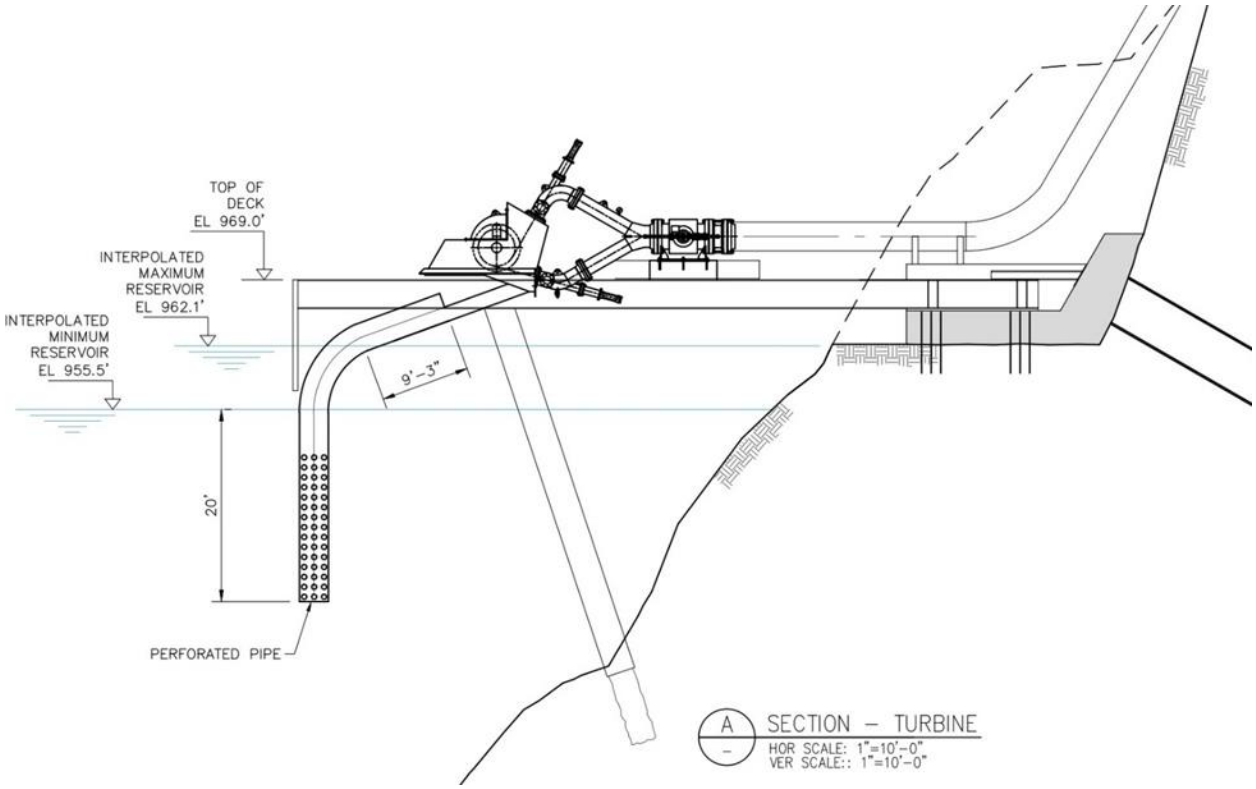

Figure 5. Project discharge design (source: application).

Our Analysis

Shell modeled the discharge volume to determine the extent of water disturbance and its potential influence on bottom sediments. The model predicted that changes in water velocity due to project discharge would occur up to 4 feet upstream of the pipe, up to 16 feet downstream, 10 feet on either side, and up to 13 feet below the bottom port of the discharge pipe.

There are no sediment deposits within the area subject to modeled project discharges; therefore, project discharges are not expected to disturb any sediments or result in elevated turbidity levels that could adversely affect aquatic resources. Thus, project operation should meet water quality standards for turbidity.

Algal Growth

Large algal blooms can have adverse effects on water quality. When algae dies, it is broken down by naturally-occurring bacteria in the water. This process consumes oxygen and can lead to areas of low or no oxygen, usually on the river bottom. Anoxic conditions can result in fish kills and the loss of other aquatic organisms.

The project's pilings, intakes, and discharge pipe would provide new substrate for the colonization of algae. As part of the ARMP, Shell proposes to inspect and clean the underwater structures seasonally to prevent algal build-up. CTCR, FWS, and Washington DFW recommend that Shell develop and implement an ARMP with the proposed inspection and cleaning measure.

Our Analysis

Filamentous algae, which is common in Rufus Woods Lake, would likely grow on the project's support structures, intakes, and discharge pipe. Seasonal removal of algae from the project's in-water structures would prevent algal build-up and any subsequent water quality effects caused by bacterial breakdown of dead algae.

Shell did not specify how often it would inspect and clean algae from project structures or how it would clean the pilings. To ensure effective implementation and facilitate administration of the license, the ARMP would need to include, at a minimum: (1) a description of the methods employed to remove algae from project structures, and (2) an implementation schedule.

Invasive Species

The main invasive species of concern are the zebra mussel and the quagga mussel. These introduced species interfere with hydropower operations and navigation, costing the U.S. economy over $1 billion dollars annually (Pimental et al. 2004). The Columbia River Basin is the last U.S. river system free of these mussels (Reilly 2018). State and federal agencies have been implementing multiple programs for years to ensure these species are not introduced to the basin. While zebra and quagga mussels are currently not present in the project area, they could become established in the future.

The project's six pilings, intakes, and discharge pipe would provide new substrate for the colonization of aquatic organisms, some of which may be invasive. Shell proposes to inspect in-water pilings and other equipment for the presence of invasive species.

Our Analysis

Monitoring of project works for the presence of invasive species and subsequent control actions would likely help the effort to prevent the establishment of these species in the Columbia River. However, Shell did not describe the frequency or methods for examining project works for invasive species or what it would do if they are found. To administer an effective monitoring program, the ARMP would need include, at a minimum: (1) a description of the frequency and methodology for examining project

works for invasive species; (2) a protocol to be followed in the event that any invasive species are discovered on project works; and (3) a description of how Shell plans to report to the agencies, CTCR, and the Commission when invasive species are discovered and what, if any, corrective action was taken.

Climate Change

EPA recommends that the EA include a discussion of reasonably foreseeable effects that changes in the climate may have on the proposed project and project area.

Our Analysis

According to the USGS National Climate Change Viewer[15], the mean temperature in Douglas County could rise by 5.8° F in the next 30 to 50 years when compared to the previous 30 years. This could lead to a rise in average water temperature in Rufus Woods Lake. Both precipitation and runoff are not expected to change in the next 30 to 50 years meaning that flows in Rufus Woods Lake would likely be similar to recent historical flow. Regardless, the project would have no effect on either water temperature or water quantity in Rufus Woods Lake; therefore project operations would not be affected by or exacerbate any effects caused by climate change that may occur over the term of any license for the project that may be issued.

Fish Community

Construction Effects

Installing the power platform would require some in-water work that could affect the fish community in Rufus Woods Lake by disturbing near-shore habitat. Shell proposes to avoid all in-water construction between April 1 and June 15 to avoid disturbing spawning or incubating salmonids.

Our Analysis

The power platform would be anchored to the shoreline via four anchor blocks and a steel piling driven into the streambank at a depth of approximately 40 feet would provide additional support for the platform. The construction of these support structures could increase turbidity in the water during construction, disturb aquatic habitat, and displace fish from the area due to noise and activity. Shell's use of rock curtains and other measures to prevent disturbing the shoreline as discussed in the Soils section would minimize these effects to the extent practicable. Further, such effects would be localized

[15] Accessed at https://www2.usgs.gov/climate_landuse/clu_rd/nccv/viewer.asp

and temporary, as construction of the entire project would be completed in six to nine months and confined to less than 0.5 acre. The shoreline of Rufus Woods Lake is fairly uniform throughout the reservoir and any fish displaced from the project area should be able to find comparable habitat away from the construction disturbance. Upon completion of construction, the local fish community would be able to recolonize the affected area.

Based on occurrence and biology, Washington DFW (2018) has identified time periods when spawning or incubating salmonids are least likely to be present in freshwater streams in the state. For Rufus Woods Lake salmonids are least likely to be spawning or incubating between s June 16 to March 31. Thus, Shell's proposal to avoid in-water construction between April 1 and June 15 should further minimize adverse effects on the fish community.

Increased Predation

Juvenile fish are often attracted to covered areas near-shore environments as a refuge from predation. Shaded areas are also known to attract predatory animals due to the abundance of prey. The power platform would provide an area of artificial cover near the shore that could attract predatory fish and birds, which in turn could increase predation of juvenile fish.

To minimize the amount of shading and cover provided by the power platform, Shell proposes to use metal grating on the platform wherever possible, which would allow diffused light through the platform. Shell also proposes as part of its proposed ARMP to install bird exclusory devices on all potential perch sites on the power platform to reduce the possibility of bird predation on fish.

FWS, CTCR, and Washington DFW recommend that the ARMP include Shell's proposed avian exclusion devices.

Over twenty miles from the proposed project site, a number of net pens that had previously been used in an aquaculture operation have been abandoned and are no longer in use. Shell proposes, as an off license measure, to provide $50,000 toward removing the defunct net pens in coordination with the agencies. FWS, CTCR, and Washington DFW recommend coordinating with the agencies on the removal, stating that this measure would help offset fish lost to higher levels of predation that could possibly result from the presence of the power platform.

Our Analysis

The power platform would be 77-feet long by 77-feet wide, covering a 5,929 square-feet of rocky shoreline substrate. The metal grating would allow sunlight to pass through parts of the platform not supporting power generation modules, thus reducing the shading and cover provided by the platform to the extent practicable. The use of bird exclusionary devices on the platform would minimize the opportunistic use of the platform as perching sites for foraging birds on juvenile fish.

While the metal grating and the bird exclusory devices would lessen the project's potential for increasing predation, some additional predation on juvenile fish from both aquatic and terrestrial predators is possible. However, we expect this increase to be negligible because of the small size of the project (less than 6,000 square feet) relative to the expanse of Rufus Woods Lake which is approximately 51-miles long and covering 6,400 acres.

Shell's description of the ARMP lacks detail to approve and implement. To effectively administer the license and ensure that the measures would achieve their intended objective, the ARMP would need to include, at a minimum: (1) a description of the type of bird exclusory devices to be installed, (2) the exact locations of all proposed bird exclusory devices, and (3) a description of possible measures Shell would undertake if the devices are found to be ineffective in preventing piscivorous birds from using the project structures as a hunting perch.

The abandoned net pens likely create refuges for predators and their removal could benefit reservoir fisheries and assist in future salmon recovery efforts in Rufus Woods Lake.

Fish Entrainment and Impingement

When the project pumps water from Rufus Woods Lake to the upper reservoir tank, fish could become entrained into the project pump, penstock, and tank. To prevent fish entrainment and impingement, Shell proposes to install a vertical bar fish screen on each of the pump intakes. The fish screen would be designed to meet NMFS velocity and opening requirements for the protection of juvenile salmonids. Rufus Woods Lake is currently home to 10 resident salmonid species (see Table 5); however, there are currently no anadromous salmonids or lamprey in Rufus Woods Lake. Nonetheless, Shell proposes to design the project's fish screen to avoid entrainment of salmon in anticipation that these species may be introduced in the future.

Without elaboration, FWS, CTCR, and Washington DFW also recommend that Shell develop a plan to improve the existing intake fish screens or develop solutions to direct fish away from the project intake if Shell observes harm to resident fish species.

Our Analysis

NMFS (1996) recommends that openings in wire screens not exceed 0.0689 inches and that approach velocities not exceed 0.4 feet per second to protect juvenile salmonids. The cylindrical, wire screen proposed by Shell would have screen openings of 0.069 inches and an approach velocity of 0.36 feet per second. Both of these specifications would meet NMFS's criteria, which are designed to protect all sizes classes of trout from impingement and entrainment, and therefore, would provide protection for the resident salmonids in Rufus Woods Lake, as well as any anadromous salmonids species that may be re-introduced in the future.

As stated above, lamprey are not currently found in Rufus Woods Lake. This may change in the future if CTCR is successful in re-establishing lamprey. However, it is unknown when this might occur is unknown. Juvenile lamprey (ammocoetes) are smaller than juvenile salmonids and much weaker swimmers. Rose and Mesa (2012) showed that vertical bar fish screens were effective for excluding ammocoetes larger than 50-65 mm in length; however, smaller fish were entrained at a level of 33%. Shell's proposed fish screen, while likely very effective for salmonids, may allow for some entrainment of ammocoetes, if present in Rufus Woods Lake.

Shell's proposed bubbler system would blow air through the fish screen upon startup of the pumping phase, clearing any debris from the screen. The bubbler system would also monitor pressure on both the inside and outside of the fish screen. If a change in pressure is detected due to a buildup of debris or fish on the screen, the bubbler system would automatically provide a burst of air clearing the surface of the screen. The cleaning system would ensure that the screens are operating properly and that the low intake velocities are maintained, thus minimizing the potential for fish impingement and entrainment.

As discussed above, Shell's proposed screening follows accepted practices, thus entrainment and impingement is unlikely; therefore, there is no need for further measures for protecting fish, particularly resident fish. If Shell, the agencies, or tribes were to observe a problem, they could petition the Commission to consider additional protective measures through the standard re-opener article included in every license issued by the Commission.

Attraction to Outflow

Adult salmonids migrating upstream to spawn can be attracted to project discharges with flows that mimic natural conditions. Fish that are distracted by or attracted to project outflows may experience migration delays and reduced reproductive success.

FWS, CTCR, and Washington DFW recommend that Shell incorporate design elements to the project discharge to distribute flow and dissipate velocities to reduce the possibility of fish attraction to the outflow.

Our Analysis

As discussed above, flows through the multi-port diffuser would spread out the 52 cfs of discharge evenly over the length and diameter of the pipe greatly reducing the force of the water. The flow coming from each individual diffuser hole would be less than 1 cfs. Flow in Rufus Woods exceeds 30,000 cfs year-round to meet the state of Washington's minimum flow requirements. Outflow of less than 1 cfs per diffuser hole would likely be imperceptible to fish that are migrating upstream. This minor amount of outflow should not attract fish and would not lead to migration delay and subsequent reduction of reproductive success.

Protection Plan for Kokanee Salmon, Bull Trout, and Redband Trout

CTCR without elaboration recommends that Shell be required to develop a plan to avoid or reduce potential effects to kokanee salmon, bull trout, and redband trout. Shell did not respond to CTCR's recommendation.

Our Analysis

Bull trout are not known to occur in the lake or the area of the proposed project, thus should not be affected by project construction or operation. Regardless, Shell already proposes to take steps to minimize effects on salmonids in general, including taking steps to prevent elevated temperature and TDG levels, increased predation, and entrainment and impingement. All of these measures would be protective of fish in the project area, including kokanee salmon, bull trout, and redband trout. The development of an additional plan for the protection of these three species would be unnecessary.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

The proposed Pearl Hill Project would be located in the Columbia Plateau ecoregion, which is the largest in Washington, encompassing roughly a third of the state. The relatively low-elevation Columbia Plateau is surrounded by more mountainous ecoregions to the west (Cascades), north (Okanogan), east (Rockies), and southeast (Blue Mountains). Located in the rain shadow of the Cascades, the Columbia Plateau has the hottest and driest climate in the state, with most of the region receiving 8 to 14 inches of precipitation annually. While a few areas exceed 3000 feet in elevation, most of the ecoregion is under 2000 feet elevation, and the lowest areas, where the Columbia River departs the region to the southwest, are within 200 feet of sea level. Underlain primarily by Columbia River basalts that were intensely sculpted by Pleistocene glacial floods, this dry region is known for open landscapes dominated by shrub-steppe and other drought-tolerant vegetation. In the last century over half of the ecoregion's landscapes have been converted for agriculture and other uses, including rangeland and both irrigated and dryland farming (Washington DFW, 2005).

The proposed project would be located in a rural area of primarily rangeland use with few residences nearby. Most of the project boundary would be located within state lands managed by Washington DNR, except for the proposed access road which would cross private lands to the south. The project would be located at the edge of the Pearl Hill plateau, following the plateau's sloping flank from the 2300 foot elevation rim down to the Rufus Woods Lake shoreline of the Columbia River at about 960 feet elevation. Shell conducted botanical surveys of the project area in 2017 and describes the area as follows.

Upland Vegetation

Upland vegetation comprises 28.6 acres of the 28.8 acres in the project boundary. The habitat is shrub-steppe, a common habitat type in the Columbia Plateau that is characterized by shrubs of medium height (1.6 to 3.3 feet) with cover of 10 to 60 percent. Sagebrush (predominately big sagebrush) is common in areas of gentler slope. Grasses become dominant in steeper areas, accounting for 90 percent of coverage. Native shrub-steppe grass species present within the project boundary include blue bunchgrass, blue-bunch wheatgrass, giant ryegrass, and rip-gut, but nonnative annual grasses dominate most areas, including soft brome, quack grass, cheatgrass, and bulbous bluegrass. These species are typical of shrub-steppe habitats in the region, where native perennial bunchgrasses are transitioning to nonnative annual grasses because of grazing.

Native and nonnative forbs occur throughout the site; common species include narrow-leaf collomia, thread-leaf fleabane, yarrow, arrow-leaf balsamroot, silky lupine, thread-leaf phacelia, western tansymustard, parsnip- flowered buckwheat, prickly lettuce, Columbia bladderpod, and Dalmatian toadflax. Turpentine spring-parsley, mountain monardella, dusty maidens, shrubby bedstraw, Douglas' silene, onion, lava alumroot, white-leaved globe mallow, Oregon woodsia, and bitterbrush occur along the steeper slopes closer to Rufus Woods Lake where grazing pressure appears to be lower.

Shrub steppe provides important habitat for wildlife species in the area, including greater sage-grouse. Historically, shrub steppe was the most common vegetation type in Douglas County; however, an estimated 54 percent of shrub steppe has been lost, primarily due to agricultural conversion and grazing.

Wetlands and Riparian Areas

Wetlands and riparian areas make up about one percent of land cover in the Rufus Woods Lake Subbasin. A National Wetland Inventory (NWI) mapped wetland is located near the proposed upper reservoir site. NWI maps several other features in the vicinity, including a drainage that crosses the proposed penstock route, and Rufus Woods Lake.

Shell delineated the extent of the wetland near the proposed reservoir on May 15 and June 12, 2017 following the USACE Wetland Delineation Manual (USACE 1987). The wetland has an area of 1.12 acres (48,924 square feet), and lies entirely outside the project boundary (Figure 6). Using the Eastern Washington Wetland Rating form for depressional wetlands, Shell determined that the wetland is a Category II wetland—a fairly sensitive wetland for which Douglas County critical areas ordinances recommend using a standard buffer distance of 100 feet to avoid impacting the wetland. The proposed access road and tank footprint would intersect a small portion of the northern and northeastern parts of the 100-foot buffer. The wetland is shown in Figures 7 and 8.

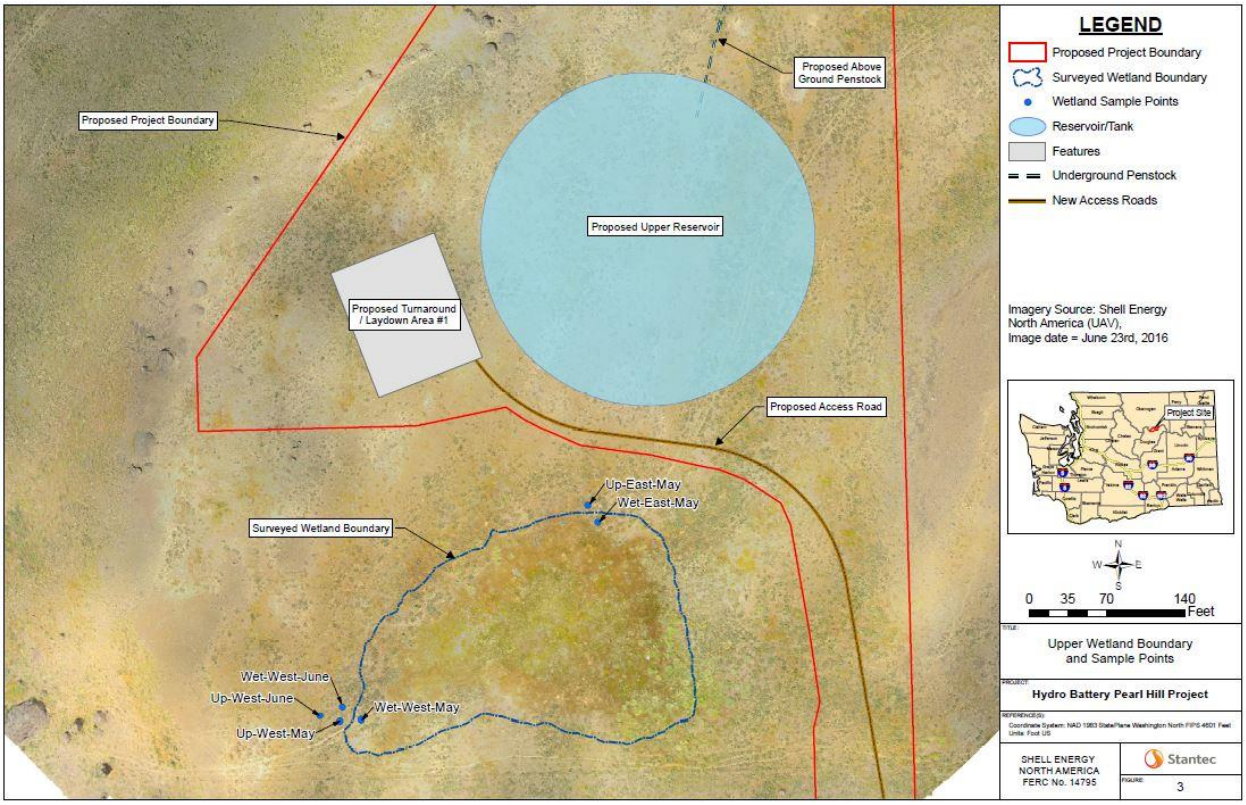

Figure 6. Proposed project boundary and works in relation to wetland (source: application).

Figure 7. Wetland south of the proposed project boundary in the vicinity of the proposed upper reservoir (tank), August 2016 (source: application).

Figure 8. Wetland south of the proposed project boundary in the vicinity of the proposed upper reservoir (tank), facing northwest, June 2017 (source: application).

Riparian vegetation on the margins of Rufus Woods Lake is limited due to fluctuating water levels from reservoir operations, as well as from the extremely rocky soil conditions (Figure 9). Shell found no evidence of riparian vegetation along the Columbia River shoreline during a 2016 site visit, and observed minimal riparian vegetation (mock- orange, chokecherry, golden currant, and mullein) in 2017. Much of the project shoreline is unvegetated; but in some areas sagebrush and grasses occur close to the water level. The project vicinity shoreline is depicted in Figure 9.


Figure 9. Shoreline conditions in project vicinity, April 2017 (source: application).

The proposed penstock would cross an intermittent stream drainage about two-thirds of the way down the flank of Pearl Hill (Figure 10). Shell observed no water in the drainage during an August 2016 site visit; but found flowing water approximately 3 inches deep during both the May and June 2017 field surveys. Shell found minimal wetland and riparian vegetation in or adjacent to the stream, including rushes, rabbitsfoot grass, smartweed, ribbed sandmat, and sour dock.

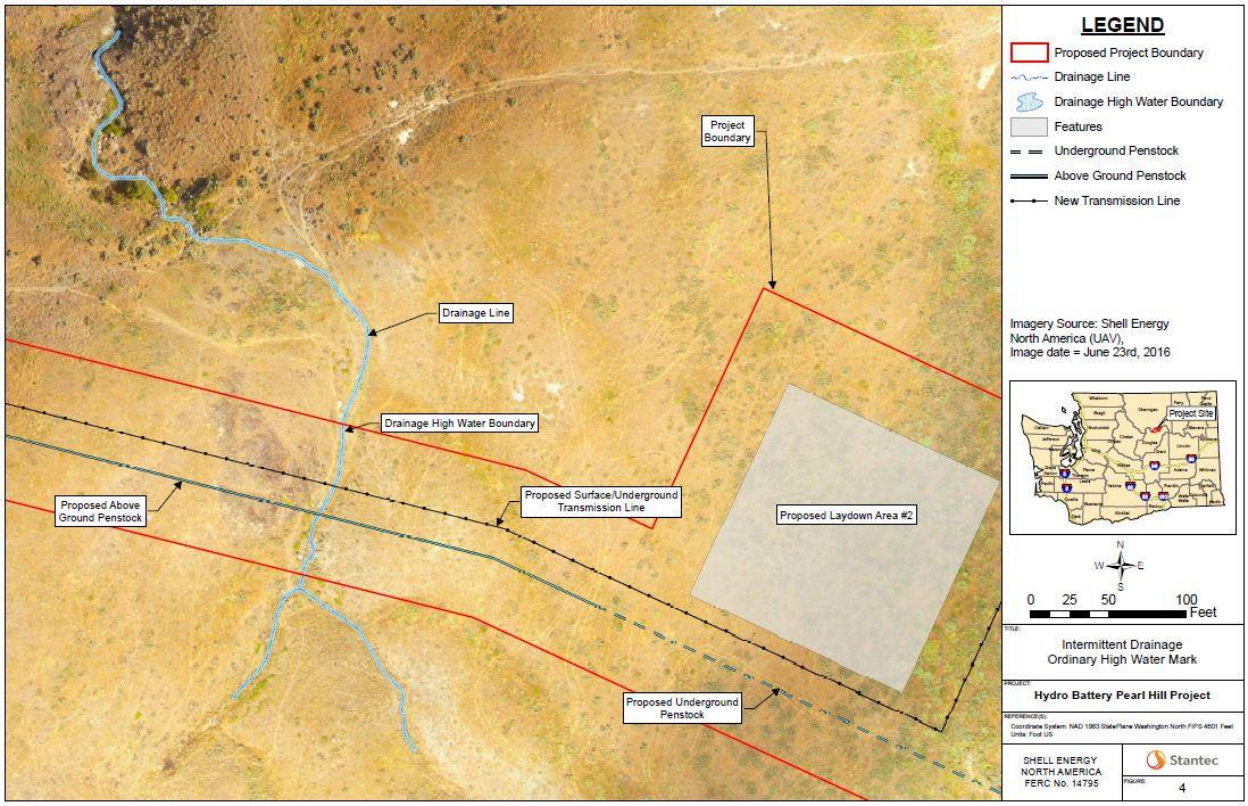

Figure 10. Proposed project boundary and works in relation to intermittent stream (source: application).

The intermittent stream drainage is shown in Figure 11. The project boundary would intercept an approximately 100-foot segment of this intermittent stream.

Figure 11. Intermittent stream drainage within the proposed project boundary, June 2017 (source: application).

Rare Plants

The Douglas County Rare Plants List (Washington DNR, 2019b) contains 31 herbaceous species that the state Natural Heritage Program recognizes as either known, or having potential, to occur in Douglas County. Twenty-eight of these species are state-listed in Washington as endangered (1), threatened (10), or sensitive (17), among which five are also classified federally as species of concern; the three remaining species are of potential concern but need further fieldwork to classify. Shell found no rare plants during site surveys conducted in May and June of 2017.

Traditional Cultural Plants

In April and July of 2018, staff from CTCR's Traditional Cultural Plants Project spent a total of five days hiking through the project area and mapping and documenting plants of traditional cultural interest. They documented 45 traditional cultural plant

species, included two trees, 12 shrubs, 28 perennials, two grasses, and an annual. Among these are plants that members of CTCR's constituent tribes utilize as food sources, as well as medicinally, spiritually, and for other purposes. Important edible cultural plants include serviceberry, chokecherry, wax currant, and Indian carrots, as well as large populations of bitterroot and Hamblen's biscuitroot numbering thousands of individuals.

Invasive Species

The Washington State Noxious Weed Control Board advises the Washington State Department of Agriculture about noxious weed control in the state. The Revised Code of Washington (RCW) defines a noxious weed as "a plant that when established is highly destructive, competitive, and difficult to control by cultural or chemical practices" (RCW 17.10.010). The Board maintains the state's official list of noxious weeds that landowners may be required to control (NWCB, 2019). This list is established in WAC 16-750, and identifies species in three classes. Class A weeds are non-native species whose distribution in Washington is still limited and for which preventing new infestations and eradicating existing infestations are the highest priority. Eradication of Class A plants is required by state law. Class B weeds are non-native species presently limited to portions of the state. Class B species are designated for control in regions where they are not yet widespread. Preventing new infestations in these areas is a high priority. In regions where a Class B species is already abundant, control is decided at the local level, with containment as the primary goal. Class C weeds are noxious weeds that are typically widespread in Washington or are of special interest to the state's agricultural industry.

During Shell's 2017 plant surveys, the only noxious weed recorded in the proposed project boundary was Dalmatian toadflax, a Class B weed. It is scattered throughout the project area, though primarily along the access road to the proposed upper reservoir and north of Road L. During the 2018 traditional cultural plants surveys, CTCR found two additional Class B weeds (diffuse knapweed and Scotch or cotton thistle) and two Class C weeds (Canada thistle and bull thistle) in the project area (CTCR, 2018). As of April 2019, none of the three Class B noxious weeds confirmed on-site are designated for mandatory control.

Beyond these state-designated noxious weeds, Shell and CTCR documented 21 additional non-native species. Among them is cheatgrass (*Bromus tectorum*), which is very common in both the project area and region. Cheatgrass is capable of outcompeting native bunchgrasses under disturbance conditions created by grazing and fire. Following burns, cheatgrass reestablishes more quickly than native grasses. It is also more flammable, resulting in an increasing frequency of fire, which Nogeire and Lawler (2015) estimate occurs every 5 to 7 years in cheatgrass-dominated systems, compared to more than 30 years in native grass systems.

Wildlife

As described above, the grazed shrub-steppe and limited riparian and wetland habitats define the expected wildlife community that inhabit the project area. Discounting forest-dependent species from elsewhere in Douglas County, there are approximately 130 vertebrates that could inhabit or periodically utilize the general project area, including two amphibians, seven reptiles, 22 mammals, and roughly 100 bird species (FCCD, 2015; Washington DFW, 2019a).

Mule deer are common in the project area, and CTCR and staff observed them at various times during site visits in several seasons (CTCR 2018b). The proposed project falls within an area broadly mapped by Washington DFW's Priority Habitats and Species Program (PHS) as major mule deer range, including winter range and fawning habitat. Observations of mule deer in the Pearl Hill area in late winter and mid-summer indicate that they use project area year-round (CTCR 2018b; Washington DFW, 2019a).

As a major game species, mule deer are valued by both state and tribal hunters. Like other game species in the state, mule deer are co-managed by Washington DFW and Tribal game managers. The Washington DNR-managed state lands where the project would be constructed are open to the public for hunting. The proposed project falls within two Game Management Units (GMUs), Foster Creek (GMU 260) to the west, and Big Bend (GMU 248) to the east. Both of these GMUs are open for mule deer hunts between September and December. Regionally, these GMUs are within the Columbia Plateau Mule Deer Management Zone (MDMZ), which is both the largest MDMZ in the state as well as that with the greatest total harvest (Washington DFW, 2016; Washington DFW 2018).

Pronghorn antelope occurred in parts of the Columbia Plateau before being extirpated from Washington State around 1900. Like mule deer, this species can undertake large seasonal migrations, with some herds documented to migrate as far as 160 miles between summer and winter ranges. Unlike mule deer, this species favors relatively flat, open terrain—grasslands and shrublands—where their exceptional eyesight and speed can best assure their survival (Sawyer *et al* 2005; Tsukamoto 2006; Washington DFW 2016). As with mule deer, pronghorn are valued as a culturally important food source for CTCR's members, although hunting of the species remains closed at present. In 2016 and 2017, the Tribes' Fish and Wildlife Department released 150 animals in the southwest part of the Colville Reservation, which is located across Rufus Woods Lake from the proposed project. In 2018, CTCR reported that pronghorn were observed leaving the Colville Reservation and crossing the Columbia River (CTCR, 2016 and 2018c).

PHS identifies Rufus Woods Lake as a fall and winter waterfowl area that regularly supports individuals and small groups of diving ducks, dabbling ducks, and geese. During unusually wet years, highly productive waterfowl breeding ponds temporarily emerge on plateau benches above cliffs in the area. PHS has not mapped any of these ponds in the vicinity of the project boundary; however, the wetland adjacent to the proposed upper reservoir could provide a seasonal water source for grouse and other shrub-steppe wildlife, as well as, in wetter years, waterfowl habitat and breeding opportunities for wildlife such as long-toed salamanders and Great Basin spadefoot toads (Corkran and Thoms 1996; Washington DFW, 2019a).

Wildlife Species of Conservation Concern and Significant Wildlife Habitats

Interior notes that both bald eagles and golden eagles are present in the general area of the proposed project. In 2007 FWS downlisted the bald eagle from the Endangered Species Act due to recovery; however, both it and the golden eagle remain federally-protected under the Bald and Golden Eagle Protection Act. There are two known golden eagle nesting territories, as well as six bald eagle nesting territories along the Rufus Woods Lake. One of these bald eagle territories is located near the proposed project and was active in 2018 (FWS, 2018); however the exact distance and location to the site was not provided.

PHS identifies Rufus Woods Lake as a bald eagle wintering area, used by 25 to 40 eagles most winters, and identifies a communal roost site more than one mile northeast of the project site along the Columbia River (Washington DFW, 2019a). In this region, eagles often use riverside ponderosa pine for perching; however, no ponderosa pine occur within the proposed project boundary. In the 1980s the Corps installed 49 pole perches as mitigation related to Chief Joseph Dam to encourage raptor perching and foraging, with nine poles located between the project area and known bald eagle nest locations.

Vegetation within the project boundary consists of relatively undisturbed native vegetation, which is surrounded by more disturbed areas. In light of the habitat quality and proximity to two golden eagle territories, the project area is likely used by foraging golden eagles.

The greater sage-grouse is the largest grouse in North America, and has become a conservation icon for the sagebrush steppe ecosystem. These birds are well-known for their showy plumage and behavior on strutting grounds or leks where they gather for courtship and mating. Sage-grouse depend on sagebrush steppe for both habitat and forage, with various sage species comprising 60-80% of the diet of adult birds. With this

strong dependence on sage, the sage-grouse has declined apace with the loss and deterioration of shrub-steppe ecosystems range-wide (Washington DFW, 2012).

The FWS classified the greater sage-grouse as a candidate species (i.e., a species being considered for listing under the ESA) in 2010. On October 2, 2015, the FWS determined that listing was not warranted, primarily due to strengthened federal and state regulatory mechanisms which substantially reduced risks of habitat loss and fragmentation for roughly 90 percent of the species' breeding habitat (80 FR 59857).

Although the greater sage-grouse is not formally protected under the ESA, in 1998 it was listed as a threatened species by the State of Washington. Sage-grouse is also designated a priority species and their habitat is designated a priority habitat by the Washington DFW PHS program. The greater sage-grouse occurs on only about 8 percent of its historic range in the state and Washington DFW estimates the species population declined 50 percent between 1970 and 2012 (Washington DFW, 2012). Washington DFW estimates the minimum viable population for the state to be 3,200 birds. In 2016 Washington DFW estimated the statewide population to be 744 individuals, the lowest estimate ever for the state and more than a 20% drop from the previous low in 2014. In Washington, major threats to greater sage-grouse are related to habitat loss from fire and conversion of shrub-steppe for agriculture or development (Washington DFW, 2016a and 2017).

There are two remaining endemic population areas in the State, as well as two others where Washington DFW and a coalition of partners are attempting translocations to re-establish populations where the species has been extirpated. In 2016, Washington DFW estimated there were 536 sage-grouse in the largest population (representing 72% of the estimated state-wide total of 744), which had been fairly stable for 20 years, but since 2010 has declined over 50%. That population lives in the Moses Coulee Priority Area of Conservation (PAC), located in Douglas and Grant counties. This PAC is composed of the Mansfield Plateau and Moses Coulee sage-grouse management units, an area spanning roughly 77 by 33 miles. The Moses Coulee PAC includes an extensive area identified by PHS as having multiple sage-grouse use areas, including breeding grounds and winter use areas (Washington DFW, 2016a and 2019a).

The proposed project site is located along the northern edge of the Moses Coulee PAC. Most of the proposed project facilities would be located within the PAC, except the power platform and the portion of the penstock below County Road L.

The Columbian sharp-tailed grouse is another shrub-steppe dependent species which shares many vulnerabilities and some habitat affinities with the greater sage-grouse. The sharp-tailed grouse does not forage on nor is as strictly associated with sagebrush, and occupies more varied and often less dense types of shrub-steppe, or

grassland with scattered shrubs. In the winter however, they are more narrowly dependent on riparian areas with certain deciduous trees or shrubs and forbs for their survival. Wintering grounds for sharp-tailed grouse are on average 2-3 miles from breeding sites, while brood-rearing areas are usually within 1.2 miles of breeding sites. Like the sage-grouse, sharptails also converge on leks at the beginning of the breeding season for showy displays of mating behavior. Also like sage-grouse, sharp-tailed grouse have declined precipitously in Washington State, primarily due to the conversion of their shrub-steppe habitat into agricultural lands. Wildfires also have significant short- or long-term habitat impacts; from 2012-2015 over 700,000 acres of historic sharp-tailed grouse range in Washington were affected by wildfires, including large areas of occupied habitat. Sharp-tailed grouse currently occupy less than 3% of their historic range in Washington, and as of the most recent (2017) status report the statewide population had declined to 608 individuals among eight remnant populations located in Douglas, Lincoln, and Okanagan counties and the Colville Indian Reservation. The state's recovery plan for sharp-tailed grouse recognized that all of the populations are now unsustainably small (<200 birds) and too isolated from one another, and that restoring habitat for genetic connectivity among these remnant populations, as well as increasing their individual populations, will be essential for recovery of the species (Stinson and Schroeder 2012; Stinson 2017). Due to continuing dwindling numbers, the Columbian sharp-tailed grouse was recently listed as endangered by the state (Washington DFW 2019a, 2019b).

The state recovery plan also identified 22 recovery units, which are areas within the historic range of sharp-tailed grouse that retain significant concentrations of steppe vegetation and have potential to contribute to recovery of the species. The purpose of these units is to strategically focus recovery efforts. Of the 22 recovery units, as of 2012 nine contained active breeding populations,[16], including the East Foster Creek unit which encompasses roughly the northeastern quarter of Douglas County and includes the proposed project site (Stinson and Schroeder 2012). The recovery plan recognized the East Foster Creek recovery unit as being an important area for connectivity among sharp-tailed grouse populations; more specifically, the proposed project site is located in an area the plan identifies as a likely movement corridor for maintaining genetic connectivity among three surrounding populations, and as an area that should be considered a priority for habitat protection or restoration (Stinson and Schroeder 2012; Stinson 2017).

Cliffs, lesser outcrops, and associated talus fields provide distinct roosting, denning, and escape structure for a range of mammals, as well as nesting opportunities for several species of birds and denning or other refuge space for herpetofauna. Shell obtained Douglas County cliff and talus habitat data, which shows cliff and talus

[16] Some breeding populations occupied more than one recovery unit.

habitat outside the proposed project boundary about 600-800 feet west and downslope of the proposed upper reservoir. PHS records indicate no known bat colonies in the township (T30N, R26E) where the proposed project would be built, including the mapped cliff and talus area. However, in the township (T30N, R27E) immediately east of the proposed upper works, and bordered by the proposed access road, PHS identifies roosting and/or breeding sites for Townsend's big-eared bat, a state candidate species; little brown myotis; and Yuma myotis (Washington DFW, 2019a). The roosts are at least 0.5 mile from the proposed upper reservoir location (Washington DFW, 2016).

3.3.3.2 Environmental Effects

Effects on Native Vegetation Communities, including Rare Plants and Plants of Cultural Significance

Construction of the project would require vegetation clearing and land-disturbance of 8.9 acres of predominantly shrub-steppe and some riparian habitat. About 4.6 acres would be occupied by project facilities (upper reservoir, penstock, access road). Another 4.3 acres, including temporary laydown areas 2 and 3, and the 25-foot wide buried penstock corridor, would be initially cleared then revegetated following construction.

Shell proposes to protect plant species with conservation priority during construction by confining its construction plans to the smallest footprint practicable, and surveying the construction area prior to land disturbing activities to identify and protect any sensitive plants, including plants of cultural and spiritual importance to the Colville Tribe, if possible. Shell would invite CTCR's cultural plants team to participate in these surveys, which would be conducted once in early spring, and again in mid-summer to ensure that both early- and late-blooming sensitive plants are observed. Shell would document all sensitive plants and would avoid disturbing them if possible.

Following construction, Shell would revegetate all disturbed areas with an appropriate native seed mix, determined in consultation with CTCR and the resource agencies. The seed mix, such as the Columbia Plateau mix from BFI Native Seeds in Moses Lake, Washington, would be applied in spring and consist of: 50 percent bluebunch wheatgrass, 15 percent bottlebrush squirreltail, 15 percent Sandberg's bluegrass, and 20 percent thickspike wheatgrass. Big sagebrush and/or other species of traditional cultural importance may be added to the seed mix, depending on the results of preconstruction surveys and seed source availability. Shell also proposes to evaluate the possibility of supplemental plantings in the fall, based on the results of the pre-construction surveys and the availability of suitable containerized plants or bareroot nursery stock. If containerized or bare-root nursery stock are to be included in the revegetation plan, they would be installed in the fall to maximize likelihood for successful establishment. Shell would also evaluate slope and soil conditions along

Rufus Woods Lake to determine if soil conditions are suitable for planting fast-growing native shade-producing trees (such as willows, alders, and/or cottonwoods) along the Rufus Woods Lake.

Additionally, Shell proposes to contract with CTCR for assistance in revegetation work, any final surveys, and recovery of native plants in the construction area. Following the revegetation work, Shell proposes to monitor all revegetated areas for five years to ensure that native species have become established; where revegetation is unsuccessful, the areas would be retreated, then monitored for an additional five years.

Interior and Washington DFW recommend that Shell develop and implement its TRMP including the preconstruction plant surveys, revegetation work, and monitoring as proposed by Shell, with two modifications: (1) in addition to CTCR, FWS, and Washington DFW should be invited to participate in the preconstruction surveys to assist in identifying botanical resources; and (2) the surveys should include ESA-listed species.

CTCR recommends that more species of cultural significance should be included in the native seed mix, and among any plantings that are done, to partially mitigate for permanent losses of culturally-significant plants where project facilities would be installed.

Our Analysis

Shell's proposed construction plans would affect 8.9 acres of shrub-steppe and riparian communities. The measures proposed by Shell would minimize the extent of vegetation disturbance and ensure that temporarily disturbed areas are revegetated upon completion of construction activities. While the affected area is actively grazed, it is relatively undisturbed in comparison with adjacent lands. Nonetheless, the survey efforts to date suggest a scarcity or absence of rare plants, but an abundance of plants of cultural significance in the project area.

Conducting vegetation surveys prior to construction would allow Shell to identify any sensitive plants[17] missed during initial site surveys or that have become established since the site surveys. Conducting the surveys in consultation with FWS, Washington DFW and CTCR would allow Shell to elicit the assistance of area experts that could help identify any species that may be important to the tribe or area wildlife. Using this

[17] Shell has defined "sensitive plants" as the Douglas County rare plants and the culturally and spiritually important plants listed in Tables 4-3 and 4-2 of the application. *See* telephone conversation memorandum between Commission staff and J. T. Steenkamp, Project Manager, Shell, filed with the Commission on June 4, 2019

information, Shell may be able to take steps to avoid disturbing the plants, such as fencing off the plants during construction or translocating individuals.

Shell's proposed revegetation seed mix is readily available and uses native grasses that would help ensure that the disturbed areas are quickly revegetated to prevent erosion and colonization of noxious weeds, are compatible with area soil and climate conditions, and are important to wildlife. Consulting with resource agencies and CTCR, which have area expertise in vegetation and culturally important species, would help inform the decision on final seed mixtures and plant species to better ensure the likelihood of successful growth and reestablishment and meeting area wildlife and cultural needs. As long as seeds or plants are readily available, including plants of cultural significance in the native seed mix would mitigate for the anticipated losses of established plants of cultural importance and diversify both the species mix and the propagule types which would enhance the potential long-term success of the revegetation effort. As noted by Shell, establishing sagebrush can be difficult, but including native shrubs in the planting mix if available, as root stock or as containerized seedlings, would provide cover and some additional wildlife forage for wildlife and promote a long-term, structurally diverse shrub-steppe community.

Active grazing of Washington DNR lands may complicate revegetation efforts. Fencing or some other form of exclusion maybe required to allow establishment of native grasses and forbs, after which the fencing could be removed to prevent further conflicts with grazing uses.

Shell does not explain where its assessment efforts would be targeted or how much shoreline it might revegetate with shade trees. Based on available information, there appears to be little reason to evaluate the establishment of native shade trees along Rufus Woods Lake as proposed by Shell. The rockiness of the project shoreline and lack of existing vegetation suggests that establishing native shade trees, such as willows, cottonwood, or alders, is unlikely to be successful. If some trees could be established here, they would eventually provide birds and other wildlife with perching, nesting, and other opportunities that are scarce in the steppe region, which could also create additional opportunities for increased predation on fish.

Revegetating disturbed areas with native plants would take time; however, in our experience, successful reestablishment of native vegetation can be accomplished within 5 years as long as there are no extreme weather conditions. The applicant's proposed monitoring program would provide a means to track and verify re-establishment of vegetation. However, Shell's proposal lacks detail. Details that still need to be finalized in consultation with resource agencies and CTCR include final seed mixes and plant species, planting densities and methods, fertilization and irrigation requirements, control of grazing and invasive weeds, specific monitoring protocols, criteria for measuring the

success of revegetation efforts, and specific procedures to be followed if revegetation is not successful.

Shell's proposal to contract CTCR to perform the revegetation work would allow local experts with familiarity and affinity for the site and its native plant species to guide revegetation efforts, which could contribute to greater success. However, the Commission cannot require Shell to contract with any entity. Consultation with the CTCR and the resource agencies on the details of the revegetation plan would ensure that interests of the CTCR are identified and addressed in any plan approved by the Commission.

Effects of Construction on Wetlands and Riparian Habitats

To construct the temporary access road from County Road L to Laydown area #3, Shell would install a steel culvert and crushed aggregate to create a temporary at-grade crossing over the intermittent stream. Shell does not specify the width of this temporary crossing; assuming the same 12-foot width as the access road used for construction of the upper works, then approximately 0.005 to 0.008 acres (240-360 sq. ft.) of riparian vegetation would be disturbed by constructing the temporary crossing. Following construction, Shell would remove the culvert and aggregate, and the area would be revegetated as discussed above.

At the lakeshore, construction of the proposed power platform would entail excavating a section of the rocky shoreline in which to anchor the platform. An area of rock and associated vegetation of roughly 0.087 acre (3800 sq.ft.) would be permanently removed for this purpose. .

Staff estimates that about 200 feet of the 12-foot-wide proposed access road would pass within 70 to 100 feet of the wetland near the proposed upper reservoir (Figure 6). Shell states that it would minimize effects to the wetland and its associated buffer, but if adverse effects to the wetland cannot be avoided, it would develop mitigation measures following license issuance.

No entity recommended measures to address adverse effects on wetland resources beyond the revegetation measures discussed above.

Our Analysis

Project construction would have minor, localized effects on riparian vegetation associated with the crossing of the intermittent drainage and along the lake shoreline. As noted above, Shell's design limits construction to the smallest footprint possible. Disturbance to the Rufous Woods Lake shoreline cannot be avoided.

While the proposed access road would cross the Douglas county-defined buffer area for the isolated wetland, the access road would not result in direct fill or discharges to the wetland. Minor indirect effects could result through soil compaction and changes in surface hydrology.

Establishment, Spread, and Control of Noxious Weeds

Land-disturbing activities create conditions that can promote the establishment of noxious weeds which can outcompete native vegetation and degrade wildlife habitats. As part of the proposed TRMP, Shell would control weeds utilizing an Integrated Pest Management (IPM) approach, which includes prevention, monitoring, and treatment, as well as evaluating the effects and efficacy of control treatments. In accordance with Washington DNR's management plan (WDNR 2011), Shell would control Dalmatian toadflax and any Class A noxious weeds detected in disturbed areas and around project facilities using appropriate mechanical, biological and chemical treatments that meet the requirements of state and Federal law.

Interior and Washington DFW recommend the noxious weed management approach proposed by Shell.

Our Analysis

No Class A noxious weeds are known to exist onsite; however, three Class B weeds, including Dalmatian toadflax, occurs onsite and in the project area. Soil disturbance and vehicle transport create conditions that could promote the establishment and spread of these and other noxious weeds without suitable control.

Shell's proposal to follow accepted IPM practices should limit the establishment and spread if properly implemented. However, Shell's proposal lacks the detail required to implement the plan. To ensure effective implementation and Commission administration of the license, the Commission would typically require that the plan include: (1) preventative measures such as cleaning of construction equipment, treatment of weed infestations prior to ground disturbance, and use of weed-free materials; (2) anticipated treatment methods and timeframes; and (3) monitoring protocols and timeframes.

Wildfire Prevention

Wildfires can dramatically alter or remove wildlife habitats. To prevent wildfires during project construction and operation, Shell proposes to develop fire suppression measures as part of its TRMP. Interior and Washington DFW recommend the fire suppression measures proposed as part of the TRMP.

Our Analysis

The proposed project is located in a fairly arid part of the state and the shrub-steppe habitats include flammable non-native grasses that exacerbate wildfires. Shell does not describe what measures it might take to prevent wildfires during construction and operation. Such measures might include protocols for promptly removing and disposing of vegetation by means other than burning, and having fire containment materials onsite. Development of a fire prevention plan as a component of the TRMP would ensure that there are specific measures in place to minimize the potential for a wildfire.

Loss of Wildlife Habitat

Project construction would result in the permanent conversion of 4.6 acres of mostly shrub-steppe habitat and mid- to long-term degradation of an additional 4.3 acres of shrub-steppe habitat. Shell worked with Washington DFW to identify options for on-site wildlife habitat mitigation to offset this loss, but Shell reports that it found none that would be feasible primarily because of conflicts with grazing uses of the Washington DNR lands. Instead, Shell proposes to provide $50,000 to Washington DFW to partially fund the replacement of a center pivot irrigation system on Washburn Island in the Columbia River, where Washington DFW manages 250 acres for waterfowl and upland bird species. Washburn Island is located 13 miles downriver from the proposed project and below the Chief Joseph Dam. Douglas County PUD owns the island, which is part of the Wells Wildlife Area (Washington DFW 2019c).

Interior and Washington DFW recommend that Shell complete a wildlife enhancement project (provide $50,000 for replacement of center pivot irrigation) as proposed by Shell and in coordination with the FWS, Washington DFW, and the CTCR.

Our Analysis

Project construction would result in a minor loss of wildlife habitat. The generation platform has been designed with a minimal footprint, and would be accessed by boat, minimizing the need for large-scale bank excavation and access road development. Short-term habitat loss is commensurately minor, with less than 5 acres

being temporarily disturbed to enable construction of the project facilities. Revegetation of the disturbed areas with native species would over time help minimize habitat losses.

While funding the partial replacement of the irrigation system on Washburn Island would assist Washington DFW in its efforts to manage for waterfowl and upland birds, the site is relatively far removed from the project, consists of habitats unlike those affected by the project, and is being managed for different species than those affected by the project. Thus, there is little connection between the proposed measure and project effects on area wildlife and wildlife habitat. Further, the Commission generally does not support just providing funds, but rather prefers to require specific measures that have a clear connection to project effects and purposes, which is not the case here.

Effects of Construction, Operation and Maintenance of Project Facilities on Grouse and other Shrub-steppe Dependent Wildlife

In addition to the longer-term habitat changes within the immediate project footprint analyzed above, construction activities also would involve short-term exposures to loud and unfamiliar noises, movements of large vehicles and equipment, and high levels of human activity, which would disturb and potentially displace area wildlife from adjoining areas. The addition of the access road to the upper reservoir has the potential to increase human access and disturbance of area wildlife, which could deter wildlife breeding activities or increased breeding failure. The project penstock could create barriers to wildlife movement. The power platform and upper reservoir would provide artificial perching sites for birds, which could lead to increased predation of fish, sage-grouse, and sharp-tailed grouse. Birds, bats, or other animals that fall into the upper reservoir could become trapped. Construction of project infrastructure would result in the loss of 4.5 acres of habitat within the Moses Coulee Priority Area for Conservation (PAC) for the greater sage-grouse, as well as another 3 acres that would be temporarily disturbed then revegetated, but likely would have some longer-term degradation of habitat quality.

To minimize effects on wildlife, Shell proposes to: (1) develop, in consultation with state, tribal, and federal resource agencies, a construction timeline and methods, as well as operational practices, to minimize disturbance to wildlife and protect sensitive species; (2) bury much of the penstock and install wildlife crossings on above-ground sections to minimize barriers to wildlife movement; (3) install bird perching exclusion devices on the margins of the upper reservoir to minimize perching sites for birds that could prey on grouse; (4) install escape ramps within the upper reservoir tank to minimize the potential for animal entrapment; and (5) mark 840 feet of existing fence lines to minimize grouse collisions.

Interior and Washington DFW recommend that Shell implement its proposed measures. CTCR states that construction activities and noise from operations "may adversely affect mule deer, pronghorn antelope, and other terrestrial wildlife"; and recommend that the Commission impose measures to minimize impacts to terrestrial wildlife from construction activities and noise, including "developing construction schedules with reference to seasonal use of the project area by sensitive species." CTCR also recommends that bird perching-exclusion devices also be attached to the elevated sections of the penstock to prevent raptor predation on small terrestrial animals. CTCR additionally recommends that Shell conduct pre- and post-construction monitoring of migrating game animal's movements in the project area, and to adaptively manage project impacts to animal migrations.

Our Analysis

Construction Timelines and Practices

Project construction schedules and practices that are informed by seasonal sensitivities and habitat uses could benefit wildlife by reducing disturbance during sensitive time periods. However, the mechanisms through which ecologically-informed construction scheduling and practices can benefit individual wildlife species varies with their particular life-histories and associated vulnerabilities.

While Shell proposes to develop construction schedules and operational practices to minimize disturbances to wildlife, habitats, and sensitive species in consultation with the resource agencies and CTCR, neither Shell, nor the resource agencies explain which species likely need protecting, or what practices and timing might be feasible or needed. Similarly, while CTCR indicates it is concerned about disturbing deer and pronghorn, CTCR does not explain when disturbances should be avoided or minimized or what construction practices would lessen those disturbances.

The project site is not currently known to support or be used by pronghorn antelope; therefore there would be little benefit in limiting construction periods or instating specific construction practices (whatever they might be) to prevent disturbing pronghorn antelope.

In the Columbia Plateau MDMZ, shrub-steppe provides year-round habitat for mule deer, as well as seasonal habitat for fawning and fawn-rearing. Construction activities are likely to temporarily disturb and displace mule deer. Such displacement would have the greatest effect on mule deer populations if they occur on critical winter

range or parturition[18] areas when mule deer energy reserves are most taxed. Suspending construction from November 15-April 30 on areas designated as crucial winter range and from May 1 to June 30 on identified parturition areas (Lutz et. al., 2011) would minimize disturbance effects. However, the project site is not known to be a critical winter range or identified parturition area. Further, the small construction footprint and availability of other similar habitats suggest that any mule deer displaced from the project site would likely find suitable habitat nearby. Therefore, there would be limited benefits from requiring these construction timing limits.

The only other sensitive wildlife species we have identified that might require special construction practices or timing protections are the greater sage-grouse and the Columbian sharp-tailed grouse. Historical records indicate sage-grouse breeding sites potentially within about 1.5 miles of the project site dating back to 2002 and 2007 (Washington DFW 2019a). Similarly, PHS records show Columbian sharp-tailed grouse breeding records in the township from 2002-2003. However, there is no current evidence of recent sage-grouse or sharp-tailed grouse breeding activity or active leks within 5 miles of the project site (Washington DFW 2019a). Consequently, we have no basis for recommending a restricted construction schedule or practices to minimize disturbance to nesting grouse or any other wildlife species.

Controlling Public Access

Construction of the access road from the existing county road to the upper reservoir may facilitate access to the project site by the public and some increase in human activity. Shell proposes to install a lockable gate where the access road would cross the existing fenceline, approximately 350 feet before reaching the reservoir. The gate would discourage vehicle access beyond that point.

In light of the low human population density in the region and the light use of the existing county road, the level of increased public access and activity facilitated by a new access road would likely be low. Similarly, any increase in disturbance to wildlife would likely be minor and localized.

Bird Perching Exclusion Devices

Predation is a normal event among wildlife species. Imperiled species, however, may have lost much of the resilience necessary to readily endure predation, particularly if predation is at an elevated level. Given the statewide decline of the greater sage-grouse, including its most robust population in the Moses Coulee PAC, any increase in predation

[18] Birthing or fawning areas.

would be harmful. Heightened predation would also be harmful for the dwindling statewide population of Columbian sharp-tailed grouse. Shell's proposal to install bird perching-exclusion devices along the margins of the upper reservoir would help ensure that the tank does not inadvertently augment avian predation of these imperiled grouse species, if present in the project area.

Shell's proposal to plant native trees and shrubs to provide visual screening around the tank and adjoining parking area (see section 3.3.7.2, *Aesthetic Resources*) could inadvertently create perch-sites, leading to increased avian predation on grouse and effectively undermining the benefit of perch-deterring devices on the tank.

As noted by CTCR, the proposed above-ground portions of the penstock would likely serve as additional perch sites for raptors, which could lead to elevated predation on small mammals and other animals. While populations of various small terrestrial animals in the vicinity of the penstock would suffer some losses from predation, it is not likely that penstock-associated predation would threaten these populations because of their high reproductive rates and abundance of other habitats surrounding the project.

However, the precarious status of greater sage-grouse and Columbian sharp-tailed grouse populations leaves them vulnerable to any increase in predation; for these species the use of perching-exclusion devices along the above-ground portions of the penstock in the sage-brush steppe areas below the upper reservoir tank may help prevent increased predation on grouse. The steep, grassy lower slope[19] where the penstock would run entirely above-ground does not provide suitable habitat for sage-grouse or sharp-tailed grouse; therefore, these species would not likely benefit from installing perch deterrents along the lower segment of the penstock. However, we are not aware of any perch deterrents that have been applied to penstocks and CTCR did not recommend a particular perch deterrent. Assuming steel spike strips, such as those applied to deter pigeons and other pest birds from landing and nesting on girders and buildings, would also deter raptors from roosting on the penstock, about 3900 feet would need to be affixed to the top of the penstock.

Escape Ramps

Open water tanks and reservoirs often create drowning and entrapment hazards for animals that land or fall into them but are unable to fly or climb out (Taylor and Tuttle, 2007). Shell's proposed upper reservoir would consist of a 20-foot tall, 300-foot diameter, lined corrugated steel tank, within which the water level would vary by as

[19] Below the major slope break at 1,440 feet elevation.

much as 20 feet as the project cyclically fills then empties the tank to generate electricity. Shell's proposed floating roof would span fully to the tank walls, and rise and fall with the varying water level.[20] This close-fitting roof would leave essentially no open-water gap at the perimeter, and eliminate any drowning hazard. Shell's proposed escape ramps would angle up from the roof to the tank rim to provide means of egress and prevent entrapment of any animals that fall into the tank. However, with walls 20 feet high and no adjoining tall vegetation to facilitate climbing, the only animals likely to enter the tank would be birds or bats that fly into the tank. At 300 feet across, most birds and bats should have sufficient room to fly out of the tank. Because there is little likelihood of non-volant[21] wildlife getting into the tank, there would be little benefit to wildlife from installing the ramps.

Marking Fences to Protect Sage-Grouse

Collisions with fencing—which tend to occur in dim pre-dawn light when sage-grouse fly in low to converge on leks—have been repeatedly documented to injure or kill sage-grouse (Van Lanen *et. al.*, 2016). Attaching simple, inexpensive visual markers to strands of fence wire has been shown to reduce sage-grouse collisions by 58-83%; effective examples of markers include three-inch strips of white vinyl siding at roughly one-meter intervals along upper fence wires (Van Lanen *et. al.*, 2016). A conservation objective for the recovery of sage-grouse is to mark fences that are in high risk areas for collision with permanent flagging and installation of any new fences should consider their impact on sage-grouse and, to the extent practicable, be at least 1 km from occupied leks (FWS 2013). FWS (2013) defines high risk areas as those habitats on flat to gently rolling terrain in areas of moderate to high fence densities (more than 1 km of fence per square km) located within 2 kms of occupied leks (FWS 2013).

Shell proposes to mark the 840 feet of existing fencing in the upper reservoir area, using vinyl markers. Shell has not proposed to install any fencing for this project, but has indicated that any new fencing that may ultimately be needed would also be marked in this manner[22]. As noted above, nothing in the project record indicates that the project site supports leks, though the proposed project facilities are within or near the Moses Coulee PAC, an extensive area containing locations important to sage-grouse for breeding and other seasonal uses. Installing markers on existing agricultural fences in the project area

[20] The purpose of the floating roof is to reduce evaporation and solar heating, but has the added benefit of preventing animals that fall into the tank from drowning.

[21] Wildlife which cannot fly.

[22] *See* telephone conversation memorandum between Commission staff and J. T. Steenkamp, Project Manager, Shell, filed with the Commission on June 4, 2019.

as proposed by Shell would reduce existing risks and enhance conditions for grouse and would be consistent with FWS's conservation objectives for the greater-sage grouse.

Conserving the Moses Coulee Sage-grouse PAC

The FWS (2013) developed range-wide conservation objectives for the sage-grouse to reduce or ameliorate threats so that it is no longer in danger of extinction or likely to become in danger of extinction in the foreseeable future. The primary threat to sage-grouse is loss and fragmentation of sagebrush habitats, which can result in reductions in lek persistence, lek attendance, population recruitment, yearling and adult annual survival, nest site selection and nesting initiation, and complete loss of leks and winter habitat (FWS 2013). A number of factors have contributed to the loss and fragmentation of sagebrush habitat including conversion of sagebrush habitats for agriculture and urban development, increased human activities and noise, wildfire, expansion of native conifers and junipers, introduction and spread of invasive species, development of non-renewable and renewable energy developments. To combat these and other threats, FWS (2013) identified key areas (PACs) across the species range that are necessary to maintain resilient populations and developed specific conservation objectives and measures for these and other areas that might support grouse populations.

To reduce habitat loss and fragmentation, FWS (2013) recommends that sage-grouse habitats be retained in PACs because once lost, habitat restoration is difficult, expensive and often results in limited success. FWS (2013) also recommends that threats be reduced. Threats and associated conservation measures applicable to the project, include controlling, or stopping the spread of invasive annual grasses; designing energy development to ensure that it will not impinge upon stable or increasing sage-grouse populations; and avoiding infrastructure development for any purpose (e.g., roads, pipelines, powerlines, and cellular towers) within PACs. Where energy development cannot be avoided within a PAC, the FWS (2013) recommends that it occur first in non-habitat, then, if necessary, in the least suitable habitat for sage-grouse and designed to ensure at a minimum that there are no detectable declines in sage-grouse population trends by (in applicable part) designing the development to minimize tall structures (e.g., turbines, powerlines), or other features associated with the development (e.g., noise from drilling or ongoing operations). Where the installation of infrastructure must occur in the PAC, FWS (2013) recommends (in applicable part): transmission corridors should be buried (if technically feasible) and disturbed habitat restored and maintained to preclude introduction of invasive species; and transmission line towers be constructed to severely reduce or eliminate nesting and perching by avian predators, most notably ravens, thereby reducing anthropogenic subsidies to those species.

The project site is located on the edge of the Moses Coulee PAC. The Moses Coulee sage grouse population had been maintaining its number for about 30 years (FWS

2013), but has substantially declined since 2010 (Washington DFW 2016a). Major concerns for the population are the lack of habitat stability due to abundant private land, habitat fragmentation, and dependence on farm programs. FWS (2013) also states that the high degree of fragmentation and "subsidized" predation (subsidized with road kill, orchards, and nesting and perching structures) increases the overall predation rate on the population.

While project construction would be inconsistent with the objective of avoiding all energy and infrastructure development within a PAC, habitat loss would be small (7.5 acres, of which less than five would be permanently converted) compared to the extent of shrub-steppe habitat in the Moses Coulee PAC (roughly 360,000 acres[23]), would occur in an area that is not known to support leks or breeding areas in the last decade, and would occur on the periphery of the PAC. As discussed earlier, burying or co-locating the project transmission line with the penstock and installing bird exclusion devices on the upper reservoir tank and the above-ground portions of the penstock in suitable grouse habitat would minimize the number of tall structures and reduce the potential for increased predation of any grouse that might be present in the project area. Revegetating disturbed areas with native species and controlling invasive species would minimize the potential introduction and spread of invasive grasses. Wildfire is a major threat to sage-grouse habitat and development of fire suppression measures would reduce the potential for any project-related wildfires. For these reasons, we do not expect project construction and operation to significantly impede recovery of sage-grouse populations in the Moses Coulee PAC and would be consistent with FWS's (2013) conservation objectives—a FPA section 10(a)(2)(A) comprehensive plan.

Wildlife Crossings

Shell's 6,276-foot-long penstock would be partially buried and partially above-ground. About 2,828 feet of the penstock would be buried, 150 feet would span the intermittent drainage, and 3,298 feet in two sections would be constructed on support structures above ground. According to Shell, the top of the penstock on the above-ground segments would typically be about four feet high, which could impede deer and pronghorn antelope movement. There is a distinct terrain break at about 1,440 feet elevation on the hillside over which the proposed penstock would run. Above 1,440 feet, the mid and upper slopes are moderately steep (averaging 18 percent and rarely exceeding 25 percent); below 1,440 feet the lower slope is consistently steep, averaging 47 percent. The upper section of above-ground penstock (about 1,300 feet long) would be located on the moderate upper slopes, while the lower section of the above-ground penstock, from the intermittent drainage crossing to the power platform (about 2,000 feet

[23] Staff estimate based on Washington DFW's (2016) sage-grouse recovery report.

long), would be mostly located on the steep slopes. Exhibit F drawings indicate that along this steep lower slope, the combination of the penstock's elevated position on support structures with the natural terrain irregularities would provide clearance of about 6 to 9 feet in several locations.

Shell proposes to construct a crossing over the upper section of the penstock about 700 feet downhill of the upper reservoir tank. This crossing would occur where the proposed penstock intersects with an existing off-road vehicle (ORV) trail. The crossing structure would be an earthen ramp about 12 feet wide where it crosses over the penstock, and extending 15 feet to either side (30-foot total length) to provide a suitable grade for ORV crossing[24].

Pronghorn are not presently established in the project area, but if they become established, they are unlikely to use the steep slopes crossed by the lower portion of the penstock because they prefer open landscapes and slopes less than 18 percent, and typically avoid steeper terrain (Tsakumoto 2006). Tsakumoto (2006) concluded slopes over 27 percent would be of limited potential use and those over 47 percent would only occasionally be used by pronghorn antelope. Therefore, most of the lower section of above-ground penstock would not affect pronghorn movement. The buried segments of the penstock and the wildlife crossing over the upper section of above-ground penstock would provide ample crossing opportunities on the gentler, higher elevation slopes that are more likely to be used by pronghorn if they use the project area in the future.

Mule deer, which are well established and range across the entire project area, could be affected by both the upper or lower above-ground segments of the penstock. Mule deer will use both over and underpasses to cross barriers (DOT, 2011; Sawyer *et al*. 2016). Studies by PacifiCorp (2013) at its Prospect No. 3 project, documented black-tailed deer using six penstock and flowline under crossings with nine-foot widths and clearances ranging from 4.5 to 7.3 feet, and averaging 6.2 feet. PacifiCorp (2013) also documented black-tailed deer and elk successfully crossing over flowlines on crossings 6 feet wide at its Prospect Nos. 1, 2, and 4 project. Since the proposed overpass for the upper penstock section would be 12 feet wide, deer should be able to cross the project penstock. Even if they were hesitant to use the overpass, deer would only be displaced a short distance before reaching a buried section of penstock and the end of any movement barrier.

[24] *See* telephone conversation memorandum between Commission staff and J. T. Steenkamp, Project Manager, Shell, filed with the Commission on June 4, 2019.

Further, the irregular topography along the lower penstock segment would naturally provide several openings with clearances of six to nine feet that could also be used by deer. Some of these openings could be enhanced to provide greater clearance with little effort and Shell has indicated a willingness to do so during project's final design. If the natural topography and final penstock design do not already provide sufficient clearance[25] to allow deer to cross the penstock easily, providing an underpass along the lower penstock segment would be sufficient to ameliorate any barriers to movement. Depending on the location of such underpass, deer would not need to travel more than 500 to 1500 feet laterally to circumvent any barrier presented by the lower penstock segment.

CTCR's recommended monitoring of big game movements in the project area prior to and following construction would enable Shell to identify whether deer have established game trails that they prefer and if the wildlife crossings are being used by deer (and potentially pronghorn if they become established). CTCR did not specify a desired monitoring method or effort, which could vary widely in the scale and types of projects to which they best apply. For example, telemetry may be effective for detailing the movements of individual animals over wide areas, yet yield little data close to a narrow focal area such as the penstock corridor (WTI, 2007). Regardless, because deer and pronghorn are highly mobile species, we do not expect that the above-ground segments will be major impediments to their movement in the project area. As described above, the proposed trail/wildlife overpass and at least one underpass, in conjunction with the buried segments of the penstock, would allow deer and pronghorn to move across the landscape. The above-ground segments are not so long that deer and pronghorn would have difficulty in finding suitable crossings. Therefore, movement studies would be of little value here.

Effects of Project Transmission Lines on Raptors, Waterfowl, and other Migratory Birds

Multiple bald and golden eagle nesting territories are documented in the project vicinity or along Rufus Woods Lake, which is also a known wintering area for several dozen bald eagles. Because of their size and flight abilities, both species are vulnerable to collision with or electrocution from elevated transmission lines. Waterfowl and other large-bodied birds experience similar risks, and collisions with transmission lines have also led to documented greater sage-grouse fatalities (Van Lanen *et. al.*, 2016; Washington DFW, 2016a; Gibson *et. al.*, 2018).

[25] An opening of at least six feet of vertical clearance and nine feet of width.

To minimize bird electrocution and collision risks, Shell proposes to bury the project transmission line[26]. Where it cannot be buried it would be affixed to the penstock to eliminate any collision or electrocution risk to birds.

No one commented on Shell's proposal.

Our Analysis

Because the transmission line would be either buried or attached to the project penstock, there would be no collision or electrocution risk to area birds, including eagles and sage grouse.

3.3.4 Threatened and Endangered Species

On June 5, 2019, Commission staff accessed FWS's Information, Planning, and Conservation System and found that the threatened bull trout and the threatened yellow-billed cuckoo may occur in the project area. In addition, in their comment letter of December 17, 2018, Interior recommended that the project area be surveyed for Ute ladies'-tresses, which is also federally listed as threatened, because the species is known to be present on the Douglas County side of Rocky Reach Reservoir.

3.3.4.1 Affected Environment

Bull Trout

Bull trout (*Salvelinus confluentus*) are cold-water fish belonging to the char subgroup of the family Salmonidae, and are native to relatively pristine stream and lake habitats of the Pacific Northwest United States and western Canada.

Within the United States, bull trout currently occur in the Columbia River and Snake River basins in Washington, Oregon, Montana, Idaho, and Nevada; Puget Sound and Olympic Peninsula watersheds in Washington; the Saint Mary basin in Montana; and the Klamath River basin of south-central Oregon. Rufus Woods Lake is the reservoir impounded behind Chief Joseph dam and extends upstream approximately 51.5 miles to the tailrace of Grand Coulee Dam (RM 596.6). Both Chief Joseph and Grand Coulee dams lack fish passage facilities and are impassable barriers to upstream movement. The nearest bull trout population is from the Methow, Entiat, and Wenatchee subbasins. Bull

[26] *See* telephone conversation memorandum between Commission staff and J. T. Steenkamp, Project Manager, Shell, filed with the Commission on June 4, 2019.

trout have not recently been observed in Rufus Woods Lake. According to Shell's investigations, only two fish have been captured and documented within the reservoir in the last 20 years, and they were likely entrained from Grand Coulee Dam and not part of a reproducing population.

Lake Rufus Woods and the project site do not fall within a critical habitat unit for bull trout. The nearest critical habitat is designated as the Mainstem Upper Columbia, which ends downstream of Chief Joseph Dam.

Western Yellow-billed Cuckoo

The yellow-billed cuckoo is a mid-sized neo-tropical migrant bird, which winters in South America and breeds in North America. The western yellow-billed cuckoo is the population segment of the yellow-billed cuckoo species which breeds west of the Continental Divide; the FWS determined that these birds comprise a distinct population segment (DPS) and in 2014 listed the DPS as threatened. The western yellow-billed cuckoo depends on extensive riparian woodlands dominated by cottonwoods and willows as habitat for both breeding and foraging. Western yellow-billed cuckoos occur at least occasionally in twelve western states and southern British Columbia, Canada. However, FWS has found that the species no longer breeds in western Canada or the northwestern United States (Washington, Oregon, and Montana) (FWS, 2014a).

The FWS also proposed a rule for designation of critical habitat for the western yellow-billed cuckoo in 2014. The proposed habitat units are blocks of cottonwood and willow-dominated riparian habitat, each greater than 200 acres in extent and 100m in width. FWS proposed 80 units across nine western states; no critical habitat units were proposed in Washington, Oregon, or Montana (FWS, 2014b). To date the proposed critical habitat rule has not been finalized.

The project site lacks the riparian vegetation that would attract or support the cuckoo.

Ute ladies'-tresses

Ute ladies'-tresses is a perennial orchid which has been documented in sporadic locations across a wide area of interior western North America. This long-lived species is typically found in lower-elevation wetland and riparian habitats dominated by herbaceous vegetation. As of January 2019, NatureServe.org has recorded 63 known occurrences or populations across the range of the species, which currently includes Colorado, Idaho, Montana, Nebraska, Nevada, Utah, Washington, Wyoming, and British Columbia; these populations are found at elevations ranging from 720 feet in Washington to 7000 feet in Utah. This orchid grows to 50-60 cm in height and, when in flower,

culminates in a spike of ivory-colored blossoms. While typically flowering from late July through August, range-wide the species may bloom from early July through late October. However, the life cycle of this species includes dormant, and vegetative (non-flowering) stages; depending on site productivity and conditions, individual plants may develop inflorescences or remain in a vegetative state through the summer. Thus, established plants are not identifiable every year (Camp and Gamon, 2011).

The varied habitats for this species include moist or wet meadows, alluvial banks, gravel bars, floodplains, river terraces, lake and reservoir shorelines, oxbows, and abandoned stream channels. Two characteristics common to this diverse array of habitats are early- to mid-seral plant communities with limited vegetation cover and competition, and sites that maintain moist to wet soil conditions throughout the growing season. Periodic disturbance events appear key to developing habitats in the early-to mid-successional stages needed by this species. Some anthropogenic disturbance mechanisms may be favorable; over half of this species' documented populations are in sites where the hydrology is influenced by dams, reservoirs, or supplemental irrigation (Fertig *et. al.*, 2005). Leading threats to this species include competition from invasive species, vegetation succession, and changes to hydrology that modify its habitat conditions. The FWS listed the species as Threatened in 1992. No critical habitat has been designated (FWS, 2019; NatureServe, 2019; Fertig *et. al.*, 2005).

In Washington, the species has been documented in the central to north-central region of the state, within the Okanogan, East Cascades, and Columbia Plateau ecoregions. As of January 2019, the Washington Natural Heritage Program has records of occurrences in four counties (Chelan, Okanogan, Grant, and Douglas), at sites ranging from 720 to 1,830 feet in elevation. Three of the known populations are established on stabilized gravel bars along the Columbia River shoreline, in Chelan County about thirty miles downstream of the project area. In Washington this species is most reliably found flowering from mid-July through the end of August (Camp and Gamon, 2011; Washington DNR, 2019b).

Shell conducted botanical surveys of the project area during May and June of 2017. In 2018, CTCR conducted surveys for traditional cultural plants in mid-April, then followed up with late-season surveys on July 18 and 20. Neither Ute ladies'-tresses nor any other species of *Spiranthes* orchids were recorded during any of these surveys. However, most of the search effort was conducted prior to the flowering season for Ute ladies'-tresses, with only the final round of surveys during the period when the species was likely to be in flower and most easily identified.

As previously described, the project area is dominated by upland, shrub-steppe habitat that would be unsuitably dry for this wetland-affiliated species. However, there are limited areas within the project boundary where marginally suitable habitat conditions

for this species exist; these include the wetland area near the upper reservoir tank, the intermittent drainage, and the shoreline of the lower reservoir. Parts of the depressional wetland may maintain the moderate to high soil moisture conditions required by this species throughout the growing season; however, this wetland is located near 2260 feet elevation, which is above the highest known occurrences (1830 feet) for this species in Washington. While the Rufus Woods Reservoir shoreline within the project boundary is extremely rocky and steep and supports minimal riparian vegetation, there might be areas of the shoreline with appropriate conditions for Ute ladies'-tresses.

3.3.4.2 Environmental Effects

Bull Trout

Our Analysis

Bull trout are not found in Rufus Woods Lake and will not be for the foreseeable future, unless fish passage facilities were to be constructed at Chief Joseph Dam. There are currently no plans to do so. Therefore, we find that the proposed project would have no effect on the bull trout.

Western Yellow-billed Cuckoo

Our Analysis

Trends in recent decades suggest that individual migrating birds could pass through the general project area at infrequent intervals (FWS 2014a, 2014b). However, no suitable breeding or foraging habitat (extensive willow-cottonwood riparian woodlands) exists in or near the project area. Given their rarity and the lack of suitable habitat in the project area, western yellow-billed cuckoo are not likely to occur in the project area and would not be affected by project construction or operation.

Ute ladies'-tresses

Shell Energy does not propose any measures specific to Ute ladies'-tresses. However, Shell proposed to conduct pre-construction surveys for sensitive plants and take steps to avoid affecting these plants if possible.

Interior and Washington DFW recommend that they as well as CTCR be invited to participate in the pre-construction sensitive plant surveys, and that ESA-listed plants be included among the species searched for during the surveys. Interior recommends late-summer surveys for presence of Ute ladies'-tresses in the area of the proposed structures and lower reservoir.

Our Analysis

There are no records of Ute ladies'-tresses in the immediate vicinity of the proposed project and available habitat in the project area appears marginal and unlikely to support the orchid. While botanical surveys conducted during 2017 and 2018 did not detect the species, the survey efforts were largely outside the season when Ute ladies'-tresses is in flower and easier to recognize. Thus, there remains a small possibility that the species could be present yet undetected in the project area.

Shell's proposed pre-construction surveys for sensitive plant species would include both early spring and mid-summer surveys. Because in this region the orchid most reliably blooms from mid-July through the end of August, Shell's proposed surveys could miss Ute ladies'-tresses plants. Surveying the riparian areas that would be subject to disturbance between August 1 and August 31[27] would increase the probability of detecting the plants, if they are present. This information could then be used to identify steps to avoid adversely affecting the populations, such as adjusting the location of the penstock or power platform.

Should Ute ladies'-tresses be present in the project area, it is more likely to be impacted by competition from exotic plants than by project construction. Competition from invasive weeds has been identified as a leading threat to Ute ladies'-tresses, and the 2017 and 2018 plant surveys have documented a variety of invasive plant species in or near the project area, including Scotch thistle, a species capable of invading wetter areas. Shell's measures to prevent and control invasive species would help prevent colonization of invasive species that might outcompete Ute ladies'-tresses.

Interior requested that we identify and address any impacts to the Rocky Reach Reservoir Ute ladies'-tresses populations from any hydrologic fluctuations associated with the proposed project. Those populations are located over 30 river-miles downstream of the proposed project, below both the Chief Joseph and Wells hydroelectric projects. Operation of the Pearl Hill Project would have no effect on flows in the Columbia River because of the very small size of the project relative to volume of flow in Rufus Woods Lake. Therefore, project operation would not affect the Rocky Reach Reservoir Ute ladies'-tresses populations.

We conclude that licensing the project, with the measures discussed above, may affect, but is not likely to adversely affect Ute ladies'-tresses.

[27] *See* telephone conversation memorandum between Commission staff and Steve Lewis, U.S. Fish and Wildlife Service, Central Washington Field Office, filed with the Commission on May 30, 2019.

3.3.5 Recreation and Land Use

3.3.5.1 Affected Environment

Recreation in the project vicinity centers on water-based recreation such as fishing, boating, swimming, waterskiing, and waterfowl hunting at Rufus Woods Lake and the Columbia River downstream of Chief Joseph Dam, as well as hunting of mule deer, pheasant and other game in the uplands area. Rufus Woods Lake is a regional, year-round angling destination known for its walleye and rainbow trout fishery.

The Corps manages numerous recreation facilities on or near Rufus Woods Lake that accommodate these uses. Brandt's Landing is the closest facility to the project site, located about 2 river miles downstream from the proposed power platform site and includes a picnic area and interpretive trails. Bridgeport State Park is located about four river miles downstream of the proposed power platform on the north shore of Rufus Woods Lake. The 673-acre park is managed by the Washington State Parks and Recreation Commission PRC (Washington SPRC) and has facilities for camping, sheltered picnicking, swimming, boating access and docking. Based on most recent recreation use data from the Washington SPRC from 2009, this area generally receives about 70,000 visitors a year. Directly across the lake from the state park is Pumphouse Road Access Area which provides informal boat access to the lake.

Upstream, between the proposed power platform site and Grand Coulee Dam, are eight river/lake recreation access sites, with the closest access site to the proposed project being the Timm Brothers Ranch Boat Launch, located about 12 miles away on CTCR land. CTCR is planning to develop recreation sites on reservation land on the north side of the river at the Timm Brothers site and two other sites further upstream - the Net Pens Recreation Access Area and Spirit Ridge. Grand Coulee Dam, located about 40 river miles upstream of the project site, impounds Franklin D. Roosevelt Lake which is part of the Lake Roosevelt National Recreation Area, a significant recreation attraction providing numerous opportunities for boating, swimming, fishing, camping, canoeing, hunting and other recreational activities.

There are no formal recreation facilities in the immediate project area and the shoreline of Rufus Woods Lake within the proposed project footprint is not used for access to the lake. Recreational uses of the project area primarily include boating and fishing on Rufus Woods Lake in the vicinity of the proposed power platform and hunting on Washington DNR lands that would be occupied by the proposed penstock and upper reservoir.

Project lands are currently grazed under an active grazing lease issued by Washington DNR. This 10-year lease, which expires in 2021, does not preclude public

access for hunting, fishing, non-consumptive wildlife uses, and other activities (Washington DNR 2011; 2012). Existing Douglas County Road L is used to access these public lands. Several all-terrain vehicle (ATV) trails cross through the project site but these trails are used by the lessees rather than the general public.

3.3.5.2 Environmental Effects

Construction of the project would require closing off a small area along the shoreline of Rufus Woods Lake from the boating public and the remaining project lands for construction of the upper reservoir tank and penstock to maintain public safety. Recreation in areas outside the immediate construction zone could be temporarily affected by increased traffic, noise, and dust. Temporary closures of Road L and other areas where the penstock and upper reservoir tank would be constructed, would require hunters and other recreationists that use Washington DNR land, to modify their activities to avoid the project area. Once project construction is complete, existing use of Road L and project lands should resume unimpeded.

During project operation, the boat barrier around the power platform would eliminate recreational boaters from a small portion (less than .01 percent) of Rufus Woods Lake's 8,022.5 acres; however, as indicated above, all other project lands would be open to public use.

To minimize disturbance to recreationists in the project area, Shell proposes to notify Douglas County, the Corps, and Washington DNR about construction-related closures, so that they could plan their use of the area accordingly. Shell also proposes to place signs along Road L near the project site to inform the public of temporary road closures and direct them around the construction area.

During both construction and subsequent operation, Shell would install navigation safety lights on the boat barriers to keep boats a safe distance from project shoreline facilities. These safety provisions would be included in Shell's general construction plan and project safety plan. No entity has recommended any mitigation or enhancement measures for recreation at the project.

Our Analysis

Because Rufus Woods Lake is large and existing recreation sites are several miles from the proposed project site, project construction would have only minor, indirect impacts to water-based recreation. Adverse effects on any land-based recreation in the project areas also would be minor and temporary (during the 6- to- 9-month construction period), given the small area affected and because existing use and access would be restored once all construction is complete. Shell's notification and signage would help

potential users plan their activities and ensure their safe use of the project area during construction.

Shell's proposed navigational barriers and lighting would alert boaters to the project's shore facilities and keep them at a safe distance, minimizing potential adverse effects on boaters during operation.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Section 106 of the NHPA requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on the undertaking. Historic properties are those that are listed or eligible for listing on the National Register. In this document, we also use the term "cultural resources" for properties that have not been evaluated for eligibility for listing on the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic. Section 106 also requires that the Commission seek concurrence with the state historic preservation office (SHPO) on any finding involving effects or no effects on historic properties, and consult with interested Indian tribes or Native Hawaiian organizations that attach religious or cultural significance to historic properties that may be affected by an undertaking.

Area of Potential Effects (APE)

Pursuant to section 106, the Commission must take into account whether any historic property could be affected by the issuance of a proposed license within a project's APE. The APE is determined in consultation with the SHPO and is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.

The direct APE covers areas that could be subject to ground-disturbing activities and conforms to the proposed project boundary, which incorporates the proposed upper reservoir tank, the penstock, power platform, transmission line, and access road. The indirect APE is the area that would be indirectly affected through visual or sound effects. Shell defined the indirect APE based on topographic features that would effectively screen views of the project facilities. Figure 12 shows the direct APE and indirect APE.

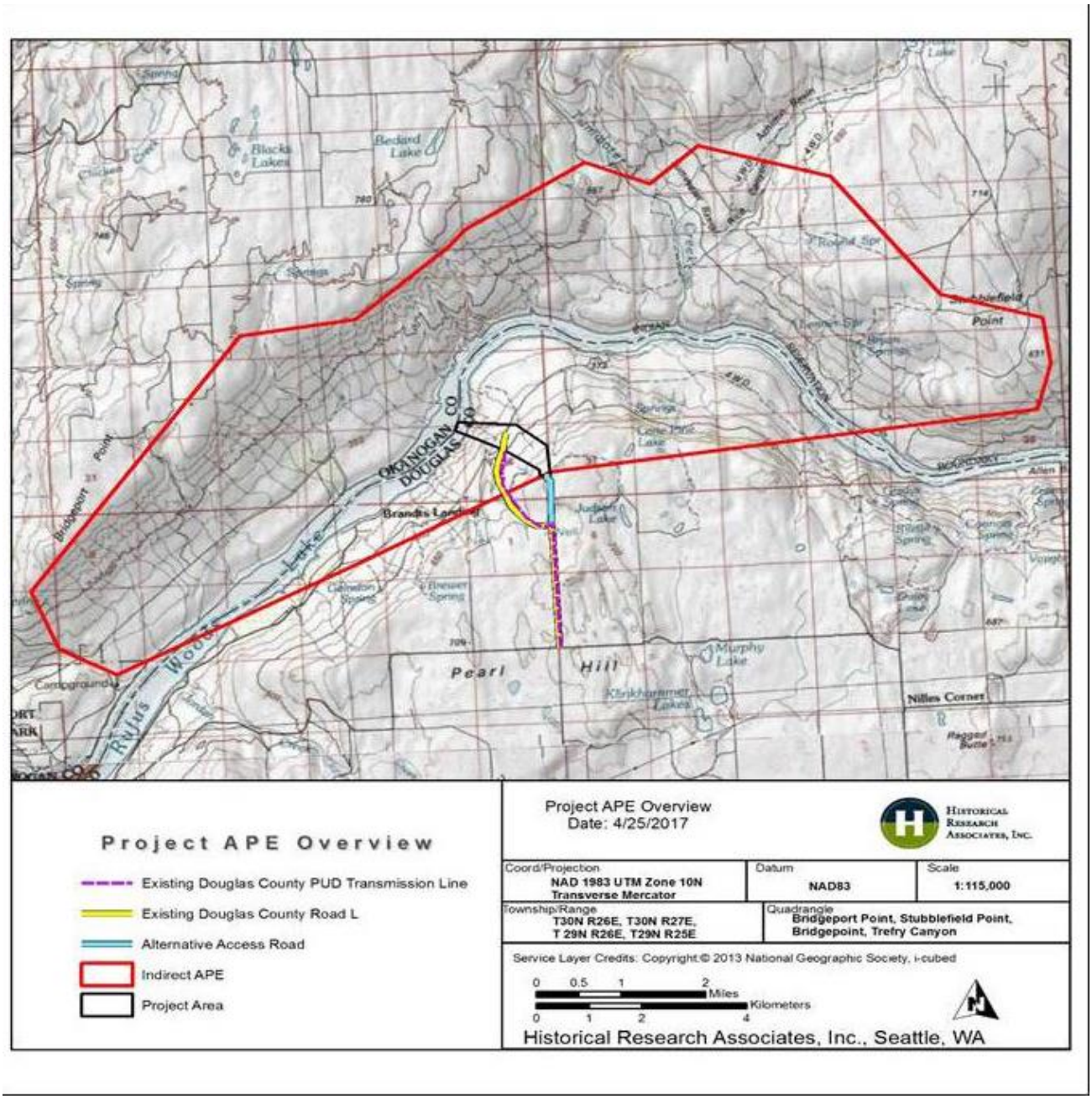

Figure 12. The direct APE (outlined in black as the project boundary) and indirect APE (outlined in red) for the Hydro Battery Pearl Hill Pumped Storage Hydroelectric Project (source: HRA 2017).

The Washington SHPO concurred with the APE in a letter dated May 10, 2017.[28]

Cultural and Historical Background [29]

Paleo-Indian Period (14,000-8000 B.P.)

Big game hunters were present in eastern Washington along the Columbia River at the end of the Pleistocene and the start of the Holocene (Mehringer and Foit 1990). It appears that the earliest identified occupants of north-central Washington were relatively mobile. Sites containing Paleo-Indian projectile points, including large fluted points or large stemmed points, may be found almost anywhere in the landscape, but site densities are highest near rivers and large permanent lakes. Single occupation sites dating to the Paleo-Indian Period are not known in the vicinity of the project but may be present, especially on the mid-level river terraces (due to channel cutting), and near upland springs or creeks. However, many Paleo-Indian sites may have been obliterated by the severe glacial processes around the end of the Pleistocene (Galm 1994). Therefore, the small, extant sample of Paleo-Indian sites in the region may be biased.

Early Archaic/Coyote Period (8000-5000 B.P.)

Archaeological evidence of Plateau culture dates to the Early Archaic/Coyote Period. Subsistence during this time period was primarily from foraging, but salmon was also a seasonal food source, especially at favored locations where they were relatively easy to obtain. Pouley (2010) describes a shift from broad spectrum to optimal foraging, following improved exploitation and understanding of Plateau environments. There is no incontrovertible evidence of pithouse[30] structures or other architecture during this era in the project area, however, Pouley provides evidence that many pithouses are likely to have eroded away, while others persist on intact but fragile landforms which may date to this period. Excavations at other sites in the region suggest that habitations tended to be built on the ground surface without any substantial subsurface pit (Connolly 1999). Early Archaic projectile points found in the area are typically leaf-shaped (Cascade) or large corner or side-notched forms (Matson and Coupland 2009:82). Point types reflect widespread mobility or exchange networks.

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[28] *See* letter dated May 10, 2017, from Robert G. Whitlam, State Archaeologist, to Kent Watt, Shell Energy North America, included in Attachment H of the Final License Application filed with the Commission on November 1, 2017.

[29] The culture historic context is taken and generalized from Dampf (2017a, 2017b and 2017c); Dampf and Tarman (2017), and Dampf and Shultze (2017).

[30] Pithouses were habitations consisting of a pit dug in the earth and roofed over.

Middle Archaic/Salmon and Eagle Period (5000-2000 B.P.)

Most researchers characterize the start of the Middle Archaic as an era of cultural change on the Plateau shifting from foraging to collecting economic systems. Compared to the Early Archaic/Coyote Period, cultures were becoming more riverine-based (Ames et al. 1998). By this era, anadromous fish runs were being effectively exploited at prime fisheries allowing surplus and storage. Pithouse villages developed where people accumulated in winter to utilize these stored resources. This reduction in mobility may have led to population growth during the Middle Archaic. Middle Archaic projectile points decrease in size gradually over time and reflect a diversity of stemmed and corner-notched point types. Ames et al. (2010) have demonstrated that this diversity is in part due to the contemporaneous use of both atlatl-thrown darts[31] and the bow and arrow.

Late Archaic/Turtle Period (2000-200 B.P.)

The Late Archaic or Turtle Period witnessed the intensification and refinement of local economies by indigenous populations. Pithouse villages became larger and more fixed, and social nucleation[32] occurred. Intensive gathering and food processing sites, such as the root fields at Chewelah (Harrison 2012), were firmly established by this time. The ethnographic pattern of aggregated winter villages and dispersed spring, summer and fall task groups became firmly established during the Late Archaic. Toward the end of the Late Archaic/Turtle Period, longhouses[33] and mat lodges[34] came into favor, while pithouses were no longer used (Rousseau 2004).

Stable and more populous villages created population stress, which contributed to the development of social and religious structures to accommodate the need for social hierarchy and leadership roles. Some have suggested a rise in intergroup competition and warfare during the Lake Archaic/Turtle Period, indicated by fortified or concealed settlement locations on islands and in tributary canyons (Chatters 2004:69). One of the best examples of this is the fortified site near the confluence of the Similkameen and

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[31] An atlatl is a stick that uses leverage to achieve greater velocity in dart or spear-throwing.

[32] Social nucleation refers to a settlement pattern consisting of a closely clustered group of dwellings.

[33] Longhouses were long, proportionately narrow, single-room communal houses consisting of a wooden frame covered with large woven mats.

[34] A mat lodge consisted of a frame covered with matting or brush.

Okanogan rivers to the north of the project area called "heaped up stone place" (Sali'lx) (Thomson 2013).

It has long been thought that the bow and arrow was first introduced during the Late Archaic and was still used along with the atlatl until about 1000 B.P. (Rousseau 2004) when the atlatl was replaced (Andrefsky 2004). Ames et al.'s (2010) analysis supports the waning of atlatl use during the Late Archaic but a few dart points were found to be still in use to the end of this period. The projectile points in collections from the Late Archaic Period represent a mixture of atlatl dart and arrow-accommodating forms and are generally small to medium sized corner or side-notched varieties.

Ethnographic History

The ethnographic historic period of the project area is generally regarded as the transition from late prehistory to the approximate point in time when Native Americans were placed on reservations. The APE lies within the traditional territory of the Southern (*Sinkaiekt)* Okanogan, a Salish-speaking band of the "Middle Columbia River Salish" group.[35] Like other native groups in the region, the Okanogan employed a diversified hunting-gathering-fishing subsistence strategy based on seasonal exploitation of resources. Their yearly cycle would have centered on the Columbia River, though upland locations were also well-used. A main staple of subsistence along the Columbia River, was salmon. The major fishing season for anadromous and freshwater fish lasted from early spring until late fall. Native groups also gathered and processed root foods, such as camas, bitterroot, and "skolkul," starting in early spring. Harvesting plants was a time for social gathering, sharing of resources, and ceremonies (Hunn 1990). Plants were harvested for medicinal purposes, as well as for general consumption.

The peoples moving through the vicinity of the APE likely also depended on game, especially after the introduction of the horse in the late 1700s to early 1800s which allowed for long-range hunting (Chalfant 1974; Teit 1928). Although land mammals were hunted year-round, fall was the prime season for deer and elk. Middle Columbia groups preferred black-tailed deer to the mule deer. In the early 1800s, it was noted that the preferred hunting method for larger game involved surrounding the prey, then slowly tightening the circle until clear shots with bow and arrows could be made (Hopwood 1971). Medium to smaller mammals were either actively hunted or trapped.

[35] Miller (1998) classified the Sinkayuse with the Wenatchi, Entiat, Chelan, and Methow bands, to the northwest on the opposite side of the Columbia River, and with the Southern Okanogan Nespelem, and Sanpoil to the north, into the "Middle Columbia River Salish" group.

Settlement areas centered on major rivers, tributaries, and at confluences for winter villages, and in a variety of environments for temporary campsites at seasonal resources areas. Sheltered areas and plentiful firewood or driftwood resources were important in selecting village locations (Hollenbeck and Carter 1986). The largest villages were centered on the Columbia River. Dwellings consisted of semi-subterranean pithouses and mat lodges lined with planks, stone slabs, or mats. Trash was collected in baskets and emptied daily, far from the living area. Dwellings became more portable in the latter years, especially after the horse became available, and were made of a rectangular pole frame with tule mat coverings (Gardner 1935; Hollenbeck and Carter 1986; Smith 1947).

Post-Contact History

Euroamerican influences arrived prior to the first settlers in the area. Aboriginal travel and trade routes also became routes for Euroamerican influences. News of Spanish and Russian fur trading expeditions reached the Plateau in the 1600s and, by the 1740s, news of the horse was heard long before any were seen by the Plateau groups. With the coming of the horse, settlement and subsistence patterns changed. Greater mobility enabled groups to extend resource location boundaries. Many groups traveled to join in bison hunts in the Plains, and even joined forces as a larger Salishan confederacy composed of Sinkayuse, Wenatchee, Entiat, Chelan, and other groups (Miller 1998).

With the onset of the fur trade industry and expeditions, such as the Lewis and Clark expedition in 1805 to 1806, Euroamerican presence expanded in the nineteenth century. In 1811, representatives of the North West Company explored the Columbia River and established depots among the Colville and Lakes groups, while the Astor Company established Fort Okanogan (Kennedy and Bouchard 1998; Miller 1998). Fort Colville was established in 1825 after a verbal agreement between the Hudson's Bay Company and the Kettle Falls chief (Kennedy and Bouchard 1998). Religious missionaries soon followed, expanding from missions built on the Plains. A mission was built near Cashmere in 1872 to serve the Wenatchee, and by 1989, Jesuits established a boarding school at St. Mary's Mission near Omak (Raufer 1966).

In the mid-1850s, the U.S. government ordered Territorial Governor Isaac Stevens to conduct treaty negotiations with Native American tribes and to place these groups onto reservations, in order to free up land for settlers heading west. The Treaty of Washington in 1864 split the Okanogan territory. The June 9, 1885 treaty at Walla Walla ceded lands along the Big Bend of the Columbia River from the Salishan tribes (Miller 1998). Tensions ran high between the indigenous populations and the Euroamerican setters (Kennedy and Bouchard 1998). War between the Native American populations and Euroamericans erupted in the late 1850s.

In 1872, an Executive Order of President Ulysses S. Grant established the Colville Reservation, covering an area of 2.8 million acres between the Columbia River and the Canadian border. In 1879 and 1880, two tracts of land called the Moses Columbia Reservation (where the present day city of Wenatchee lies), north to the Canadian Border between the crest of the Cascades and the Okanogan River were established by another Presidential Executive Order for the Chief Moses tribe consisting of the Columbia, Chelan, Entiat and Wenatchi. Three years later, Chief Moses and his people agreed to either move to the Colville Indian Reservation or accept an allotment of 640 acres for the head of each family. In 1892, the north half of the Colville Reservation was removed from the reservation by the U.S. Congress. The resulting 1.4 million-acre south half represents the current Colville Reservation on which twelve tribes and bands ultimately have been placed, including the Chelan, Colville, Entiat, Lakes, Methow, Moses-Columbia (Sinkayuse), Nespelem ,Chief Joseph Ban of the Nez Perce, Okanogan, Palus, San Poil, and Wenatchi. Prior to the reservation era, the Nespelem, Lower Okanogan, and Moses-Columbia were geographically closest to the current project APE. The Nespelem and other people of the tribes of the Colville Reservation traveled through or used the area south of the Columbia River for plant gathering (Miller 1998). Ethno-historically the Moses-Columbia ranged over a large area from the Big Bend of the Columbia to east of the Grand Coulee (Banks Lake), having embraced horse culture more than other northern Plateau tribes (Ray 1933).

Spurred on by the Homestead Act of 1862 and again in 1892 by the opening of the north half of the Colville Reservation to non-Indian settlement, Americans hungry for land and looking for wealth (through minerals, timber, or agriculture) began to settle Okanogan County in growing numbers. Many aboriginal travel routes continued to be used as settlers and miners came west, and other routes were established as well (Meinig 1968). Placer mining operations could be found along the Columbia and Methow Rivers, and gold strikes occurred in the Methow valley in the 1880s. Silver and copper were also mined in the area (Oxendine et al. 2006) By the turn of the twentieth century, however, the mining boom was over, and some former mining towns were deserted (Portman 1993).

Farmers and Ranchers

Farming increased in the 1880s as farmers and ranchers began to settle in the Okanogan Valley starting in 1886 (Roe 1980). Formal surveys of the project vicinity did not begin until 1893, and it took over a decade to complete. Impatient settlers squatted on unsurveyed lands and refused to be removed by officials until eventually many squatter's rights were deemed valid. The population of Okanogan County nearly tripled between 1890 and 1900 and again by 1910 as homesteaders arrived in droves, mostly by train (Wilma 2006). By 1893, the Great Northern Railroad built a line across Stevens

Pass and the area increased in population and industry as a result. A few ranchers settled in Okanogan County after 1886, with cattle and sheep being the primary stock

State Trust Land

The Omnibus Enabling Act of 1889 enabled Washington Territory to form its constitution and State government, and become the State of Washington (United States Congress 1889). Section 10 of the Act granted millions of acres of land to the state in financial support of public institutions such as schools, state universities, other state educational institutions, and prisons. The federal government granted Sections 16 and 36 of each township to the state to support the public or "common" schools. If sections were already patented (private land) or otherwise unavailable, an equivalent amount of property, known as "in lieu" land, was granted to the State elsewhere. The property on which the APE is located (in section 36) is managed for the benefit of the Common School Trust (DNR 2019).

Previous Investigations and Recorded Resources

HRA, Shell's cultural resources contractor, reviewed archaeological site records and cultural resource survey reports on file at the Oregon Department of Archeology and Historic Preservation and HRA's reference library. These two repositories contain information about archaeological and historical research completed in the area, including inventory reports, archaeological site and historical structure forms, and National Register nominations. In addition, HRA examined General Land Office plats and other historic maps and atlases, available through online resources to locate nearby historical features.

Seven previous cultural resource investigations were conducted within a half mile of the project's APE (Hamilton et al. 2003; Salo 1998, 2009; USACE 1978, 2002; Pouley 2009; Lancaster 2010 The majority were in relation to the operation and maintenance of Chief Joseph Dam. Hamilton et al. (2003) identified two sites within the project's indirect APE. Site 45OK317 is a prehistoric habitation/open campsite consisting of sparse middens of fire-cracked rocks and charcoal scattered on a high river terrace on the north bank of the Columbia River. The site has been largely destroyed by erosion and inundation (Arthur et al. 2000a). Site 45OK318 is a cemetery/humans remains site. When originally recorded in 1976, it consisted of four prehistoric cairn burials on the edge of a low terrace on the north bank of the Columbia River (Salo and Munsell 1976b). When revisited in 2000, all four of the cairns were partially buried by soil and obscured by vegetation. Human remains were not observed, but were considered probable based on a lack of signs of vandalism and apparent intact cairns (Arthur et al. 2000b).

Pouley's work (2009) identified the Rufus Woods Lake Archaeological District (Site No. 45DT10). This archaeological district was listed on the National Register in February 1978 (Stump n.d.a., n.d.b). While the lower third of the proposed project's penstock and the power platform extend into the boundary of the archaeological district, no recorded sites that are part of the archaeological district are located within the project boundary.

Historic-period 19th century plats from the U.S. Surveyor General and other historic maps and atlases were reviewed by HRA for the presence of structures, sites, and features that might be within the APE. No historic buildings or structures are located within the project boundary.

New Cultural Resources Investigations of the APE

HRA archaeologists conducted pedestrian and subsurface surveys of the lands within the direct APE between November 15 and 17, 2016. The surveys consisted of surface inspection at transect intervals no greater than 20 meters. Ground exposures (e.g., exposed bank, trails, ditches) encountered in or outside of transects were examined closely for the presence of subsurface features and/or cultural materials. Members of the Colville Tribe accompanied HRA and observed the fieldwork.

Due to the potential for buried cultural deposits, shovel probes measuring approximately 30 cm in diameter and up to 100 cm in depth were placed approximately 25 meters apart in generally flat areas (less than 10 degrees slope) exhibiting minimal previous ground disturbance, while maintaining a more or less even distribution across the landform to ensure adequate sampling coverage. Radial probes were excavated at 5 meter intervals from probes found to contain precontact cultural materials. Given the size of known cultural resources in the vicinity and their distribution of artifacts, HRA considered subsurface testing sufficient coverage of the APE. Excavated soils were screened through 0.25-inch hardware mesh to identify any small cultural items that may have been present. A total of 49 shovel probes were excavated.

The pedestrian survey resulted in the identification of one historic archaeological site (45DO1188), one stacked rock feature of unknown age (45DO1187), and two pre-contact archaeological sites consisting of lithic scatter (45DO1186 and 45DO1185).

Site 45DO1188 consists of two earthen berms within a small ephemeral drainage oriented northeast-southwest, with stacked rock retaining walls on the upstream (southeast) and downstream (northwest) sides. The feature is situated on the proposed transmission line route and probably functioned as a dam for agricultural or ranching purposes. An unpaved, two-track road remnant, measuring 10 feet in width, begins approximately 100 feet west of Road L and travels roughly westward less than 500 feet to

the former (blown out) dam. The road segment is almost completely obscured by vegetation, and becomes indistinguishable as it extends generally southwest beyond the drainage. The road did not appear on any of the historic maps reviewed by HRA.

Site 45DO1187 consists of a stacked rock feature situated on a basalt outcrop about 40 meters northeast of the penstock route. The feature consists of at least three rocks in association, with at least two of the rocks having been placed to lean on the others. This placement cannot have occurred naturally but was done long enough in the past that lichen growth is consistent across all of the exposed rock surfaces. The feature measuring approximately 1.1 meters by 0.7 meter and 0.8 meter in height, does not appear to have historic-period purposes (e.g. rock-jack, corner marker); however, features such as this are commonly representative of Native American ritual activities and have been observed in similar settings throughout northern Washington, including in some abundance on the Colville Reservation.

Site 45DO1186 consists of two pieces of lithic debris identified on the ground surface spaced 0.5 meters apart and located 5 meters southeast of the proposed penstock route. The artifacts were observed on a relatively shallow deposit of soil on a rocky exposure along the northwest-facing slope of the canyon. The items, chunks of chert and petrified wood, exhibited small flake scars and other characteristic of cultural modification and are likely fragments of cores or shatter. A total of five probes were excavated between the surface finds and the penstock route, none of which yielded additional cultural materials. HRA conducted a close interval pedestrian survey over the site and surrounding area and observed no additional artifacts on the ground surface.

Site 45DO1185 consists of a pre-contact lithic scatter situated in the proposed location for the upper reservoir tank near the southeast corner of the APE. Pedestrian surveys over the area resulted in the identification of two flakes (i.e. debris resulting from stone tool manufacture/maintenance) on the ground surface, spaced less than 0.5 meter apart and approximately 16.5 meters north-northwest of the center of the proposed tank location. HRA conducted a close interval pedestrian survey over the site and surrounding area and observed no additional artifacts on the ground surface. A total of seven probes were excavated at 25 meter intervals inside the area; one of those seven, placed 25 meters northwest of the center, contained one chert flake. An additional 14 radial probes were placed at 5 meter intervals to define the extent of buried cultural materials and four of those probes turned up a total of 10 flakes. The site measures approximately 15 meters north-south by 5 meters east-west.

Each of these sites were evaluated for National Register eligibility by HRA in relation to Criteria A, B, C, and D.[36] Only Sites 45DO1187 and 45DO1185 were found by HRA to be possibly eligible for listing on the Federal Register. Site 45DO1185 was found possibly eligible under Criterion D due to its potential to provide important information on regional pre-contact history. Site 45DO1185, however, was not formally evaluated for eligibility at this time but HRA proposed to evaluate its eligibility if the site could not be avoided during project construction. HRA postponed making a determination of eligibility on Site 45DO1187 until a Traditional Cultural Properties study conducted by the Colville Tribe was completed because it was unclear what the property was used for.

HRA conducted archaeological testing at Site 45DO1185 in July 2017 and found that the site was possibly related to occupation sites along both banks of the Columbia River but the contents, which consisted of intermediate stage flake production but no structures, indicated that the artifacts found at this site were common to the area and not essential to maintaining the archaeological record. HRA therefore concluded that the site was not eligible for listing on the Federal Register. At the same time as Site 45DO1185 was surveyed, however, three new sites were discovered in talus slopes within and along the southern boundary of the project's direct APE. Two of the sites (45DO1232 and 45DO1233) represented cultural alteration of talus slopes (a series of circular pits within the talus material) and the third site (45DO1234) was a rock cairn. The cairn and one of the talus slope sites are completely encompassed within the direct APE, while the second talus slope site straddles the southern boundary of the project with most of this site outside of the boundary. The Tribal Historic Preservation Officer (THPO) for the Colville Tribe reviewed these newly discovered sites and determined that they likely comprise a spiritual use area for pre-contact ancestors of the Colville Tribe and could be related to the other discovered sites within the APE.[37] Based on this information, HRA contracted with the Colville Tribe in 2018 to re-evaluate pre-contact sites 45DO1185, 45DO1186, 45DO1187, 45DO1232, 45DO1233, and 45DO1234 for National Register

[36] Under 36 C.F.R. 60.4, potential historic sites must be evaluated for eligibility for listing on the National Register under the following criteria: Criterion A – association with historically important events or broad patterns of use; Criterion B – association with historically significant people; Criterion C – characteristic of the type of materials, construction, engineering or use associated with a certain time period, the work of a master, or possessing high artistic values or other distinguishing characteristics; and Criterion D – potential to provide data important in history or prehistory.

[37] *See* Letter from Dr. Michael Marchand, Chairman, Colville Business Council to J.T. Steenkamp, Shell Energy North America, filed with the Commission on December 29, 2017.

eligibility as an Archaeological and Traditional Cultural Property District (Pearl Hill TCP District) and examined each site individually for its eligibility as an archaeological site and as an element of the Pearl Hill TCP District.

Upon completion of the evaluation, the Colville Tribe recommended the Pearl Hill TCP District and all of its constituent sites as eligible for listing on the National Register under Criteria A, B, C, and D because they retain all aspects of integrity as both Traditional Cultural Properties and archaeological sites. The areas of significance under which the Pearl Hill TCP District was recommended as eligible include (1) Ethnic Heritage/Native American, (2) Exploration/Settlement, (3) Religion, (4) Social History, and (5) Archaeology/Prehistoric. Shell adopted the Colville Tribe's eligibility recommendation.[38] The Washington SHPO concurred with the CTCR's recommendation on July 7, 2018,[39] as do Commission staff and the Corps.

The primary area of significance under which the District was recommended as eligible for listing on the National Register is Ethnic Heritage/Native. The Pearl Hill TCP District was found eligible under Criteria A because it is related to a significant event – the gifting of eternity to the people of the Columbia Plateau by the Person known as "Rock." The Pearl Hill TCP District is also recommended as eligible under Criterion B for its association with the life of "Rock" who is important within the history of the CTCR; under Criterion C for embodying a well-recognized type and method of construction associated with spirituality and land use among the people of the Plateau (stacking and placement of rock features); and under Criterion D for its history of providing, or potentially providing, important information about the cultural practices and teachings of the Okanogan Tribe and other constituent tribes of the CTCR.

The Pearl Hill TCP District is recommended as eligible for its significance under Exploration/Settlement, which relates to Criteria A and D, because the Pearl Hill TCP District exemplifies broad patterns of indigenous settlement, as evidenced by the lithic debris and rock features, as well as the displacement of the Okanogan people from this area of their homelands to the Colville Reservation, and because it yields important information regarding these settlement patterns. The Pearl Hill TCP District is also

[38] *See* letter from J.T. Steenkamp, Project Manager, Shell Energy North America, to Robert Whitlam, Washington State Archaeologist, Department of Archaeology and Historic Preservation filed with the Commission on August 2, 2018.

[39] *See* National Register of Historic Places Registration Form for the Pearl Hill Archaeological and Traditional Cultural Property District included in the letter from J.T. Steenkamp, Project Manager, Shell Energy North America, to Robert Whitlam, Washington State Archaeologist, Department of Archaeology and Historic Preservation filed with the commission on August 2, 2018.

recommended for its significance under Social History, which corresponds with Criterion D, because it contains a physical record of Okanogan tribal cultural continuity from prehistoric through at least pre-reservation times. Finally, the Pearl Hill TCP District is significant as Archaeological/Prehistoric, which corresponds with Criterion D, because it has potential to provide information important within the history and prehistory of the Okanogan Tribe and the CTCR.

The Pearl Hill TCP District retains integrity because it has an integral relationship to traditional cultural practices or beliefs and the property is in a condition that allows these relevant relationships to survive. The cairn sites, rock feature complexes, and lithic materials sites within the Pearl Hill TCP District are integrally related to the traditional cultural practices and beliefs of the CTCR because they are related to subsistence and spiritual practices and their presence provides a means for the CTCR to document the existence and significance of this TCP District and its role in retaining such practices. The site also retains physical integrity because each individual cultural site within the Pearl Hill TCP District is within the original landform upon which it was constructed or deposited, and the relationship between sites is clearly defined. The rock features and subsurface cultural material remain intact. The Pearl Hill TCP District has integrity of design because it clearly shows the relationships between the Pearl Hill TCP District's constituent sites and nearby habitation areas, prehistoric and ethnographic period activity areas, and legendary places and landscapes. The Pearl Hill TCP District and its constituent sites also maintain integrity of setting because the topography underlying each site remains intact, and changes to the surrounding landscape do not detract from the "character" of the place in relation to its history. The materials from which the artifacts were found in the Pearl Hill TCP District remain in place (other than artifacts removed as part of the project's surveys). The rock feature sites maintain integrity of workmanship typical of the time in which they were made and integrity of feeling because the sites, both individually and collectively, convey a sense of the spiritual life and subsistence practices of the Plateau people which contributes to the maintenance and perpetuation of traditional practices. Finally, the Pearl Hill TCP District and its constituent sites maintain integrity of association because of its relationship with broad patterns of indigenous settlement, subsistence, and land-based spiritual practices which are respected by contemporary CTCR members.

3.3.6.2 Environmental Effects

Construction of the upper reservoir tank and penstock would result in the destruction of the site 45DO1185 (lithic scatter). The presence of all the project facilities (upper reservoir tank, penstock, power platform, transmission line, access road) would indirectly alter the integrity of setting and feeling associated with the remaining sites (45DO1186, 45DO1187, 45DO1232, 45DO1233, and 45DO1234) and the Pearl Hill TCP

District because of the modifications to the landscape and the visual and auditory impacts from project construction and operation.

Specifically, these impacts would alter the character of the Pearl Hill TCP District and compromise its ability to convey a sense of tribal spiritual and subsistence practices and its ability to maintain and perpetuate traditional ways of life. The loss of site 45DO1185 through the construction of the upper reservoir tank would compromise the integrity of association of the Pearl Hill TCP District because it would hamper the TCP District's ability to convey its association with subsistence-related and spiritual practices and traditional cultural and spiritual teaching associated with these practices. Increased accessibility to the Pearl Hill TCP District through the proposed project access road could further compromise the elements of integrity of the Pearl Hill TCP District because these new access road may invite unwanted visitation of the Pearl Hill TCP District's sites as well as previously-undiscovered cultural sites within and in the vicinity of the project area.

To minimize disturbances to cultural resources, Shell re-routed the penstock to avoid the talus slope sites; however, Shell states that site 45DO1185 cannot be avoided because it is the only feasible location for the reservoir tank. To mitigate project impacts on the Pearl Hill TCP District and its constituent sites, Shell proposes to: (1) contract with CTCR to: (a) monitor construction activities, (b) train project construction workers on how to identify and avoid sensitive cultural areas, and (c) assist in surveying, recovering, and the revegetating native plant resources in the project construction area (see section 3.3.3 *Terrestrial resources*); and (2) contribute $50,000 to CTCR to conduct a study of how resources found in the project area are related to those previously identified within the Rufus Woods Lake Archaeological District. To reduce the contrast of the existing facilities on the landscape, which should minimize the indirect visual effects on cultural resources, Shell proposes to paint above-ground project facilities in natural brown and/or grey colors chosen in consultation with CTCR and WDNR and establish vegetative screening using native shrubs and trees around the proposed upper reservoir tank and parking areas. Shell also to develop a HPMP that it would follow to address project impacts on cultural resources. On August 2, 2018, Shell filed with the Commission an outline for a draft HPMP.

CTCR states in its December 14, 2018, letter filed with the Commission that there is "no acceptable mitigation for the project's potential adverse impacts to sacred traditional cultural properties within the Project boundary."[40] However, CTCR indicates

[40] *See* letter from Andrew C. Joseph, Jr., Chairman, Colville Business Council, Confederated Tribes of the Colville Reservation to Kimberly D. Bose, Secretary, Federal Energy Regulatory Commission, December 14, 2018a.

in its December 20, 2018, letter that should a license be issued for the project despite its objections, it recommends that the Commission require Shell to file with the Commission, a HPMP prepared in consultation with CTCR's THPO and the Washington SHPO, that adheres to Commission and Advisory Council guidelines and incorporates Shell's avoidance and mitigation measures noted above, as well as any additional measures agreed upon by Shell, the THPO and the Washington SHPO during the preparation of the HPMP. CTCR further recommends an on-site archaeological resource monitor to be present during construction and that Shell develop and implement a process for addressing inadvertent discovery of cultural resources.

Our Analysis

Construction and operation of the proposed project would have both direct and indirect adverse effects on the Pearl Hill TCP District and its individual components. Construction of the upper reservoir would directly impact Site 45DO1185 by destroying most, if not all, of it. Any important archaeological information the site might hold in relation to the ethnography of the area would be lost. No other known archeological sites within the Pearl Hill TCP District would be directly affected by the project.

However, the presence of the 20-foot-high reservoir tank would be visible throughout the Pearl Hill TCP District. The remaining project facilities may be visible depending on where within the TCP District one is standing. While the proposed project facilities would not be the only landscape modification surrounding the project (e.g. existing roads, a transmission line, Rufus Woods Lake, agricultural fields), they would add to those modifications to the landscape. Therefore, as noted above, the addition of the project features on the landscape would likely degrade the experience of tribal members using the area for religious or other traditional practices. Shell's proposal to paint the tank a light brown, and plant screening vegetation around it, to blend with the surrounding landscape would somewhat reduce the visual effect but not to the point where it would be unnoticeable.

As discussed in more detail later, the project area is rural and relatively tranquil. Consequently, construction and operation noise is likely to also distract from tribal experiences and site integrity. Noise from construction activities would be temporary. The closest known archeological site is about 1,800 feet away from the power platform, Shell's noise analysis indicates that operational noise is expected to attenuate to background noise levels at a distance of 536 feet from the power platform (see our *Aesthetic Resources* discussion in section 3.3.7.2). Shell's proposed monitoring of noise levels during project start-up and employment of sound damping measures if unexpected sound resonance is identified during this time period, would ensure that noise from project operation would have only minor effects on any tribal uses and the Pearl Hill TCP District's site integrity.

The presence of the new access road could also invite unwanted use of the Pearl Hill TCP District and lead to possible damage to TCP sites. Shell's proposal to gate the access road could help to discourage such access but would probably not be a significant deterrent because it would only prevent access to project lands near the upper reservoir tank. However, because the area only receives light recreational use (primarily hunters using Washington DNR land), the new access road is not expected to significantly increase public use of the area.

While much is already known about the cultural resources on the project site, construction activities could identify new cultural sites. Including on-site monitors trained in the identification of cultural artifacts would ensure that any newly discovered sites are protected during construction.

Unavoidable adverse effects on Site 45DO1185 could be partially mitigated through data recovery and recordation. Data recovery at the site would require systematic excavation and evaluation to fully document the site's importance and significance in a regional context. Understanding the Pearl Hill TCP District's relationship to the established Rufus Woods Lake Archeological District would contribute to the knowledge of the area, and convey the Pearl Hill TCP District's importance to tribal history and help mitigate the loss of Site 45DO1185.[41]

Such data recovery and recordation efforts are typically defined and completed as part of a HPMP and implemented through a PA. While Shell has prepared an outline for a proposed HPMP which would include mechanisms to implement its proposed measures to avoid or mitigate impacts to cultural resources, it has not developed an actual plan at this point. Because the project would adversely affect the TCP District and its individual components, the Commission typically would recommend that an HPMP be developed in consultation with the SHPO, any affected land management agency, and affected tribes, which in this case would include the Washington SHPO, the Corps, and the CTCR. The HPMP would need to be completed, approved by the Commission, and implemented prior to any ground-disturbing actions that would adversely affect archaeological sites determined to be eligible for the National Register.

[41] Staff would leave it to Shell to determine how to implement the construction site monitoring and evaluation of the relationship between the Pearl Hill TCP District and the Rufus Woods Lake Archaeological District (e.g., whether to contract with CTCR).

Along with following the Commission's and Advisory Council's guidelines for the development of HPMPs,[42] any HPMP would need to include the following to be effective:

- A basic cultural and historical background section in order to give context to National Register eligibility determinations;
- A map showing the direct and indirect APE established in consultation with the Washington SHPO and CTCR;
- Complete National Register eligibility determinations (assessing for criteria A, B, C, and D) on all cultural resources located within the project's direct APE;
- Determinations of project-related effects on each of the significant archaeological cultural resources that occur in the direct and indirect APE;
- A set of measures to avoid, reduce, or mitigate any project-related adverse effects on all individual National Register-eligible cultural resources within the project's direct and indirect APE, including site-specific data recovery plans (including schedules to complete the work) for Site No. 45DO1185;
- A detailed plan for studying the relationship of the Pearl Hill TCP District to the Rufus Woods Lake Archaeological District to determine its importance in the tribal history of the region;
- A description of future construction and operation activities that would be subject to review by the Washington SHPO and CTCR (i.e., exempt, little effect, and case-by-case) and how the review would be conducted and adverse effects resolved;
- Detailed monitoring procedures during construction, including provisions to have a professional trained in the identification of cultural artifacts present during construction to monitor activities and to train project personnel in how to identify and avoid culturally sensitive areas; and
- Detailed provisions for addressing any newly discovered cultural resources.

Because of the above described adverse effects on cultural properties, Commission staff would execute a PA with the Washington SHPO (along with the Advisory Council, if they choose to participate in the PA), that would stipulate that Shell file its final HPMP for Commission approval one year after issuance of any license for the project.

[42] *See* Commission and Advisory Council on Historic Preservation's "Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects" dated May 20, 2002.

3.3.7 Aesthetic Resources

3.3.7.1 Affected Environment

The project area is characterized by a rural, relatively undeveloped and steeply sloping open landscape on the south side of Rufus Woods Lake and a more gently sloping, cultivated agricultural landscape with orchards and several small structures visible on the CTCR lands on the north side of the lake. The proposed upper reservoir area supports grassland and scattered shrubs, with several rocky scree slopes that are devoid of vegetation. A single residence is visible from the area of the proposed upper reservoir tank. Background noise levels in the project area are currently low with most noise sources emanating from wind, local vehicular traffic, farm equipment, airplanes and motorized boats.

Shell conducted a visual resource and soundscape study between December, 2016 and June, 2017 to collect ambient sound measurements and take photographs at key viewing areas and points. Four key observation points (KOPs), were established for the visual study and noise measurements were taken at six locations for the sound study. In addition to the four KOPs, Shell also identified two potential viewing areas of the project from communities and rural hunting and agricultural areas on the Colville Reservation and ambient noise levels were noted at these two locations as well. Below is a description of each viewing area and sound measurement location.

Viewing Areas

KOP 1 (Figure 13) looks north from the existing County Road L and represents a distant view of the new access road leading to the upper reservoir tank site. The view is characterized by open grassland with slopes that gently rise in the background. The foreground is dominated by the existing dirt road that travels in a relatively straight line until it curves to the left in the background. Several utility poles are visible on the left side of the road. The new access road would originate at the curve in the road and continue straight into the background.

Figure 13. KOP 1- view of new access road site. The new access road would originate at the curve in the road and continue in a straight line into the distance (source: application).

KOP 2 (Figure 14) represents a public viewpoint looking downhill in a northwest direction across County Road L toward Rufus Woods Lake along the buried alignment of the proposed penstock. The scene is characterized by open grassland and scrub vegetation with rocky outcrops and rises in the background. Several existing utility poles are visible along Road L in the distance.


Figure 14. KOP 2 – view of proposed penstock route (source: application).

KOP 3 (Figure 15) represents a public viewpoint looking southeast and uphill from Road L along the buried portion of the proposed penstock and toward the proposed upper reservoir tank location. The scene is characterized by open scrubland with grassy hill slopes in the background.

Figure 15. KOP 3 – view of location of penstock and upper reservoir tank site (source: application).

KOP 4 (Figure 16) represents a typical boater's view from Rufus Woods Lake of the area where the proposed power platform would be located as well as the hillside on which the aboveground section of the proposed penstock would be installed. The scene is characterized by steeply sloping grassy hills and rocky outcrops forming the banks of the lake, with gently rolling open grassy uplands in the background.

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Figure 16. KOP 4 - representation of a boater's view of the proposed powerhouse platform and above-ground penstock sites (source: application).

Colville Reservation Photograph 1 (Figure 17) shows a representative view of the project area looking southeast across the Columbia River from the Colville Reservation. The view is from a high point on reservation land typical of where hunting activities occur and shows a panoramic view of the entire project area including the proposed power platform site, the penstock route, and the site of the proposed upper reservoir tank. County Road L is visible traversing through the middle ground of the scenery.


Figure 17. View of project site from Colville Reservation (source: application).

Colville Reservation Photograph 2 (Figure 18) shows a representative view of the project area looking east toward the proposed project area from the Colville Reservation orchard on the northwest side of Rufus Woods Lake. Several pine trees and scrub brush are visible in the foreground with orchard trees in the middle ground, and the steep grassy slopes, plateau and gently rising hills in the visible in the background where the proposed penstock and upper reservoir tank would be located.

Figure 18. View of proposed penstock and upper reservoir tank site from the Colville Reservation (source: application).

Sound Measurement Locations

Sound measurements were taken at six locations within the project boundary: at the intersection of County Road L and the proposed access road, at the proposed reservoir tank (labeled West Wetted Edge), where the proposed penstock crosses County Road L, in the proposed laydown area, at the point where the proposed penstock crosses the intermittent stream drainage, and at the Columbia River's edge near the proposed power platform (Figure 19). Measurements were recorded in dBA[43] using a handheld digital sound level meter over a 2-minute period. The sound level meter was pre-calibrated and had an accuracy of +/- 1.5 dBA and ranges in measurements of 30 to 130 dBA. The data suggest that existing noise levels vary primarily due to wind levels, wildlife use, agricultural activities, and Corps dam operations. Ambient data collected within the proposed project boundary varied from an average 38.5 dBA to 53 dBA (Table 7). The

[43] A-weighted decibels refers to the relative loudness of sounds in air perceived by the human ear. As an example, a sound of 25 A-weighted decibels approximates the loudness of a person whispering in a quiet room.

highest measurement of 75.6 dBA was recorded during a sustained wind event in an exposed location. The lowest measurement of 38.6 dBA was recorded on Road L while no winds were present, and habitat containing wildlife (i.e., birds) was minimal.

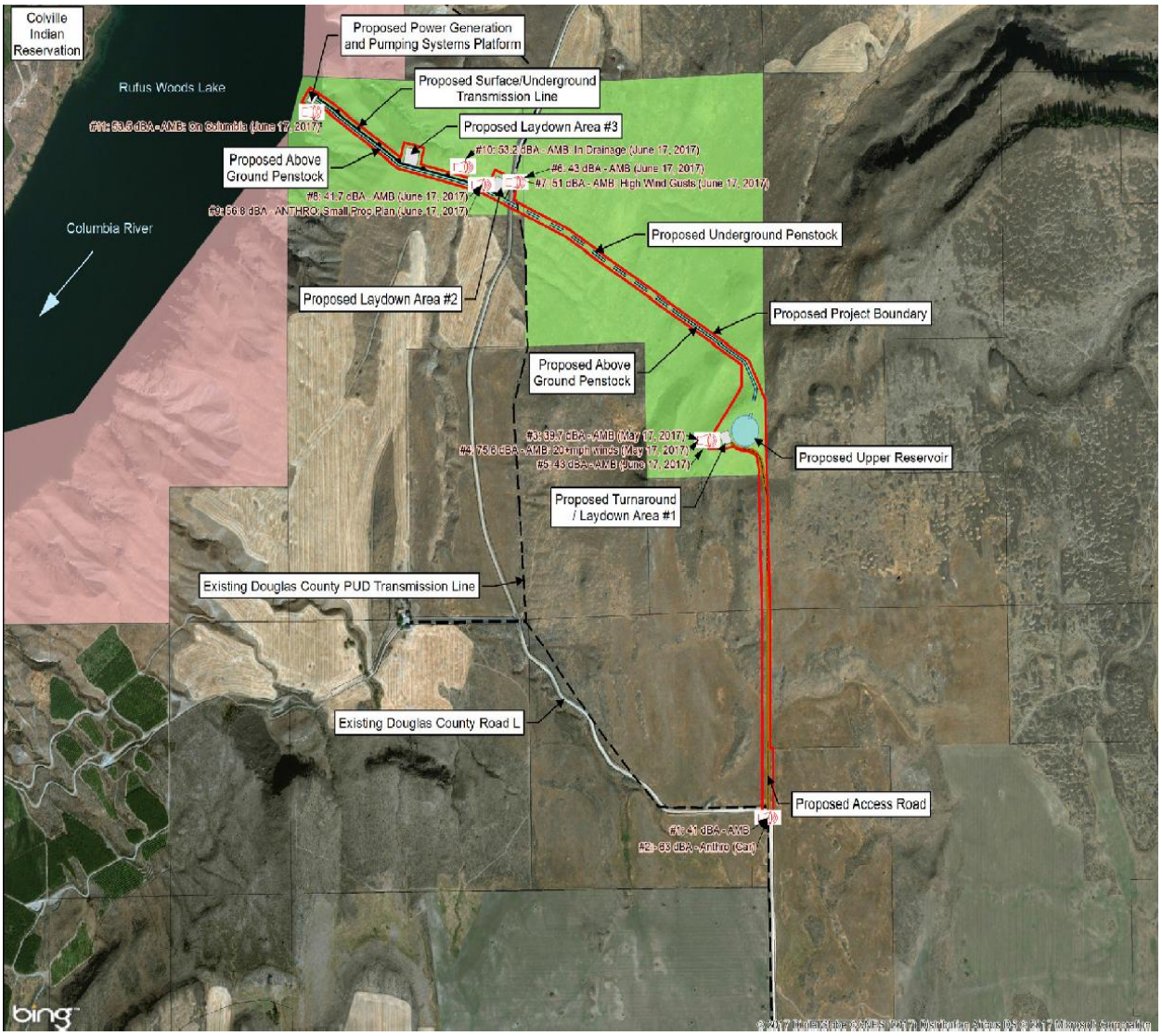

Figure 19. Locations of ambient sound recordings for the Hydro Battery Pearl Hill Pumped Storage Hydroelectric Project sound study (source: application).

Table 7. Ambient noise levels measured at the Pearl Hill project site (source: application)

Location	**Noise (dBA)**		
	Ambient	**Wind**	**Anthropogenic (Max)**
Intersection of proposed access road and Road L	41.1		63.4 Pick Up Truck
West Wetted Edge (May 2017)	39.7	75.6 (gusts 20+ mph)	
West Wetted Edge (June 2017)	43.3	51.8 (gusts 10+ mph)	
Crossing of Penstock and County Road L	38.5	43.7 (gusts 10+ mph)	
Mid-point Laydown Area	38.6	41.3 (gusts 10+ mph)	56.8 Cessna aircraft
Crossing of Penstock and Stream Drainage	53.2		
Edge of Columbia River	53.5		

The region in which the proposed project is located is rated EDNA Class C. According to Washington State Noise Control Laws, the maximum noise levels for Class C is 70 dBA (Washington State Legislature 2003). With the exception of the measurement during high winds, all measurements were under the maximum noise limit. During Shell's field visit to the Colville Reservation visual observation sites, it was noted that background noise in these areas was low, but irrigation pumps could be heard from the orchard from along the river.

3.3.7.2 Environmental Effects

Visual Effects

Some adverse visual impacts would occur during construction and operation of the project due to the introduction of developed facilities in an area largely free of development. Project construction activities would result in temporary changes in the visual landscape. The proposed upper reservoir tank, the above-ground penstock, power platform, and the new access road, would result in permanent changes to the visual landscape.

To minimize visual effects, Shell proposes to: bury approximately 40 percent of the penstock, bury or attach the project transmission line to the above-ground portions of the penstock, paint the upper reservoir tank a light brown color to blend with the predominant landscape colors, and round cut and fill slopes of the proposed access road

to better blend with the rolling character of the surrounding landscape. Shell also proposes to plant screening vegetation around the upper reservoir tank and parking area to minimize their visibility.

Our Analysis

Land-disturbance would create dust and vegetation clearing in a rural area with relatively little disturbance. Once constructed certain project facilities would be clearly visible to nearby landowners, recreational boaters on Rufus Woods Lake in the vicinity of the project, and CTCR members engaged in orchard operations, subsistence hunting and other cultural practices (see section 3.3.6).

However, given the large vistas and scale of the project, the changes would be minor. The lower portion of the penstock would be above-ground and would be easily visible from the lake and from reservation lands across the river. The upper portion of the proposed penstock (above elevation 1,400 feet) would be buried, and its corridor would be largely hidden from view after revegetation of disturbed areas. The 20-foot tall reservoir tank would be largely screened by existing topography except for those using County Road L and engaged in agricultural practices, hunting, or other cultural practices on lands adjoining the project. Available data indicates that such use is light. Security and navigation lighting for the project would add night-time light pollution where none currently exists and would highlight the platform at night. A visual rendering of the proposed project is provided in Figure 21.

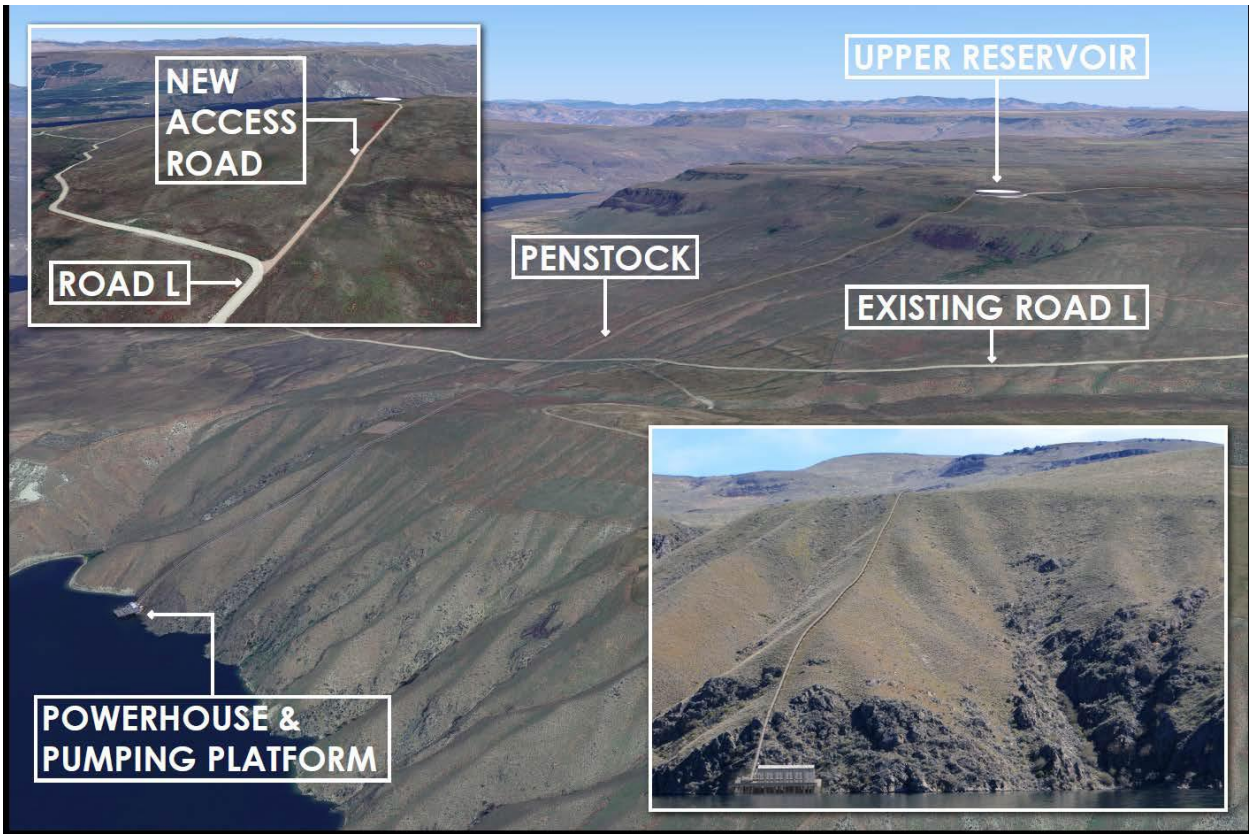

Figure 20. Visual rendering of what the completed project is anticipated to look like, with the buried penstock section and revegetated construction work areas (Source: application).

Shell's proposal to bury most of the penstock, bury or co-locate the transmission line with the penstock, paint the reservoir tank to blend with the landscape, and quickly revegetate disturbed areas would minimize visual effects to the extent practicable. While adding vegetation screening (e.g. trees and shrubs) around the upper reservoir tank would likely help obscure the tank from view, such vegetation would take time and add elements that are not natural to the existing landscape. In order to screen the upper reservoir tank, trees would need to be planted around the tank's perimeter and, depending on the species of tree, it could take up to 15 years before the trees are of sufficient height to fully screen the 20-foot-high reservoir tank. The presence of tall trees around the tank could also be a detriment to the greater sage-grouse, a Washington state-designated threatened species, because these trees could serve as perches for bird species that prey on the greater sage-grouse (see section 3.3.3.2, *Terrestrial Resources, Wildlife Species of Conservation Concern and Significant Wildlife Habitats*).

Noise Effects

There would be a temporary increase in noise levels from construction activities and increased traffic to the project area. Proposed power generating and pumping equipment would generate noise during project operation. This noise would be particularly noticeable to boaters on adjacent potions of Rufus Woods Lake and to recreationists using adjacent river shorelines and uplands. The noise effects would be most pronounced on days with little wind and calm conditions because the noise would emanate from the open air power generating and pumping platform on the shoreline.

To reduce noise impacts from the generating and pumping equipment, Shell proposes to design the generating and pumping equipment to meet the maximum permissible environmental noise standards set by the state and outlined in the Douglas County noise code (Washington Administrative Code 173-60-040; Douglas County Code 8.04.090), which would be 70 dBA. Because unexpected resonance could occur during project operation that could exceed state noise standards, Shell proposes to test the generating and pumping equipment during the first several weeks of project operation to ensure that the state standards are met at the Washington DNR property boundary on the Douglas County side of Rufus Woods Lake. If sound levels exceed the noise standards, Shell would deploy baffling or noise attenuation measures, which would likely include wrapping equipment in insulation although other forms of sound attenuation might be necessary depending on the level of noise.[44]

Our Analysis

The ambient background noise levels along the Columbia River were measured and recorded at the project site to be 53.3 dBA. The distance at which the turbine noise output would fade into this background noise level is calculated to be at 563 feet from the platform location. Thus, based on Shell's modeling results, noise created by the project generator and pumps would be most noticeable to recreationists on Rufus Woods Lake that are closer than 563 feet from the power platform. Each turbine is expected to produce 92 dBA of noise at a distance of 3.28 feet. Each pump is expected to produce 90 dBA at this same distance. Assuming all pumps are running concurrently, the combined noise output would be 98.2 dBA at 3.28 feet. Noise levels are expected to attenuate to 65 dBA at 150 feet away which would be within the state's standard of 70 dBA. Because the nearest resident is located across the river about 3,100 feet from the generating

[44] *See* telephone conversation memorandum between Commission staff and J. T. Steenkamp, Project Manager, Shell, dated May 24, 2019, and filed with the Commission on June 4, 2019.

platform, noise from project operations are not expected to reach any of the nearest residences.

While noise levels are not expected to exceed state standards, it is possible that the project pumps and generators could create some unexpected resonance effects that would be audible to nearby recreationists or CTCR members within the Pearl Hill TCP District and negatively affect these users' aesthetic experience. Shell's proposal to test sound levels during the initial start-up period of project operation and employ sound damping measures, if necessary, would ensure that any unexpected sound effects are minimized.

3.3.8 Socioeconomic Resources

3.3.8.1 Affected Environment

As of 2016, the population of Douglas County was 41,319 (Data USA 2017). Towns within a few miles of the project site include Bridgeport (population 2,448) in Douglas County and Pateros (population 768), Brewster (population 2,471), Okanogan (population 2,570), and Methow (population 57) in Okanogan County. The Colville Reservation, located across the Columbia River from the project site, has a population of 5,760 and includes the town of Nespelem (population 214). The nearest major urban area is Wenatchee, located in Chelan County about 50 miles southwest of the project site. According to U.S. Census Bureau demographic data, most of the population in Douglas County is white (71.2 percent). Other races/ethnicities in Douglas County include Hispanic or Latino (30.9 percent), American Indian or Alaska Native (0.9 percent), Asian (0.8 percent) African American (0.3 percent), native Hawaiian or other Pacific Islander (.1 percent), and those identifying with two or more races (4.4 percent). These demographics generally reflect those of the entire state of Washington in regard to the percentage of White or Native American residents but differ for other groups. For instance, there is a higher percentage of Hispanic or Latino residents in Douglas County than statewide (30.9 percent versus 12.3 percent, respectively). Asian Americans and African Americans comprise a larger percentage of the population statewide (3.7 percent and 8.1 percent, respectively) (U.S. Census Bureau 2018.) For Okanogan County, which is adjacent to the project area and includes the Colville Reservation, most of the population is white (65.7 percent) but there is a larger percentage of American Indians or Alaska Natives (9 percent) and a lower percentage of Hispanic or Latino residents (19.7 percent) than in Douglas County. In Nespelem, the percentage of American Indian residents is 78.4 percent (Data USA 2017).

According to the U.S. Census Bureau (2016), there were 16,226 housing units in Douglas County in 2004, 72 percent of which were occupied between 2010 and 2014. Median value of owner-occupied housing was $200,800, while median gross rent costs were $782 (U.S. Census Bureau 2016). City-Data (2016) reported that Douglas County median house or condo value in 2013 was $196,257, compared to a statewide median of

$250,800. In 2000, the U.S. Census Bureau reported 2,767 housing units in the Colville Reservation in 2000, with a 33 percent owner-occupied housing rate (U.S. Census Bureau 2000). City-Data (2016) reported that the Colville Reservation median value for a house or condo was $160,213. Between 2010 and 2014, 14,140 households were reported in Douglas County with an average of 2.75 persons per household. Stability was high, with 87 percent living in the same house for more than one year.

In 2016, the median household income for Douglas County was $53,758, less than that of the state median of $70,979. During this same time, median household income on the Colville Reservation was $32,539 (City-Data 2016). The 2018 unemployment level for Douglas County was 6.6 percent, higher than the state level of 4.3 percent, but lower than the 10.4 percent unemployment rate on the Colville Reservation (U.S Bureau of Labor Statistics 2018). In 2013, 14.6 percent of Douglas County residents were estimated to be living in poverty, compared to 14.1 percent for the state of Washington, while 20 percent of families on the Colville Reservation were living below the poverty level (City-Data 2016).

Energy production from Grand Coulee Dam and Chief Joseph Dam and irrigation capabilities have been the primary economic drivers in the Rufus Woods Lake area, enabling agriculture, orchards, logging and aquaculture (Northwest Power and Conservation Council 2004). Apples, cherries, pears, and peaches make up the largest share of crops, but grapes for wine production are increasingly being grown. Agricultural production also creates nonfarm employment in food processing and manufacturing, fresh fruit packinghouses, and shipping. Wineries also have become tourist destinations (Washington State Employment Security Department 2015).

Educational, health, and social services employ 23 percent of workers; agriculture, forestry, fishing, hunting, and mining employ 18 percent; retail trade employs 18 percent; and professional, scientific, management administrative, and waste management services employ 16 percent of the work force in Douglas County (City-Data 2016). Educational health and social service industries employ 23 percent of residents on the Colville Reservation; public administration employs 16 percent; and arts, entertainment, recreation, accommodation and food services employ 11 percent of the Colville Reservation workforce (U.S. Census Bureau 2016).

The mean travel time to work for Douglas County residents between 2010 and 2014 was 19.6 minutes (U.S. Census Bureau 2016). For residents for the Colville Reservation, in 2000 the mean travel time to work was 23.7 minutes (U.S Census Bureau 2016).

3.3.8.2 Environmental Effects

Project construction is expected to take 6 to 9 months to complete. Shell estimates that during peak construction period, 20 to 30 personnel would be coming to the site each day, resulting in increased traffic on local roads. The influx of workers commuting to the area during construction, or temporarily relocating to the area, would result in an increase in spending on local goods and services. Shell, however, plans to hire local labor where possible. Operation of the project would be performed from a remote location; however, it is estimated that one or two full-time personnel would be needed to manage project operation.

Our Analysis

The influx of construction workers is likely to have a small but positive effect on the local and regional economy, particularly in Douglas County, because these workers would spend money locally. Shell's proposal to hire locally as much as possible would also benefit the local economy by creating more jobs in an area with a relatively high percentage of people living at or below the poverty level. Large urban areas such as Portland, Spokane and Seattle, are also likely to experience small economic benefits from the fabrication and manufacture of project components. The state of Washington would derive revenues from the long-term lease of state lands for the project and therefore receive additional money that could help fund the state school trust and other programs.

The project would not require any unusual incremental government expenditures and no residences or businesses would be displaced by the project. Existing roads used to access the project area, even during peak construction activities, are expected to be able to accommodate the additional traffic generated by up to 30 personnel since these roads are not heavily used (Douglas County Transportation 2018) and are adequate to accommodate construction vehicles and trucks bringing in materials. Housing vacancy rates in Douglas County should be sufficient to accommodate the small number of project personnel that may need to temporarily relocate to the area during project construction. This small temporary increase in local population due to the project should be easily accommodated by existing infrastructure and local government services.

3.3.9 Environmental Justice

3.3.9.1 Affected Environment

According to EPA's guidance, environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development implementation, and enforcement of environmental laws, regulations, and policies. Meaningful involvement means: people have an opportunity to participate in decisions about activities that may affect their environment and/or health; the public's contribution can influence the regulatory agency's decision; community concerns will be considered in the decision-making process; and decision makers will seek out and facilitate the involvement of those potentially affected. Section 1.4, *Public Review and Comment*, describes the process by which the Commission has afforded the public the opportunity for meaningful involvement in the licensing decision.

Three factors were used to determine if there were a disproportionate number of low-income individuals in the area of analysis: income, poverty, and unemployment. Available data indicates that there are disproportionately more individuals with low incomes living in poverty, or unemployed at the county level relative to the state of Washington. The percentages of individuals in these situations was higher on the Colville Reservation relative to county levels (see section 3.3.8, *Socioeconomics*). The area affected by the project also contains resources that are important to the CTCR in Okanogan County. Okanogan County does have greater percentages of American Indians as a whole, such that impacts from the project could disproportionately affect Indian tribes and low income and minority residents of Douglas and Okanogan counties in the area of analysis.

3.3.9.2 Environmental Effects

Project construction activities could affect environmental justice communities, primarily the CTCR and the rural communities near the project. These communities could experience increased traffic and noise and dust emissions during project construction. Cultural resources important to the CTCR would also be lost. As such, local residents and tribal people could be disproportionately affected by construction activities.

Our Analysis

We describe above the Commission's consultation effort with the CTCR (section 1.4), the efforts to identify cultural resources important to the CTCR, and the adverse effects of construction on those cultural resources (section 3.3.6). The project does

contain a number of cultural sites important to the CTCR and one of these sites would be lost by constructing the project.

Project construction would result in about 30 new jobs and, as Shell proposes, it is expected that most of those jobs would be given to local residents. This employment, however, would be short-term. Increased tax revenues from project operation might impact social programs. Quantifying the impact on county social programs, however, is not possible because many of these programs receive state and federal funding as well as county funds. If social program funding is increased, effects would benefit low-income residents and other environmental justice communities.

Shell's proposal to notify the public of construction activity and provide direction to alternate routes would minimize disruption of existing roadways. Further, use of best management practices would minimize air and noise emissions during construction, limiting effects on local residents and tribal members.

The proposed location of the project was chosen on the basis of its elevation and proximity to water needed for pumped storage project operation. The location for the upper reservoir tank, approximately 1,300 feet above the Columbia River, would provide the hydraulic head and water necessary for the operation of the pumped storage project. Shell has worked closely with the CTCR in an effort to protect cultural resources and has adjusted the location of the upper tank and penstock in an effort to avoid several cultural sites that were discovered over the course of the pre-licensing process. Therefore, we do not find that Shell selected the project location due to the economic status of the CTCR or surrounding rural community.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the project's use of the Columbia River for hydropower purposes to see what effects various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of a hydropower project, as articulated in *Mead Corp*.,[45] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA for the protection, mitigation, and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost for the project. If the difference between the cost of alternative power and total project cost is positive, the project helps to produce power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project helps to produce power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROJECT

Table 8 summarizes the assumptions and economic information we use in our analysis for the project. This information was provided by Shell in its license application or estimated by staff. We find that the values provided by Shell are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs, net investment, estimated future capital investment required to maintain and extend the life of facilities, licensing costs, normal operation and maintenance cost, and Commission fees.

[45] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 8. Parameters for the economic analysis of the Pearl Hill Project (Source: Shell, 2017, as modified by staff).

Parameter	Value
Period of analysis (years)	30
Federal tax rate (%)	21
Initial construction cost, $[a]	$16,980,300
Licensing cost, $[a]	$3,060,000
Operation and maintenance, $/year[a]	$334,400
Alternative energy value ($/MWh)[b]	$33.44
Capacity value ($/kW-year)[c]	$144.00
Pumped storage round trip efficiency (%)	70
Interest rate	1.5
Discount rate[d]	5.5

[a] From Table 2 in Exhibit A of final license application, provided in 2017 dollars, as modified by staff.

[b] Based on the Energy Information Association (EIA) Annual Energy Outlook 2017 cost of natural gas in the Pacific Census Division.

[c] Average value of the range provided by the applicant.

[d] Applicant provided different values for project construction and operation; because construction is expected to last for only a small portion of the license term, staff selected the discount rate provided for operation.

A pumped storage generating facility includes an upper reservoir, a lower reservoir, and a reversible pump-turbine unit in between the two reservoirs. For the Pearl Hill Project, a tank will serve as the upper reservoir. In generating mode, water from the upper reservoir flows through the reversible unit to the lower reservoir. The water turns the turbine, which is attached to a generator, producing electricity that is transmitted to the electric grid. In pumping mode, power is drawn from the electric grid to "motor" the unit in reverse to act as a pump, pushing water from the lower reservoir back up to the upper reservoir. Therefore, pumped storage facilities are net energy consumers. The amount of energy produced as water passes from the upper reservoir to the lower reservoir through the turbines is less than the amount of energy required to pump water back up to the upper reservoir and provide station service power.

However, one of the benefits of a pumped storage project is realized when the price of power for pumping is less than the value of generation. Typically, there are projects that can provide power at lower rates during nighttime or low-demand hours, compared to rates during daytime, high-demand hours. Such facilities can include base-load nuclear, coal, and fossil-fueled facilities, as well as renewable resource facilities powered by solar, wind, biomass, and other sources. Base-load units are typically brought online and remain operational through the course of the day because it is inefficient to bring them online and offline due to the lengthy start-up time required, and because they operate at optimum efficiency at higher loads. Therefore, the pumped storage facility can provide higher priced power during the day when energy demands are high and can use lower cost power from other facilities during the night and other periods when energy demand is low. Pumped storage facilities can also be used to store the energy produced by facilities during low-demand periods by pumping water into the upper reservoir during those periods so that it can be used for generation during higher-demand periods.

Shell intends to integrate the project with wind and solar generation facilities planned or proposed throughout Washington to provide power to pump water to the upper reservoir during nighttime (i.e., low demand) periods including weekends. The variability of the output of these facilities can be problematic to the electric grid because they can create system imbalances by themselves. Such facilities typically work best when they are located close to generating facilities that can provide system balancing capabilities, such as those provided by pumped storage facilities and gas-fired combustion turbines installed specifically to work in concert with solar and wind farms to provide system stability. Pumped storage facilities are designed to be able to change modes rapidly and can fill gaps due to wind and solar power variability.

The ability of pumped storage facilities to quickly switch between pumping and generating, as needed, provides unique benefits to the electric grid. Pumped storage facilities can provide a number of ancillary services to the grid and therefore generate additional revenues in the electric market. Among these services are spinning reserve,[46]

[46] Spinning reserve is the extra generating capacity that is available by increasing the power output of generators that are already connected to the power system. Non-spinning reserve or supplemental reserve is the extra generating capacity that is not currently connected to the system but can be brought online after a short delay.

non-spinning reserve, grid frequency regulation,[47] voltage support and regulation,[48] load following capability, peak shaving, and black-start capability.[49]

Pumped storage facilities can operate as load following or peaking power facilities and change operating modes seasonally and daily. Most hydroelectric facilities have the ability to start within minutes, if not seconds, depending upon available water supply. When in load following mode, the output of the pumped storage facility can be adjusted as necessary to meet widely varying load requirements. Shell intends to use the Pearl Hill facilities to exclusively provide ancillary services to support renewable energy generation infrastructure in the region, including wind and solar facilities located nearby.

We used a value of $144.00 per kilowatt (kW) per year for ancillary services. This represents the mean value of the revenues that Shell estimated it would receive for providing ancillary services to nearby renewable generation facilities. At the above rate, ancillary services revenues could contribute $3,456,000[50] toward offsetting pumping and other costs of the project during each year of the 30-year period of analysis.

4.2 COMPARISON OF ALTERNATIVES

Table 9 summarizes the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: no-action, Shell's proposal, and the staff alternative.

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[47] Grid frequency is a system-wide indicator of overall power imbalance. These imbalances are removed by requesting generators to operate in frequency control mode, altering their output continuously to keep the frequency near the required value.

[48] System voltage levels vary over the course of a day due to a variety of factors, including: (1) the location of the local distribution line, (2) proximity to large electricity consumers, (3) proximity to utility voltage regulating equipment, (4) seasonal variations in overall system voltage levels, and (5) load factor on local transmission and distribution systems.

[49] Black-start is the procedure to recover from a total or partial shutdown of the transmission system, which has caused an extensive loss of supplies. This entails starting isolated power stations individually and gradually reconnecting them with each other to form an interconnected system again.

[50] Calculated by staff based on the ancillary services value of $144 per kilowatt per year and an annual generation of 24,000 MWh.

Table 9. Summary of the annual cost of alternative power and annual project cost for applicant's proposal and the staff alternative for the Pearl Hill Project.

	Shell's Proposal	Staff Alternative
Installed capacity (MW)	5	5
Annual generation (MWh)	24,000	24,000
Annual cost of alternative power ($ and $/MWh)	$1,522,560 63.44	$1,522,560 63.44
Annual project cost ($ and $/MWh)	$2,303,410 95.98	$2,303,670 95.99
Difference between the cost of alternative power and project cost ($ and $/MWh)	($780,850)[a] (32.54)[a]	($780,820)[a] (32.53)[a]

[a] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is more than the cost of alternative power by that amount.

4.2.1 No-Action Alternative

Under the no-action alternative, the project would not be constructed and would not produce any electricity. The only cost associated with this alternative would be the cost to prepare the license application.

4.2.2 Shell's Proposal

Shell proposes numerous environmental measures, as presented in table 10. Under Shell's proposal, the project would have an installed capacity of 5 MW, and generate an average of approximately 24,000 MWh of electricity annually. The average annual cost of alternative power would be $1,522,560, or $63.44/MWh. The average annual project cost would be $2,303,410, or $95.98/MWh. Overall, the project would produce power at a cost that is $780,850, or $32.54/MWh, more than the cost of alternative power generation.

4.2.3 Staff Alternative

The staff alternative includes the same developmental proposal as Shell's and, therefore, would have the same capacity and energy attributes. Table 10 shows the staff-recommended additions, deletions, and modifications to Shell's proposed environmental protection and enhancement measures and the estimated cost of each.

Based on a total installed capacity of 5 MW and an average annual generation of 24,000 MWh, the cost of alternative power would be $1,522,560, or $63.44/MWh. The average annual project cost would be $2,303,670, or $95.99/MWh. Overall, the project would produce power at a cost that is $780,820, or $32.55/MWh, more than the cost of alternative power generation.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 10. Cost of environmental mitigation and enhancement measures considered in assessing the effects of constructing and operating the Pearl Hill Project.

Enhancement/Mitigation Measures	Entity	Capital cost [a]	Annual cost [a, b]	Levelized annual cost [c]
Geology and Soils				
1. Implement temporary environmental controls during shoreline construction including: (1) silt curtains; (2) temporary erosion and rock fall controls[e]; and (3) waste management	Shell, Staff	$204,000	$0	$13,270
2. Develop soil and sediment erosion control plan	Shell, Staff	$16,320	$5,100	$6,160
3. Apply dust control on sections of Road L, the access road, parking, and construction laydown areas	Shell, Staff	$20,400	$1,220	$2,550
Aquatic Resources				
4. Allow neighboring rancher to use 29 AF annually for stock watering and allow emergency responders access to tank water in case of wildfire	Shell, Staff	$0	$660[d]	$660
5. Develop storm water pollution prevention plan	Shell, Staff	$10,000[d]	$0	$650
6. Develop construction waste plan	Shell, Staff	$24,480	$0	$1,590
7. Avoid all in-water construction between April 1 and June 15	Shell, Washington	$0	$0	$0

	DFW, Staff			
8. Develop an aquatic resources management plan (ARMP) that includes (1) monitoring and controlling temperature and TDG discharges; (2) installing bird exclusory devices on power platform; (3) seasonally inspecting and cleaning in-water pilings and other equipment of invasive species and algae; (4) installing a fish screen on the project; and (5) installing a bubbler system on the fish screen[e]	Shell, Interior, CTCR, Washington DFW, Staff	$331,500	$45,070	$66,630
9. Modify ARMP to require consultation with UFS, NMFS, CTCR, and Washington DFW in the case of unexpected effects on fish at the project intake	Interior, CTCR, Washington DFW	$0	$0	$0
10. Develop a protection plan for kokanee salmon, bull trout, and redband trout	CTCR	Unknown[k]	Unknown	Unknown
11. Develop a response and contingency plan for penstock or tank ruptures.	CTCR	Unknown[k]	Unknown	Unknown
Terrestrial Resources				
12. Develop a terrestrial resources management plan (TRMP) that includes (1) conducting pre-construction surveys for sensitive	Shell, Interior, Washington DFW,	$140,890	$33,460	$42,580

plants; (2) revegetating disturbed areas with native plants; (3) monitoring revegetated areas; (4) evaluating planting shade trees along lake; (5) controlling noxious weeds; (6) marking fences to prevent grouse collisions; (7) implementing fire suppression; (8) installing wildlife penstock crossings; (9) installing bird perching-exclusion devices on the tank rim; (10) installing wildlife escape ramps in upper reservoir, and (11) providing $50,000 to Washington DFW for wildlife enhancement at Washburn Island[e]	CTCR			
13. Develop a TRMP that includes the measures identified in item 12 except for installing the wildlife escape ramps, evaluating planting of shade trees, and providing funding for Washburn Island enhancement	Staff	$65,100	$33,360	$37,690
14. Invite FWS and Washington DFW to participate in the plant surveys	Interior, Washington DFW, Staff	$0[f]	$0[f]	$0
15. Conduct August surveys for Ute ladies'-tresses orchid	Interior, Staff	$1,500[d,g]	$0	$100
16. Contract with CTCR for assistance in revegetation and recovery of native plant resources	Shell, CTCR	$0[f]	$0[f]	$0

17. Install bird perching-exclusion devices on elevated sections of penstock	CTCR, Staff	$15,100	$390[d]	$1,370
18. Monitor pre- and post-construction ungulate activity in penstock area	CTCR	Unknown[k]	Unknown	Unknown
19. Develop construction schedule and practices to minimize disturbing wildlife.	Shell, Interior, Washington DFW	Unknown[k]	Unknown	Unknown
Recreation and Land Use Resources				
20. Notify agencies of construction-related closures, place closure and detour signs along Road L during construction, and place navigation barriers and lights around the generating platform	Shell, Staff	$0[i]	$0	$0
Aesthetic Resources				
21. Paint project upper reservoir tank and other above-ground project facilities to blend facilities with the landscape; round edges of access roads to blend with rolling landscape.	Shell, Staff, CTCR	$0[i]	$0	$0
22. Use vegetative screening to blend upper reservoir tank and parking area with the landscape	Shell, CTCR	$25,500	$1,330	$2,980
23. Test noise levels of project generators and pumps and install	Shell, Staff	$1,000	$0	$70

abatement measures if they exceed 70 dBA[h]				
Cultural Resources				
24. Develop Historic Properties Management Plan (HPMP)	Shell, CTCR, Staff	$50,000	$0	$3,250
25. Conduct data recovery at Site No. 45DO1185	Staff	$100,000	$0	$6,500
26. Conduct a study of the relationship of cultural resources in the project area to resources within the Rufus Woods Lake Archaeological District	Shell, CTCR, Staff [j]	$50,000	$0	$3,250
27. Monitor construction activities and train project construction workers on how to identify and avoid sensitive cultural areas	Shell, CTCR, Staff [j]	$50,000	$0	$3,250

[a] Costs provided by the applicant in 2017 dollars escalated to 2019 dollars unless otherwise noted.
[b] Annual costs typically include operational and maintenance costs and any other costs which occur on a yearly basis.
[c] All capital and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing costs.
[d] Staff estimated cost.
[e] 10(j) recommendation.
[f] Cost for this component included in the total TRMP cost.
[g] This is cost as a stand-alone survey; if incorporated with the sensitive plant surveys its additional component cost would be $0.

[h] Shell has allocated $50,000 for abatement measures if noise levels exceed 70 dBA which would result in an estimated annual levelized cost of $3,250.
[i] Cost for this component included in Initial Construction Cost.
[j] Staff recommends requiring the study and monitoring associated with these measures, but not hiring CTCR to complete these activities.
[k] Measure lacks specificity required to estimate costs.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on the project and our review of the environmental and economic effects of the proposed project and project alternatives, we selected the staff alternative as the preferred alternative. We recommend this alternative because: (1) issuing a license for the project would allow Shell to operate its project as a dependable source of electrical energy; (2) the 5 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of the staff alternative would exceed those of the no-action alternative; and (4) the proposed and recommended measures would protect and enhance fish, wildlife, cultural, aesthetic, and recreation resources.

In the following section, we make recommendations as to which environmental measures proposed by Shell or recommended by agencies or other entities should be included in any license issued for the project. In addition to Shell's proposed environmental measures listed below, we recommend additional staff-recommended environmental measures to be included in any license issued for the project.

5.1.1 Measures Proposed by Shell

Based on our environmental analysis of Shell's proposal in section 3.0, *Environmental Effects,* and the costs presented in section 4.0, *Developmental Analysis,* we conclude that the following environmental measures proposed by Shell would protect and enhance environmental resources and would be worth the cost. Therefore, we recommend including these measures in any license issued for the project:

- Develop an ESCP to prevent soil and sediment from entering Rufus Woods Lake.

- Develop a SWPPP to contain runoff from construction sites.

- Develop a waste management plan to prevent construction wastes from entering Rufus Woods Lake.

- Minimize dust emissions from County Road L, the project access road, and parking and construction laydown areas by applying suppressants when necessary.

- Avoid all in-water construction between April 1 and June 15 to protect spawning or incubating salmonids.

- Develop an ARMP that includes: (1) monitoring water temperatures and TDG in the upper reservoir tank, the power generation system, and upstream and downstream of the discharge point and use active temperature control (e.g. cycling or release of water), if needed, to reduce water temperature or TDG levels in the project discharge; (2) installing bird perching exclusion devices on all potential perch sites on the power platform to reduce the possibility of bird predation on fish; (3) inspecting in-water pilings and other equipment for the presence of invasive species and clean underwater support structures seasonally; (4) installing a fish screen on the project intake that meets NMFS requirements for protection of salmonids; and (5) installing a bubbler system on the fish screen to clean debris and protect fish from impingement.

- Allow a neighboring rancher to use up to 29 AF of water from the upper reservoir annually to water livestock and permit local emergency responders to use the tank water to fight wildfires.

- Develop a construction timeline and methods, as well as operational practices, to minimize disturbance to wildlife and protect sensitive species.

- Develop and implement a TRMP that includes provisions to: (1) conduct pre-construction surveys to identify sensitive plants including plants of cultural and spiritual importance to CTCR; (2) revegetate all areas of ground disturbance with native plant species; (3) monitor all revegetated areas annually for 5-10 years to ensure successful revegetation; [51] (4) control noxious weeds within the disturbed areas; (5) mark the 840 feet of existing fence to minimize risk of grouse collisions; (6) install bird perching exclusion devices on the tank rim to minimize the potential for predation on grouse by predatory birds; (7) implement fire suppression measures to control wildfires; and (8) provide wildlife crossings over or under the above-ground penstock.

- Allow public access to project lands for hunting, fishing, and wildlife viewing, except during construction and to the shoreline facilities (power platform) during project operation.

- Provide signage and notifications to inform boaters and hunters of construction activity, temporary closures, and alternate access routes around construction areas to maintain public safety.

- Install navigation safety lights and a boat barrier to keep boats a safe distance from shore-based facilities during project operation.

- Monitor for cultural resources during construction, and train construction workers on cultural resources sensitivities and avoidance of sensitive areas.

- Evaluate the relationship between the cultural resources found within the Pearl Hill TCP District and the Rufus Woods Lake Archaeological District as mitigation for the loss of the cultural site at the upper reservoir tank.[52]

- Develop an HPMP to protect cultural resources in the project area.

- Paint above ground project facilities in natural brown or grey colors to reduce the contrast of the facilities with the surrounding landscape; and round cut

[51] Shell proposes to contract with CTCR to assist in revegetation, surveys, and recovery of native plant resources in the project construction area. Staff recommends these measures, but will leave it up to Shell to determine how to implement the measures (e.g., whether to hire CTCR to conduct the survey).

and fill slopes of the proposed access roads to better blend with the rolling character of the surrounding landscape.

- Test noise levels of project generating and pumping equipment at the beginning of project operation and deploy baffling or noise attenuation measures if sound levels exceed 70 dBA.

5.1.2 Additional Measures Recommended by Staff

In addition to Shell's proposed measures noted above, we recommend including the following additional and modified measures in any license that may be issued for the Pearl Hill Project.

- To protect aquatic resources, modify the ARMP to specify: (1) the proposed locations of the temperature and TDG gages; (2) how real-time water temperatures and TDG levels in the tank and in Rufus Woods Lake will be monitored; (3) the protocol/criteria for deciding when to release water back to Rufus Woods Lake to avoid temperature exceedances; (4) the methods and schedule for inspecting and removing algae and invasive species from project structures; and (5) a reporting schedule for temperature and TDG data and the discovery of any invasive species.

- To protect deer, grouse, and sensitive plants, modify the TRMP to include: (1) an additional wildlife underpass to aid mule deer movement across the lower sections of the above-ground penstock, if such crossings do not naturally exist; (2) a provision for agency involvement in the preconstruction surveys for sensitive plants; (3) pre-construction surveys for Ute ladies'-tresses between August 1 and 31; and (4) installation of additional bird perching exclusion devices on the elevated portions of the penstock within suitable grouse habitat to minimize increased bird predation on grouse.

- To protect cultural resources to the extent practicable, develop an HPMP, in consultation with the Washington SHPO, Corps, and CTCR that includes: (1) an identification and evaluation of all cultural resources that occur within the APE, (2) a description of measures to avoid, reduce, or mitigate any project-related adverse effects on cultural resources, including a site-specific data recovery plan, (3) a plan for studying the importance of the Pearl Hill TCP District in relation to the Rufus Woods Lake Archaeological District; and (4) specific protocols and procedures for evaluating cultural resources in the project area, monitoring construction activities, consulting with the above-named entities, addressing any newly-discovered cultural resources, and protecting cultural resources during future construction and operation activities.

Below, we discuss the basis for the staff-recommended measures and modifications.

ARMP modifications

Shell proposes, as a part of its ARMP, measures to prevent elevated water temperatures and TDG levels in the project's discharge and the introduction of algae and invasive species. Shell would monitor temperature and TDG in the upper reservoir and at the project intake, and release tank water back into Rufus Woods Lake if the water in the tank is in danger of heating more than 0.3° C above ambient conditions. To reduce TDG levels, Shell would pass the discharge over a series of baffles to de-gas the water. Additionally, Shell proposes to remove algae from project structures and to monitor project facilities for the presence of invasive species.

The measures proposed would generally protect water quality in Rufus Woods Lake. However, the proposed ARMP lacks sufficient detail. We, therefore, recommend that the ARMP include: (1) the exact locations of the temperature and TDG gages; (2) a description of how real-time water temperatures and TDG levels in the tank and in Rufus Woods Lake would be monitored; (3) the protocol for deciding when to release water back to Rufus Woods Lake to avoid temperature exceedances; (4) the methods and schedule for removing algae from project structures; (5) a description of the methods and schedule for examining project works for invasive species; (6) protocols for treating invasive species if discovered on project works; and (7) a description of how Shell plans to report to NMFS, Washington DFW, and CTCR. Inclusion of these details in the ARMP would have no additional cost, but would facilitate Commission administration of the license.

Surveys for Ute-ladies'-tresses and other sensitive or culturally important plants

Construction of the project would require vegetation clearing and land-disturbance of 8.9 acres of predominantly shrub-steppe and some riparian habitat. Shell proposes to protect plant species with conservation priority during construction by confining construction to the smallest footprint practicable, and by surveying the construction area prior to land disturbing activities to identify any sensitive plants, including plants of cultural and spiritual importance to the Colville Tribe, and protect any found, if possible. Shell would invite CTCR's cultural plants team to participate in these surveys, which would be conducted once in early spring and again in mid-summer to ensure that both early- and late-blooming sensitive plants are observed. Following construction, Shell would revegetate all disturbed areas with an appropriate native seed mix, determined in consultation with CTCR and the resource agencies.

Interior and Washington DFW recommend that Shell conduct the preconstruction plant surveys and revegetation work, as proposed, but recommend that in addition to

CTCR, Shell invite FWS and Washington DFW to participate in the preconstruction surveys. FWS also recommends that surveys for Ute ladies'-tresses be conducted in suitable habitat in August. CTCR recommends that more species of cultural significance be included in the native seed mix proposed for revegetating disturbed areas to partially mitigate for permanent losses of culturally-significant plants where project facilities would be installed.

While the presence of Ute ladies'-tresses is not likely at the project site, Shell's previous surveys were not conducted when the plant is known to bloom and be recognizable. Similarly, Shell's proposed surveys do not specifically include the August blooming period. Conducting a survey for the orchid between August 1 and August 31 in those areas that might support suitable habitat and would be disturbed (along the lake shore and the intermittent drainage) would verify whether the plant is present in areas that would be disturbed by project construction. If Shell schedules its mid-summer plant survey for August, there would be no additional cost for conducting the Ute-ladies'-tresses survey. If Shell conducts an additional survey just for the orchid, the cost would be minor; $1,500 (levelized $100).

Including plants of cultural significance in the native seed mix would help to mitigate for the anticipated losses of established plants of cultural importance and diversify both the species mix and the propagule types which would enhance the potential long-term success of the revegetation effort. As long as seeds or plants are readily available, including plants with cultural significance would not significantly increase the costs because Shell already proposes to work with CTCR and the agencies to finalize the revegetation plantings and has accounted for those costs in its planning.

However, Shell's proposed revegetation plan lacks sufficient detail at this point. Therefore, staff recommends that the TRMP include final seed mixes and plant species, planting densities and methods, fertilization and irrigation requirements, control of grazing and invasive weeds, specific monitoring protocols, criteria for measuring the success of revegetation efforts, and specific procedures to be followed if revegetation is not successful.

Wildlife crossings

The above-ground portions of the penstock (3,298 feet in two sections) would typically be about four feet high and could impede the movement of mule deer which are known to use the project area. Shell proposes to install wildlife crossings over or under the penstock, but only identifies one overpass near the upper reservoir tank. Interior and Washington DFW support the installation of the crossings. CTCR recommends that Shell conduct pre- and post-construction monitoring to evaluate the effectiveness of wildlife crossing locations and ensure that they function as planned.

Along the lower penstock segment the irregular topography would likely provide several openings beneath the penstock with clearances of six to nine feet that could also be used by deer. If necessary, some of these openings could easily be enlarged to provide at least six feet of clearance, and Shell has indicated a willingness to provide for this during the project's final design. Staff recommends that, if the natural topography and final penstock design do not already provide sufficient clearance to allow deer to cross the penstock easily, Shell construct an underpass along the lower penstock segment to mitigate barriers to movement along the steep slopes above the lake.

However, monitoring to determine the best location of the underpass or to confirm its use, as recommended by CTCR is likely not be needed. Because mule deer are highly mobile and would need to travel no more than 1500 feet to find a suitable crossing, they should easily be able to locate and use any such crossings.

Bird perching-exclusion devices on elevated portions of penstock

CTCR is concerned that the elevated portions of the penstock may serve as perching locations for raptors to prey on small terrestrial animals, and recommends that Shell install bird perching-exclusion devices on the elevated portions of the penstock, in addition to the upper reservoir tank as Shell proposes. While most populations of small terrestrial animals could withstand additional predation pressure because of their high fecundity, any increase in predation on greater sage-grouse or Columbian sharp-tailed grouse, which may be present in the area and are experiencing declining populations, would be harmful to recovery efforts. Installing bird perch-deterring devices where the above-ground sections of the penstock pass through shrub steppe habitat suitable for these species (about 1,300 feet) would have a levelized annual cost of $1,370. The additional protection afforded to these imperiled species if present would be worth the cost.

Historic Properties Management Plan and Data Recovery

The project would directly or indirectly adversely affect the Pearl Hill TCP District (the district itself as well as its component features). While Shell has provided an outline of an HPMP, it lacks detail. To protect cultural resources to the extent practicable, staff recommends that Shell develop an HPMP that includes: (1) a basic cultural and historical background section in order to give context to the National Register eligibility determinations; (2) a map showing the APE established in consultation with the Washington SHPO and CTCR; (3) complete National Register eligibility determinations (assessing for criteria A, B, C, D) on all cultural resources located within the project's APE; (4) determinations of project-related effects on each of the significant archaeological cultural resources that occur in the APE; (5) measures to avoid, reduce, or mitigate any project-related adverse effects on all individual National Register-eligible cultural resources including site-specific data recovery plans (including

schedules to complete the work) for Site No. 45DO1185; (6) a detailed plan for studying the relationship of the Pearl Hill TCP District to the Rufus Woods Lake Archaeological District to determine its importance in the tribal history of the region; (7) a description of future construction and operation activities that would and would not be subject to review by the Washington SHPO, Corps, and CTCR (i.e., exempt, little effect, and case-by-case) and how the review would be conducted and adverse effects resolved; (8) detailed monitoring procedures during construction, including provisions to have a professional trained in the identification of cultural artifacts present during construction to monitor activities and to train project personnel in how to identify and avoid culturally sensitive areas; and (9) detailed provisions for addressing any newly discovered cultural resources.

Shell proposes to provide $50,000 to CTCR to evaluate the relationship of the cultural sites found on the Pearl Hill TCP District to the Rufus Lake Archeological District and another $50,000 to provide an on-site, trained archaeologist to monitor construction activities and to train project personnel in avoiding sensitive cultural areas. Staff recommends conducting the proposed evaluation because it would contribute to the knowledge of the area, establish the TCP District's importance to tribal history, and help mitigate for the loss of Site No. 45DO1185. Staff also recommends having a professional who is trained in identifying cultural resources on-site during construction to monitor activities and to train project personnel in how to identify and avoid culturally sensitive areas to protect cultural resources to the extent possible, during construction.

As to providing $50,000 each to both CTCR and an on-site trained archaeologist in order to accomplish the aforementioned staff-recommended measures, the Commission has made clear that a licensee cannot satisfy the obligation to perform certain tasks by a simple payment to another party, nor can the obligation be limited by a particular dollar figure.[53] Therefore, staff recommends that Shell conduct the evaluation and provide the archaeological monitor and include these measures as provisions of the HPMP. How it accomplishes these measures would be left to Shell's discretion.

Staff further recommends that the HPMP be reviewed and approved by the Commission prior to any ground-disturbing actions. Developing the HPMP, as staff recommends, would entail data recovery and recordation. We estimate that preparing the plan as well as this field testing and data recovery would have a levelized annual cost of $9,750 and find that these efforts would be needed to mitigate, to the extent practicable, adverse effects to the archaeological sites eligible for the National Register.

[53] *See Policy Statement on Hydropower Licensing Settlement*s, Docket No. PL06-5-000, issued on September 21, 2006.

5.1.3 Measures Not Recommended

Response and contingency plan in case of catastrophic events

CTCR recommends that Shell be required to develop a response and contingency plan in case of catastrophic events to protect water quality in Rufus Woods Lake. As discussed in section 3.3.1.2, the Commission requires that all licensees file an Emergency Action Plan (EAP) for approval that is developed in consultation with the appropriate federal, tribal, and state agencies. An EAP would serve the same purpose as a response and contingency plan; therefore the development of a response and contingency plan would be duplicative.

Fish entrainment and impingement contingency plan

To prevent fish entrainment and impingement, including salmon if they are reintroduced to Rufus Woods Lake in the future, Shell proposes to install a vertical bar fish screen on each of the pump intakes. The fish screen would be designed to meet NMFS velocity and opening requirements for the protection of juvenile salmonids. Shell would use a bubbler system that would blow air through the fish screen upon startup of the pumping phase and when there is an increase in pressure across the screen, to keep debris cleared from the screen which increase pressures and velocities across the screen.

Without elaboration, FWS, CTCR, and Washington DFW recommend that Shell develop a plan to improve the existing intake fish screens or develop solutions to direct fish away from the project intake if Shell observes harm to resident fish species.

As discussed in section 3.3.2.2, our analysis shows that impingement and/or entrainment at the project is unlikely with Shell's proposed screening. Shell's proposed cylindrical wire fish screen on the project intake would have screen openings of 0.069 inches and an approach velocity of 0.36 feet per second, both of which NMFS recommends as protective for all sizes classes of salmonids. These design parameters have been shown to be effective for this purpose at numerous existing hydropower facilities, and we have no reason to believe they would not be effective in this case. Additionally, CTCR's and the agencies' recommendation for a contingency plan is too vague to evaluate. For these reasons, we do not recommend the fish entrainment and impingement contingency plan.

Protection plan for kokanee salmon, bull trout, and redband trout

Without elaboration, CTCR recommends that Shell be required to develop a plan to avoid or reduce potential effects to kokanee salmon, bull trout, and redband trout. As discussed above, Shell proposes to develop and implement an ARMP with provisions for: (1) temperature and TDG monitoring, (2) bird exclusory devices on potential perch sites

to reduce possibility of bird predation on fish, (3) inspection of in-water pilings and other equipment for the presence of invasive species, (4) a fish screen on the project intake that meet NMFS requirements for protection of salmonids, and, (5) a bubbler system on the fish screen to protect fish from impingement. In addition, Shell has designed the project to minimize temperature fluctuations, shading, disturbance of sediment, and attraction flows. All of these measures would protect fish in the project area, including kokanee salmon, bull trout, and redband trout. CTCR's request is too vague to evaluate the cost of such a plan. The development of an additional plan for the protection of these three species is unnecessary for the reasons noted above.

Establishing construction timelines and practices to minimize wildlife disturbances

Shell proposes to develop construction schedules and operational practices to minimize disturbances to wildlife, habitats, and sensitive species in consultation with the resource agencies and CTCR. Washington DFW and Interior support Shell's proposal. CTCR supports the proposal, stating that mule deer, pronghorn antelope, and other terrestrial wildlife could be negatively affected by construction-related disturbances.

Neither Shell nor the resource agencies explain which species or life stages should be protected, nor do they (or CTCR) specify what practices and timing might be feasible or needed. Evaluating the benefits and costs of such general recommendations is not feasible and the staff-recommended alternative includes measures to address adverse effects on wildlife, including providing wildlife crossings, revegetating disturbed areas with native vegetation, and preventing noxious weed introductions.

The project site is not currently known to support or be used by pronghorn antelope, is not known to be a critical mule deer winter range or identified parturition area, and is not known to support active grouse leks. Therefore, while we are not opposed to Shell developing construction practices and timing to minimize disturbing wildlife in consultation with the resource agencies and CTCR, we have no basis for recommending a license condition that stipulates specific construction timing or practices to protect wildlife.

Evaluating the potential to establish native shade trees along Rufus Woods Lake

As part of its revegetation efforts, Shell proposes to evaluate slope and soil conditions along Rufus Woods Lake to determine if site conditions are suitable for planting fast-growing native shade-producing trees (such as cottonwoods) along the Rufus Woods Lake. Shell does not specify the areas that would be targeted for evaluation or how much shoreline might be revegetated.

Project construction would not require the removal of any riparian trees along the lake. As discussed in section 3.3.3.2, the likelihood of successfully establishing shade trees along the shore of Rufus Woods Lake is low and, if successful, the potential area it might enhance is limited. If some trees could be established there, they would eventually provide birds and other wildlife with perching, nesting, and other opportunities that are scarce in the steppe region, which could also create additional opportunities for increased predation on fish. Because of the limited benefit, lack of a project effect on riparian trees, and likely poor success of establishing trees, we do not recommend Shell's proposed measure and conclude that such efforts are not worth the cost of $500. However, Shell is free to do so of its own volition.

Escape ramps from the floating roof of upper reservoir

Shell proposes to install escape ramps in the upper reservoir tank to aid wildlife that might become entrapped in the tank. However, as discussed in section 3.3.3.2, the 20-foot tall corrugated steel tank, together with the absence of tall vegetation or other conveyances to aid climbing animals, make it unlikely that any non-flying wildlife could access the tank and become trapped. With the tank's 300-foot breadth, it is likely that birds and bats would be able to fly out of the tank. Further, a close-fitting floating roof would prevent any animal from drowning in the tank. Because there is little likelihood of wildlife entrapment in the tank, there would be no need to install the ramps at the estimated capital cost of $3,600[54].

Wildlife enhancement at Washburn Island

Shell proposes to provide $50,000 toward a wildlife enhancement project at Washburn Island because it could not identify any measures to mitigate for lost habitat at the Pearl Hill project site. Washington DFW supports Shell's proposal.

Project construction would result in the permanent loss of 4.6 acres of shrub-steppe habitat, and temporary disturbance and possible long-term degradation of another 4.3 acres. While funding the partial replacement of the irrigation system on Washburn Island would assist Washington DFW in its efforts to manage for waterfowl and upland birds, the mitigation site is relatively far removed from the project, consists of habitats unlike those affected by the project, and is being managed for different species than those affected by the project. Thus, there is little connection between the proposed measure and project effects on area wildlife and wildlife habitat. As noted above, Shell has proposed measures that adequately reduce adverse effects on wildlife and wildlife habitat,

[54] Shell did not provide a cost for the ramps, but rather included in its overall construction costs. Staff's estimate of escape-ramp cost is derived from commercially-available wildlife ramps, scaled to the tank's 20-foot depth.

including minimizing the construction footprint, revegetating disturbed areas with native vegetation, installing wildlife crossings and bird-perching exclusion devices. Therefore, we do not recommend Shell's proposed mitigation measure. However, Shell is free to do so as an off-license agreement with Washington DFW.

Vegetative screening around the upper reservoir tank and parking lot

The upper reservoir tank would be highly visible to those within and in close proximity to the project area, including CTCR members who use the area for traditional cultural practices. To minimize any adverse visual effects from the reservoir tank, Shell proposes to paint the tank a light brown color that would match the surrounding terrain and to use vegetative screening to obscure the tank and the abutting parking area. While planting vegetation to screen the reservoir would over time obscure its visibility, it would likely take about 15 years for any trees to grow to a sufficient height to do so. Further, as we discuss in section 3.3.7.2, the clustering of tall trees around the tank in an area which is surrounded by open terrain, would stand out rather than blend with the surrounding environment. Such trees would also likely serve to increase roosting sites for avian predators, which could adversely affect grouse and negate the benefits of adding roosting deterrents to the upper reservoir tank. For these reasons, we do not recommend Shell's proposed planting trees to screen the upper reservoir tank.

5.2 UNAVOIDABLE ADVERSE IMPACTS

There would be localized, short-term disturbances to the riverbed during the installation of the platform. On-shore construction activities would disturb wildlife habitat, temporarily disrupt use of County Road L and lands in the immediate project area, and create noise and dust. The proposed upper reservoir tank, the above-ground penstock, power platform, and the new access road, would result in permanent changes to the visual landscape. A cultural site within a TCP District would be lost due to construction of the upper reservoir tank and the presence of project facilities would have an adverse aesthetic effect on CTCR tribal members using the area for traditional cultural practices.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. Section 10(j) of the FPA states that whenever the Commission finds that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency. In

response to our October 18, 2018, notice soliciting comments, recommendations, terms and conditions, and fishway prescriptions, Interior and Washington DFW filed four section 10(j) recommendations on December 17, 2018. The recommendations consisted of multiple components.

Staff has made a preliminary determination that all of Interior's and Washington DFW's recommendations filed pursuant to section 10(j) are within the scope of section 10(j), with the exception of the following components of the TRMP and ARMP: (1) coordinating with Washington DFW, National Oceanic and Atmospheric Administration (NOAA) Fisheries, and the CTCR for the proposed removal of defunct net pens in Rufus Wood Lake; (2) conducting rare plant surveys; (3) evaluating site conditions to determine if is feasible to plant native trees (willows, cottonwoods, and alders) along Rufus Woods Lake; and (4) completing the wildlife project at Washburn Island (i.e., providing $50,000 to replace the center-pivot irrigation system). These components do not fall within the scope of section 10(j) because providing funds to agencies, coordination, and conducting rare plant surveys are not specific fish and wildlife measures, and evaluating site conditions for planting native trees is a study that could have been done prior to licensing. While we recommend the rare plant surveys and measures to protect these plants, we do not recommend including the remaining measures as a requirement in the license for the reasons discussed in section 5.1.

Table 11 lists these recommendations, and whether the measures are recommended by staff.

Table 11. Analysis of fish and wildlife agency recommendations for the Pearl Hill Project.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
1. Implement proposed measures to minimize rock excavations for platform footings and penstock anchors and installation of footings and anchors using hydraulic equipment.	Interior, Washington DFW	Yes	$13,270	Yes
2. Installation and year-round operation of intake screens that met Washington DFW and NOAA screening requirements.	Interior, Washington DFW	Yes	$22,880	Yes
3. Develop and implement the following project design features: a. overwater structures shall be designed as small as possible and positioned to reduce shade impacts and to distribute discharge flows to reduce false attraction; b. decking of the overwater platform shall be made of light-penetrating grating to allow approximately 50 percent light penetration to the water below, fully covering only those housing critical electrical elements that must be fully contained from weather. c. the discharge manifold shall be designed to reduce exit velocities and distribute those exit velocities in a manner that avoids sediment disturbance; and d. the multi-port diffuser pipe shall be	Interior, Washington DFW	Yes	$0[b]	Yes

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
constructed to allow outflow to diffuse over a large area to limit sediment disturbance and turbidity at discharge.				
4. Develop an ARMP that includes : a. temperature and TDG monitoring; b. steps to reduce residence time in the tank; c. bird perching exclusory devices on power platform; d. periodic inspection and treatment of in-water works for invasive species; and e. incorporation of the following design features: (1) fish screening technology protective of salmonids and other fish species, including anadromous fish and lamprey, (2) power platform design to allow approximately 50 percent light penetration, (3) discharge manifold design, (4) insulation of tank walls and floating roof and painting the floating roof white to reduce thermal loading, (5) measures to minimize rock excavations and rock and sediment fallback into the lake, and (6) coordinate with Washington DFW, NOAA Fisheries and the CTCR regarding the proposed off-license removal of defunct net pens in Rufus Wood Lake[a].	Interior, Washington DFW	Yes, except for funding and coordinating with the resource agencies for the off-license removal of fishing nets from the lake because they are not a specific fish and wildlife measure.	$66,630	Yes, except funding and coordinating with the resource agencies on fishing net removal because as an off-license measure the Commission would lack jurisdiction.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
5. Develop a TRMP that includes: a. two pre-construction surveys (once in early spring and once in early summer) for ESA-listed or sensitive plant species, invite Washington DFW, FWS and CTCR to participate in surveys, and avoid areas with sensitive species; b. revegetate disturbed areas with proposed native seed mix and supplemental plantings (e.g., culturally important plants), and finalize selection of seed mix and plantings in consultation with agencies and CTCR; c. monitor revegetation efforts annually for five years and evaluate planting fast-growing native shade-producing trees along the Rufus Woods Lake ; d. follow proposed Integrated Pest Management program to control noxious weeds; e. complete a wildlife enhancement project at Washburn Island (provide $50,000 for replacement of center pivot irrigation); f. mark existing fence line to prevent sage grouse collisions; g. implement fire suppression measures to minimize wildfires, and	Interior, Washington DFW	Yes, except for plant surveys and funding the enhancement project on Washburn Island because they are not a specific fish and wildlife protection measure; evaluating site conditions for native planting is a study that could have been done pre-filing	$37,690	Yes, except we do not recommend the Washburn Island enhancement project, the escape ramps, or evaluating plantings along Rufus Woods Lake

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
h. design bird-perching exclusion devices and wildlife escape ramps in consultation with resource agencies.				

[a] Shell proposes this measure as an off-license agreement.

[b] Shell reports the cost of the multi-port diffuser pipe as $50,000, but includes the other measures as part of its design/construction costs; therefore, rather than reporting only part of the levelized annual cost we have treated all of the costs as part of the proposed design/construction costs.

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) of the FPA, 16 U.S.C., § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed the following 23 comprehensive plans that are applicable to the Pearl Hill Project. No inconsistencies were found.

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6.0 FINDING OF NO SIGNIFICANT IMPACT

Based on our independent analysis, we find that the issuance of a license for the Pearl Hill Project, with additional staff-recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment. Preparation of an environmental impact statement is not required.

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