USDA Forest Service

Gifford Pinchot National Forest

Existing Information Analysis

For

Water Quality Resources

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Abstract

Packwood Lake Hydroelectric project delivers warmed water to Cowlitz River via the 8,000 ft. tailrace and affects Lake Creek water temperatures. The result is adverse effects to the function of the aquatic ecosystem and detrimental change in habitat for aquatic species.

I. Existing Situation

Temperature

Packwood Lake Hydroelectric project releases minimum flows from the lake surface into Lake Creek. The released waters exceed the state temperature standard (16°C) during the summer. Water temperatures that flowed out of the lake prior to project may have been a combination of surface and subsurface waters and consequently would have been cooler.

The riparian area along Lake Creek provides adequate shade which blocks solar radiation to the stream. Cool water temperatures from groundwater contributions contribute to the lowering of the stream temperatures in Lower Lake Creek. Lake Creek temperature near the confluence with the Cowlitz River is about 5°C cooler than the water released from the diversion point.

Flows from the diversion point move through the tunnel faster than would result in a natural stream channel. This results in less time for the water temperature of the flow to cool prior to entering the Cowlitz River. The water then flows through the power house and into an exposed 8,000 ft flume. Water temperature at the end of the tailrace is slightly warmer than at the power house during July, the month when potential solar radiation to the exposed tailrace is highest. The maximum 7 Day average temperature for the end of the tailrace exceeds state standards. Maximum 7-Day average differences between the upper and lower tailrace are the critical periods in which to assess changes from the hydroelectric project.

The Cowlitz River is wide as it flows through the wide, flat valley bottom of the Cowlitz Valley. Stream temperatures increase within the Cowlitz River primarily from solar

radiation heating the wide stream where riparian shade does not reach the entire stream width. The tributaries within the upper Cowlitz Valley supply cool waters to the Cowlitz River which is important to maintain water temperatures that support fish and aquatic life.

Food webs are also altered in response to water temperature regimes (Power et al. 1996).

II. Management Direction

Forest Plan
The Gifford Pinchot National Forest Land and Resource Management Plan (1995) provides the management direction for all National Forest System lands and their associated resources within the project vicinity. The amended Forest Plan is an amalgam of the prevailing direction and standards and guidelines from the Record of Decision pertaining to the Northwest Forest Plan (1994) and the Gifford Pinchot National Forest Management Plan (1990).

The Aquatic Conservation Strategy (ACS), a core component of the Northwest Forest Plan (Forest Plan page 2-2), provides management direction aimed at maintaining or restoring the ecological health and functioning of watersheds and the aquatic ecosystems contained within them. Specifically, objectives 2 and 4 pertain the most to this Existing Information Analysis. These objectives are stated as follows:

> *Objective 2 – Maintain and restore spatial and temporal connectivity within and between watersheds. Lateral, longitudinal, and drainage network connections include floodplains, wetlands, upslope areas, headwater tributaries, and intact refugia. These network connections must provide chemically and physically unobstructed routes to areas critical for fulfilling life history requirements of aquatic and riparian-dependent species.*
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> *Objective 4 – Maintain and restore water quality necessary to support healthy riparian, aquatic and wetland ecosystems. Water quality must remain within the range that maintains the biological , physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.*

Additionally, the Northwest Forest Plan Standard and Guideline LH-2 states: "During the Relicensing of hydroelectric projects, (the Forest Service shall) provide written and timely license conditions to FERC that emphasize in-stream flows and habitat conditions that maintain or restore riparian resources and channel integrity." (Forest Plan page 2-30).

The federally managed lands within the Lake Creek Watershed are designated as a Tier 1 Key Watershed. Tier 1 Key Watersheds were selected for directly contributing to anadromous salmonid and bull trout conservation. Key watersheds are highest priority for watershed restoration.

The Gifford Pinchot National Forest Land Management Plan objectives include meeting State Water Quality Standards established in accordance with The Federal Clean Water Act.

III. Forest Plan Desired Condition

To meet Aquatic Conservation Strategy Objectives 2 and 4, operate the existing Projects in the manner that improves impaired water quality downstream from project facilities so that native aquatic species can utilize available habitat and maximize their productivity levels in Lake Creek and the Cowlitz River Subbasin. Specifically, improve temperatures to within Washington Department of Ecology Standards. This suggests increasing the minimum flows released into Lake Creek where water temperatures decrease 5°C from the diversion point to the mouth of Lake Creek.

The Northwest Forest Plan Aquatic Conservation Strategy Objectives emphasizes mimicking natural processes to the greatest extent feasible to reestablish proper function and provide the basis for healthy riparian and aquatic habitats.

IV. Need for Change

The project is altering some processes related to water temperature and consequently degrades aquatic habitat in Lake Creek and the Cowlitz River.

Increasing the minimum flow release to Lake Creek will benefit water quality by diverting water from the tailrace which increases summer water temperatures of flows entering the Cowlitz River and increasing flow depth in Lake Creek which may decrease stream temperatures.

There is a need to lessen the effect of solar radiation heating the flow released from the power house so that peak temperatures are not increased within the exposed tailrace prior to discharge into the Cowlitz River.

V. USDA Forest Service Interests and Preliminary Objectives

Water quality must remain within the range that maintains the biological, physical, and chemical integrity of the system and benefits survival, growth, reproduction, and migration of individuals composing aquatic and riparian communities.

Operate the project to mimic natural processes to the greatest extent possible.

Reduce the effect of solar radiation heating the flow released from the power house so that peak temperatures are not increased within the exposed tailrace prior to discharge into the Cowlitz River.

Continue to monitor stream temperature after the water flows through the power house, and at the end of the tailrace.

VI. Study Requests

To better understand project effect related to water temperature:

1) Analyze existing water quality data from all sources to determine project effects and impacts to aquatic habitat. Provide a baseline survey of the following parameters : temperature, dissolved oxygen, total dissolved gas, nitrogen and phosphorus.

2) Analyze existing water temperature data from all sources to determine compliance with State and Federal Standards and the need for new temperature monitoring sites. Continue ongoing temperature monitoring at existing sites. Determining the differences between the power house and at the end of the tailrace of the Maximum 7-Day average in July and in August would portray conditions at critical periods when solar radiation has the most potential to heat water temperatures.

3) Determine reservoir influence on stream temperatures below the diversion point in Lake Creek.

4) Integrate water quality study results with the fish and aquatic species studies to determine what effects on-going water temperature regimes and water quality outflows have on the aquatic habitat and listed threatened and endangered fish species. Identify the life history stage and levels in the food web most sensitive to changes in temperature. Identify where the movement or migration of fish is affected by project effects to temperature.

VII. References Cited

Power, M. E., W. E. Dietrich and J.C. Finlay. 1996. Dams and downstream aquatic biodiversity: potential food web consequences of hydrologic and geomorphic change. Environmental Management 20(6):887-895.

USDA, Forest Service; U.S. Department of the Interior, Bureau of Land Management. 1994. Final Supplemental environmental impact statement on management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl (Northwest Forest Plan).

USDA Forest Service 1995. Land and Resource Management Plan Gifford Pinchot National Forest.