4.0 AFFECTED ENVIRONMENT, IMPACTS, MITIGATION MEASURES, AND SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

4.1 GEOLOGY, SOILS, AND SEDIMENTS

4.1.1 Affected Environment

At the time of dam removal, an estimated 2.4 million cubic yards of sediment (2.3 million cubic yards according to Finley Engineering Co. [2006]), primarily silt and sand with some gravel, would have accumulated in Northwestern Lake since the construction of Condit Dam in 1913. More than 7,500 feet upstream from the dam and primarily upstream from Northwestern Lake Bridge, the size of reservoir sediments is dominantly in the sand (.075–4.75 mm) and gravel (4.75–75 mm) range. Closer to the dam, the sediments are primarily sand and silt (.0039–.075 mm), and finally silt and clay (<.0039 mm) nearest the dam. Tributary streams to the reservoir have formed deltas into the reservoir with sand and gravel as well as cobbles (75–300 mm). The fine-grained portion of the river’s suspended load has either passed through the dam to the lower reaches of the river or collected in the reservoir basin behind the dam.

Laboratory analysis of the lake sediments indicated a limited distribution of low to trace concentrations of chlorinated pesticide residue and selected metals. Metals were generally present at concentrations consistent with established background levels. Volatile organic compounds, polynuclear aromatic hydrocarbons, dioxins, and polychlorinated biphenyls were not detected in the lake sediment samples (FERC 1996). A 2007 laboratory analysis of the fine sediments in Northwestern Lake indicated that they contain an average concentration of mercury of 0.72 mg/kg (Kleinfelder 2007a). The maximum concentration of mercury detected was 2.03 mg/kg. These values are beyond the criteria contained in the *Interim Final Northwest Regional Sediment Evaluation Framework* (USACE et al. 2006). The mercury concentration in a sediment sample from the Underwood In Lieu Fishing Access Site at the confluence of the White Salmon and Columbia Rivers also was found to be 0.72 mg/kg. The elevated mercury concentrations are attributed to natural volcanic processes and are within the range of background concentrations reported in the literature. The fine sediments contained behind Condit Dam would get flushed downstream when the dam is removed and could adversely impact water quality and aquatic resources downstream (see Sections 4.2 and 4.5).

4.2 WATER RESOURCES

The water resources discussed in this section include surface water features such as rivers, streams, and lakes, as well as groundwater that might be affected by activities associated with removal of Condit Dam, the resulting actions during removal, or the absence of the reservoir. Adjacent areas that might affect the water also are discussed.

4.2.1 Affected Environment

The affected environment for surface water resources includes Northwestern Lake, the White Salmon River downstream from Condit Dam, and the portion of the Columbia River downstream from the confluence with the White Salmon River. Upland areas where work would occur that could affect water resources include the area immediately surrounding Condit Dam, access roads to work areas and staging areas, the tailrace from the power plant, the corridor occupied by the wood stave pipeline where concrete from the dam would be disposed of, and the spillway from the surge tank to the White Salmon River.

4.2.2 Impacts

Dam Breaching and Removal

Dam breaching and removal would result in water quality impacts (suspended sediment) in the White Salmon River. Elevated mercury levels in the fine sediment to be released from Northwestern Lake also could affect downstream water resources. Management of the concrete from the dam would include disposal of the concrete debris on the existing flowline alignment between the dam and the surge tank. The concrete debris would be covered by sediment removed from the drained reservoir and possibly excavated fill from the original flowline construction. Potential surface water and groundwater quality impacts include increased sediment load and changes to pH.

Impacts Associated with Elevated Mercury Levels in Fine Sediments

The fine sediments in Northwestern Lake contain an average concentration of mercury of 0.72 mg/kg (Kleinfelder 2007a). The maximum concentration of mercury detected was 2.03 mg/kg. These values are beyond the criteria contained in the *Interim Final Northwest Regional Sediment Evaluation Framework* (USACE et al. 2006). The elevated concentrations are attributed to natural volcanic processes and are within the range of background concentrations reported in the literature (Kleinfelder 2007b). The mercury in the fine sediments contained behind Condit Dam would get flushed downstream when the dam is removed and would adversely affect downstream water quality.

In January 2009, GEC mercury concentrations in the White Salmon River and the Columbia River resulting from dam removal (GEC 2009). Three scenarios were evaluated. The third scenario, which assumes that 75% of the total fine-grained sediment will erode, and that 50% of this will erode in the first day after breaching, is the most likely. Mercury concentrations were estimated at four locations: 1) in the White Salmon River immediately downstream from Condit Dam, 2) in Bonneville Pool, 3) downstream of Bonneville Pool, and 4) in the lower Columbia River near Quincy, Oregon. Mercury concentrations would likely exceed Ecology's acute and chronic water quality criteria for the protection of aquatic life in the White Salmon River for 20 and 49 days, respectively, following dam removal. The EPA acute and chronic water quality guidelines or criteria for the protection of human health also would be exceeded in the White Salmon River for 22 and 39 days, respectively. Mercury concentrations would be sufficiently diluted once entering the Columbia River that the neither the Ecology acute criterion for the protection of aquatic life nor the EPA acute water quality criterion for the protection of human health would be exceeded within or downstream of Bonneville Pool. The Ecology chronic water quality criterion for the protection of aquatic life would likely be exceeded for 17 days in the Bonneville Pool, and for seven days at Quincy, Oregon. Within Bonneville Pool, the EPA chronic mercury criterion would likely be exceeded for five days.

People are not likely to ingest water from the White Salmon River during the time the mercury levels would be elevated because of the associated high suspended sediment load and turbidity.

Concrete Disposal

Approximately 34,000 cubic yards of concrete from the dam would be disposed of on site. Approximately half of the dam could be removed in large blocks (4 feet by 6 feet by 10 feet). The remaining portion would be blasted into smaller rubble. The concrete would be transported by truck and placed along the existing flowline alignment between the dam and the surge tank. This alignment is an approximately 5,100-foot-long by 35-foot-wide bench cut into the hillside above the White Salmon River. The flowline is generally within 200 feet of the river, but elevated 80 to 100 feet above it.

There is no toxic byproduct associated with the concrete. However, a potential concern with on-site disposal of concrete is changes to the pH of local waters as a result of contact with fine concrete rubble and debris. Lime ($CaCO_3$), the common binder in cement, when in solution, has the ability to increase the pH of water beyond the range tolerable for most biota. This is normally a concern in concrete mixing operations, where the washout water can approach a pH of 12. The primary concern is the potential for water leaching off the concrete with an elevated pH and running into waters where effects on aquatic biota might occur.

The proposed method of dam demolition would result in large blocks and large-dimension rubble from cutting and blasting. The amount of surface area of fresh concrete faces would be limited. Only a very small amount of concrete powder would be expected to adhere to the larger pieces of debris (see Final SEPA SEIS Section 4.2-10). In addition, very little water would move past the concrete, since all streams and seeps would be separated from the concrete, and the soil covering would be contoured to avoid concentrating infiltration where the concrete is placed. As a result, changes to the pH of water in the vicinity of the disposal site are expected to be minimal.

The natural buffering capacity of the native soils also would minimize any adverse effects of the concrete disposal. The native soils in the vicinity of the disposal site are mapped as Hood loam (Haagen 1990). This is a very deep, well drained soil that formed in silty or loamy lacustrine deposits. The disposal site is on a lacustrine terrace escarpment with 30 to 65 percent slopes. Hood soils typically are fine to loamy-textured (loams or silt loams with 18 to 25 percent clay.) They are slightly to moderately acid (pH 5.7 to 6.2) and have moderately-high cation exchange capacities. Based on their texture, organic matter content, mineralogy, and acidity, these soils would be expected to have a moderately high ability to buffer increases in soil pH.

The nature of the concrete disposal site would limit potential adverse effects. Rather than being placed in a single large pile, where leachate can concentrate, disposal would occur along a linear bench. Alkaline leachate from the debris would not concentrate in a single location, but would be dispersed along the entire length of the disposal site. The small amount of flow in contact with fine concrete debris would easily infiltrate downslope of the disposal site and be buffered. Therefore, there should be no change in pH in the White Salmon River as a result of the concrete disposal along the flowline alignment.

To further limit the potential of alkaline runoff reaching the White Salmon River, disposal zones would be kept a minimum of 100 feet (horizontal distance) from the ordinary high water mark of the river. Appropriate disposal zones would be marked along the flowline alignment. This 100-foot buffer currently contains mature forested vegetation that would greatly minimize any potential water quality impacts to the White Salmon River. In addition, streams and seeps that cross the flowline alignment would be culverted and separated by membrane material from the concrete. These features have been mapped in the vicinity of the flowline alignment and are shown on the Erosion Control Plan (PacifiCorp Energy 2008b). Based on preliminary calculations, the flowline alignment would provide an adequate area for disposal of all concrete from the dam and surge tank.

The concrete blocks and rubble would be capped with approximately 18 inches of soil/ sediment excavated from the drained reservoir and possibly from the original flowline excavated fill. Excavation areas would be chosen where fine to medium-grained sediment is available. Depending on the nature of this sediment, additional topsoil or soil amendments may be required on top of the sediment to promote establishment of vegetation. The disposal area would be contoured for drainage and seeded as per the Revegetation and Wetlands Management Plan (PacifiCorp Energy 2009b). Additional erosion and sedimentation controls are listed in the Erosion Control Plan and include silt fencing, culverting and protection of stream crossings, surface roughening, and mulching (PacifiCorp Energy 2008b). No bare soil would be left exposed during the rainy season. The Revegetation and Wetlands Management Plan recommended the use of bonded-fiber matrix composed of wood fiber mulch and tackifier to stabilize reservoir sediments (PacifiCorp Energy 2009b). Sediments can be seeded prior to placement of the bonded-fiber matrix and the plants can emerge through the material. The use of unconsolidated reservoir sediments to cap the concrete disposal site may require the use of this material or erosion control blankets, especially in steeply sloping areas.

The Erosion Control Plan provides for maintenance and monitoring of the erosion control measures (PacifiCorp Energy 2008b). In addition, water quality monitoring in the White Salmon River has been proposed in the Environmental Monitoring Plan (PacifiCorp Energy 2009e). These sites would continuously measure turbidity and pH using electronic data loggers. If runoff from the concrete disposal site is increasing the pH in the river, this would be detected at the monitoring sites. In this unlikely event, contingency measures to deal with the alkaline runoff would be proposed. These could include redirecting water or chemically treating the runoff on site to reduce pH.

The concrete in the spillway below the surge tank is a somewhat different situation from the flowline alignment. The concrete from the surge tank and its spillway is proposed to be disposed of in the location of the surge tank spillway. The lower end of the concrete spillway is within about 50 feet horizontally and 50 feet vertically from the White Salmon River. Mostly exposed bedrock lies between the end of the spillway and the river. The slope where the spillway is located is very steep, falling more than 80 feet in a horizontal distance of about 140 feet. A horizontal barrier is proposed across the lower end of the spillway to keep materials from escaping into the river. The concrete rubble disposed of in this location would be an estimated average of seven feet deep and would be covered with soil material so that it can be revegetated. If the chunks of concrete are large, there would be relatively little surface area for leaching water to contact. The soil cover may be adequate to buffer any leached water.

However, even with a horizontal barrier, the likelihood is high that covering soil material would have a tendency to slide down the slope when it is saturated during the winter. If such a slide occurred, it is likely that at least the soil material would end up in the White Salmon River. Extra stabilization and erosion control measures would be applied to prevent problems with this location.

4.2.3 Mitigation Measures

Concrete Disposal Areas

Implement the best management practices (BMPs) as described in the Erosion Control Plan (PacifiCorp Energy 2008b) and Dust Control Plan (PacifiCorp Energy 2008d).

Proper implementation of these BMPs should minimize turbidity in stormwater runoff related to disturbance of soil in the upland areas and changes in pH. The BMPs may not be as effective in areas where there are steep slopes (such as along roads that may be constructed down into the canyon and in the area of the surge tank spillway). Extra stabilization and erosion control BMPs would be applied in the spillway location.

4.2.4 Significant Unavoidable Adverse Impacts

Significant unavoidable adverse impacts with respect to surface water include massive turbidity and sediment transport as part of the dam breaching and removal, as previously identified in the Final SEPA SEIS. After the Final SEPA SEIS was published, additional sediment sampling found mercury levels in Northwestern Lake sediment that exceed screening criteria, warranting further review. Additional analysis concluded that mercury concentrations would likely exceed Ecology's acute and chronic water quality criteria in the White Salmon River for 20 and 49 days, respectively, following dam removal (GEC 2009). Mercury concentrations would be sufficiently diluted once entering the Columbia River that the acute water quality criterion would not be exceeded within and downstream of Bonneville Pool. The Ecology chronic water quality criterion would likely be exceeded for 17 days in the Bonneville Pool, and for seven days at Quincy, Oregon. The impacts from mercury would be unavoidable, but would not rise to the level of a significant impact on organisms.

4.3 AQUATIC RESOURCES

Aquatic resources in this document are the fish, aquatic insects, and other aquatic invertebrates that live in the waters of the project, as well as the habitat elements within and adjacent to the waters that they rely upon. Other organisms, including amphibians and some reptiles, birds, and mammals, spend significant parts of their life cycles in the water or have critical linkages to the water. These organisms could be considered aquatic resources, but in this document, they are primarily covered in the wildlife section.

4.3.1 Affected Environment

The affected environment for aquatic resources includes Northwestern Lake, the White Salmon River below Condit Dam, the Bonneville Pool of the Columbia River, the river and stream channels inundated by Northwestern Lake, and the White Salmon River and its tributaries above Condit Dam up to the maximum extent upstream that anadromous and fluvial salmonids may be expected to migrate. The aquatic resources would be affected by removal of the dam and reservoir and may be affected by activities in the area immediately surrounding Condit Dam, the access roads, and the work areas and staging areas.

Because the release of reservoir sediments following the breaching of Condit Dam is expected to kill all fish and eggs in gravel present in the White Salmon River and temporarily eliminate anadromous spawning in the lower White Salmon River, a mitigation measure long agreed to is the capture and relocation of Chinook salmon spawners to maintain a population base. The Biological Opinion (NMFS 2006) approved trapping and hatchery rearing. However, a decision was made in early 2008 by the White Salmon Working Group (which includes the National Marine Fisheries Service, US Fish and Wildlife Service, and the Tribes) to perform adult Lower Columbia River (LCR) fall Chinook salmon out-planting upstream of Condit Dam during the year of dam removal in lieu of adult collection and subsequent hatchery propagation (Engle and Skalicky 2009). That process was conducted as a pilot study in fall 2008. The Washington Department of Fish and Wildlife estimated a 2008 White Salmon River spawning escapement of 775 LCR fall Chinook salmon, of which 296 were of hatchery origin and 479 were not externally marked. A capture goal of 500 LCR fall Chinook salmon was established to seed spawning habitat in the White Salmon River from the head of Northwestern Lake upstream to Husum Falls (Engle and Skalicky 2009).

A genetic analysis of juvenile Chinook salmon naturally produced in the lower White Salmon River downstream of Condit Dam (Allen and Connolly 2006) identified two populations of juveniles, with the earlier group genetically similar to LCR fall Chinook and the later group genetically similar to upriver bright fall Chinook (Smith et al. 2007). The genetic analysis also found the LCR fall Chinook salmon from Spring Creek National Fish Hatchery to be genetically similar to the LCR fall Chinook salmon juveniles captured in the White Salmon River (Smith et al. 2007).

In September 2008, to assess the feasibility of capturing and out-planting LCR fall Chinook, biologists tested several capture methods in the lower White Salmon River. Beach seines were adopted for the capture of Chinook spawners based on catch efforts and the difficulties in deploying and maintaining gill nets. Ninety hatchery-origin LCR fall Chinook salmon (37 male and 53 female) were captured in the lower river and 333 Chinook (162 male and 171 female) were collected from the Spring Creek National Fish Hatchery, for a total of 423 adult Chinook spawners. These fish were transported and released upstream of Condit Dam (Engle and Skalicky 2009).

LCR Chinook salmon were released at one of two sites in the upper White Salmon River above Condit Dam. The first site was located at the head of Northwestern Lake at the public boat ramp located at river mile (RM) 4.9. The second site was located at RM 7.5 and is just downstream of Husum Falls at a whitewater rafting take-out site. A total of 249 fish were released at the Northwestern Lake Boat Ramp and 174 fish were released near Husum Falls (Engle and Skalicky 2009).

A total of 35 of the planted fish were radio-tagged to track their movements, 25 at Northwestern Lake and 10 near Husum Falls. Radio-tagged fish at the Husum Falls release site demonstrated a strong fidelity to that area, while radio-tagged fish released at the Northwestern Lake site showed a large, variable amount of movement, with most fish showing an exploratory movement period between the upper and lower portions of Northwestern Lake (Engle and Skalicky 2009). No tagged fish were detected above Husum Falls. Fish from both release sites moved large distances, so the ability of LCR fall Chinook salmon to move within the river channel between RM 4.9 and RM 7.9 (Husum Falls) does not appear to be restricted.

Based on three redd surveys, a total of 80 redds was estimated, suggesting that the transport of spawners can be successful. A number of adjustments in the process were recommended, and presumably a similar transport of spawners would occur prior to breaching the dam in the fall of 2010.

4.3.2 Impacts

Impacts Associated with Elevated Mercury Levels in Fine Sediments

The duration of elevated mercury concentrations from suspended sediments in the White Salmon River would likely cause harm to aquatic organisms. However, it is already assumed that all fish and aquatic macroinvertebrates within the White Salmon River channel downstream of the dam would likely be killed or displaced by the load of suspended solids released during dam breaching. A study of the effects of exposure to high levels of suspended sediments on juvenile Chinook salmon indicated that mortalities over a 36-hour period begin to occur at 1,400 µg/L and that mortality reaches 90% at 39,000 µg/L (Newcombe and Flagg 1983). The concentration of suspended sediments in the White Salmon River following the breaching of the dam is predicted to exceed acute levels for a longer period than the concentration of water-borne mercury (GEC 2009). Therefore, the elevated mercury concentrations would not contribute to additional mortality within the White Salmon River. During the high flows immediately following the beaching of the dam, the White Salmon River would comprise approximately 7% of the average flow of the Columbia River (G&G Associates 2004a and 2004b, GEC 2009). As a result of the dilution in the Columbia River, total mercury concentrations within and downstream of the Bonneville Pool are not expected to exceed the Ecology (2.1 µg/L) or EPA (1.4 µg/L) acute mercury water quality criteria (GEC 2009). Downstream of Bonneville Pool, the EPA chronic mercury water quality criterion is not expected to be exceeded, while the Ecology criterion (0.012 µg/L) would likely be exceeded for seven to eight days. Within Bonneville Pool, the EPA chronic mercury criterion (0.077 µg/L) would likely be exceeded for five days, while the Ecology criterion would likely be exceeded for 17 days.

Most of the mercury present in the water-borne sediments would be inorganic mercury, rather than methyl mercury, which is far more toxic to fish. In a 2002 study, de Oliveira Ribeiro et al. (2002) exposed Arctic char (*Salvelinus alpinus*), a close relative of the native bull trout (*S. confluentus*), to a 96-hour acute concentration (15 µg/L) of inorganic mercury. Histopoathological effects to gill tissue were observed within 12 hours and modifications of cilia of ciliated olfactory cells appeared after 24 hours. A partial recovery was seen in both tissues by the end of the 96-hour exposure period. The liver was little affected by the exposure to water-borne inorganic mercury. The maximum predicted concentration of mercury from water-borne sediments would be 28.768 µg/L in the White Salmon River, 0.056 µg/L in the Bonneville Pool, and 0.019 µg/L downstream of the Bonneville Pool.

Huckabee and Griffith (1974) found that the lowest concentration of water-borne mercury that had a significant effect on the hatchability of carp eggs was 3 mg/L. The concentration of water-borne mercury in the lower White Salmon River would be far below this level before spawning salmonids are able to utilize the lower White Salmon River for spawning.

Exposure to sublethal mercury concentrations of 0.1, 0.05, and 0.01 mg/L have been demonstrated to impair the ability of mosquito fish to avoid predation by largemouth bass (Kania and O'Hara 1974). Assuming that juvenile salmonids would be similarly affected, at predicted mercury concentrations following the breaching of Condit Dam (GEC 2009), the ability of juvenile salmonids within the Bonneville Pool would likely be slightly impaired for approximately 38 days and approximately 11 days downstream of the Bonneville Pool.

Juvenile salmon exposed to sublethal concentrations of water-borne mercury did not display elevated mercury concentrations when returning to spawn after four years at sea (Amend 1970).

The lack of acute mercury exceedance and the relatively short durations of chronic mercury exceedance in the Columbia River suggest that the dam breaching is not likely to result in long-term impacts to aquatic organisms in the Columbia River associated with mercury toxicity. Any fish likely to be affected by acute mercury exceedance in the White Salmon River after the breaching of Condit Dam would have been killed by the high levels of suspended sediments present in the river immediately following the breaching of the dam and continued high levels of suspended sediments present during the period of elevated concentrations of mercury present in the lower White Salmon River.

Mercury in Stream and Bonneville Pool Substrate Sediments

The bioaccumulation and toxicity of mercury is influenced by several factors and the complex interactions among them. Kleinfelder (2008b) provides a technical summary of mercury cycling and toxicity to aquatic organisms. Mercury in water largely occurs in the inorganic form, mercury sulfide, which is insoluble and less harmful to fish. Under certain conditions, this can be converted into the more soluble organic form (methylmercury), which can accumulate to toxic levels in fish. Spangler et al. (1973) demonstrated that the methylation of mercury in sediments may be obviated by demethylation reactions by microbes, resulting in small or possibly zero net methylmercury release to the water. It is not possible to know the fate of mercury in the fine sediment that would be flushed into the Columbia River without more detailed and site-specific studies. Bioassays conducted on fine sediment from Northwestern Lake showed that mercury was in a form that could bioaccumulate in the food chain, though the sediment had no adverse effect on the life cycles of test species. The different and dynamic environments in the Columbia River would determine if and how much of the mercury enters the food chain.

The mercury in the fine sediments in Northwestern Lake and the lower White Salmon River downstream of Condit Dam is most likely from a natural source and is within the range of background concentrations reported in the literature (Kleinfelder 2008a). The expected mercury concentrations in the Columbia River are at the low end of the toxicity scale. Documented mercury concentrations in sediments of the Bonneville Pool and its tributary streams outside of the vicinity of the White Salmon River basin vary between 0.014 and 0.2 mg/kg (Table 3). The average documented mercury concentrations in sediments of the White Salmon River basin are 0.142 mg/kg, with 0.72 to 1.2 mg/kg reported from the Underwood In Lieu Fishing Access Site and the mouth of the river, and 0.02 to 2.03 mg/kg (0.724 mg/kg average) reported from Northwestern Lake sediments. Hence, the expected sediment mercury concentrations of fine sediments from Northwestern Lake that would be deposited in the lower White Salmon River and Bonneville Pool in the vicinity of the mouth of the White Salmon River, following the breaching of the dam, would be unlikely to exceed the existing mercury concentrations in sediments currently present.

The concentrations of mercury in walleyes collected in Franklin D. Roosevelt Lake and the upper Columbia River had no significant correlation to mercury concentrations of the sediments present at their collection locations (Munn and Short 1997). This was attributed to the bioavailability of mercury varying due to local differences in the physical and chemical environment and the preferred foraging locations of the fish. Mercury concentrations in the tissue of non-hatchery rainbow trout collected from Northwestern Lake range from 0.185 to 0.295 mg/kg (Table 3). Mercury concentrations from Bonneville tributary streams have ranged from 0.1 to 0.5 mg/kg (Table 3). Mercury concentrations in fish tissue collected from 18 lakes and 2 rivers in 13 counties of Washington State averaged 0.217 mg/kg (Ecology 2003). The mercury concentration in fish tissues of juvenile salmonids collected throughout tributaries of the Bonneville Pool is within the range of mercury concentrations of juvenile salmonids from Northwestern Lake, despite the elevated level of mercury in sediments of the White Salmon River basin relative to other stream basins draining into the Bonneville Pool.

The lack of correlation between mercury concentrations present in sediments and the tissues of juvenile salmonids collected in tributaries of the Bonneville Pool, as well as the relative health and abundance of salmonids in the White Salmon River despite the elevated levels of mercury in the basin's sediments, both suggest that the dam breaching is not likely to result in long-term impacts associated with mercury bioaccumulation to fish or their forage base in the Columbia River.

In addition, the deposited sediments would be deep enough (up to five feet) at the Underwood In Lieu Fishing Access Site and the adjacent Columbia River/Bonneville Pool that most of the volume would be effectively isolated from both the methylating bacteria and the organisms that might bioaccumulate the mercury. The clay and fine silt fraction would either be carried out to the Pacific Ocean or would be deposited over a broad area and diluted by other sediments being carried by the Columbia River and its tributaries.

Concrete Disposal

Water in contact with fine concrete particles at the concrete disposal site may have an elevated pH. If the pH rises too much, aquatic organisms can be adversely affected, and levels above pH 9 are likely to be increasingly lethal to salmonids, especially if the increase is rapid (Wagner et al. 1997). The likelihood of such a rise in pH is unlikely because of dilution and buffering. Downstream from the powerhouse, the pH would be monitored continuously and compared with background levels. Any runoff of high pH water from the disposal sites is expected to be very limited, and would be diluted below harmful levels once reaching the river.

Beneficial Effects of Dam Removal on Fish

Potentially, 32.4 miles of new steelhead habitat and 15.3 miles of new salmon habitat may be accessed by anadromous salmonids after dam removal, increasing the run size and long-term viability of anadromous salmonid populations in the White Salmon River and increasing the availability of salmon and steelhead angling opportunities in the White Salmon River basin. The benefits of restoring access to anadromous and migratory salmonid habitat in the White Salmon River through the removal of Condit Dam are discussed in the Water Resource Inventory Area 29 limiting factors report (WCC 1999) and the White Salmon River subbasin summary report (Rawding 2000), and are part of the larger recovery effort for Endangered Species Act-listed salmonids in the lower Columbia River. New thermal refuge habitat for migrating Columbia River anadromous salmonids from other sub-basins also would be accessible after the removal of Condit Dam. Additional stream habitat for resident fish would be created in the lakebed of the former reservoir. Additionally, the small increase in water temperature below Condit Dam from the discharge of warmed reservoir surface water would be eliminated, improving the quality of thermal refuge, and the recruitment of gravel and large woody debris from sources above the dam site would be reestablished. Foraging, wintering, refuge habitat, and possibly spawning habitat would be created for Columbia River bull trout. Juvenile anadromous salmonids would provide forage for bull trout, and salmon carcasses in the watershed above the Condit Dam site would provide an additional source of marine-derived nutrients to the watershed. There would be more suitable substrate for stream-dwelling aquatic macroinvertebrates after the stream substrate has stabilized.

4.3.3 Mitigation Measures

Drain Tunnel

Concrete rubble from construction of the tunnel would be captured and prevented from entering the river. After dam breaching, any blocks of concrete that get in the stream would be removed. Downstream from the powerhouse, pH would be monitored continuously and compared with background levels.

Sediment Transport

The dam will be breached in late autumn to take advantage of the rainy season when there will be fewer adverse effects on aquatic life.

Dislodging unstable sediment and woody debris would help ensure that the reservoir sediment is transported downstream over the predicted three- to five-year period and does not affect long-term water quality, pool depths, or spawning gravels.

Heavy equipment should be used to cut channels through tributary lake sediment delta at Mill Creek to hasten the creation of a stable stream channel and prevent fish passage blockage by the sediment. The sediment assessment following reservoir draining will determine specific needs.

The White Salmon Working Group has proposed to capture the fall Chinook returning to the White Salmon River before the dam is breached in October, and transport them upstream of the project area to prevent the loss of a Chinook year-class.

Dam and Appurtenance Removal

Use of BMPs will avoid or minimize impacts associated with the use of haul roads, staging area, and disposal sites, and filling the surge tank tailrace.

Cofferdam removal would occur as soon as possible after dam removal and probably be accomplished by blasting while suspended sediment levels exclude upstream migrating fish.

4.3.4 Significant Unavoidable Adverse Impacts

The duration of elevated mercury concentrations in the White Salmon River would undoubtedly harm aquatic organisms. However, it is already assumed that all fish and aquatic macroinvertebrates within the White Salmon River channel downstream of the dam would likely be killed or displaced by the load of suspended solids released during dam breaching. Therefore, the elevated mercury concentrations would not contribute to additional mortality within the White Salmon River.

4.4 TRANSPORTATION

Changes that affect transportation have been made in the project since the Final SEPA SEIS. The first change is that the proposed location for concrete disposal has been moved to the flowline alignment from SA-3. That means that the trucks hauling concrete would not travel on access road AR-3 or on Tamarack Lane (now known as Forester Lane). The new location for the concrete disposal also necessitates hauling soil material from the drained reservoir and possibly from original excavated fill from flowline construction to use as a topsoil cover over the concrete so that revegetation would be successful. If it required 1,000 truckloads of soil material and one assumed that the material was hauled over a period of three months, then about 15 loads per day would move over Northwestern Lake Road, SR 141, and Powerhouse Road, as well as the local access roads at each end.

4.4.1 Affected Environment

The roadways potentially affected by the proposed project were described in the Final SEPA SEIS, including SR 141, SR 14, Powerhouse Road, Graves Road, Northwestern Lake Road, and Cabin Road. Existing traffic volumes were reported, and based on the volumes, the roads were determined to be at LOS A. With expected growth, the LOS would still be at LOS A at the time the project is underway.

4.4.2 Impacts

The analysis in the Final SEPA SEIS showed that the number of vehicle trips (both employee vehicles and trucks) generated by the project would not change the LOS or operation of any of the roads. That would be true even if concrete recycling required trucks to haul the concrete off site. With the proposed changes, including the addition of trucks hauling sediment from the reservoir to cover the concrete in the new disposal area, the same result would occur. In other words, the increase in traffic is so slight that there would be no change in level of service or other operational measures.

4.4.3 Mitigation Measures

The mitigation measures listed in the Final SEPA SEIS would be unchanged.

4.4.4 Significant Unavoidable Adverse Impacts

With the implementation of the mitigation measures identified above, no significant unavoidable adverse impacts are expected to occur to transportation or traffic.

4.5 LAND USE/CRITICAL AREAS

This section evaluates land use and critical areas that could be affected as a result of the proposed action. Recreational impacts and mitigation measures were addressed in previous FERC documents and are not addressed in this section. Other discussions related to land use/critical areas were included in Water Resources (Section 4.2), Aquatic Resources (Section 4.3), Public Safety (Section 4.11) and Public Services (Section 4.12) of the Final SEPA SEIS (Ecology 2007).

The Federal Power Act would preempt state and local permits, as noted in FERC's May 18, 2006 declaratory order (except laws adjudicating proprietary water rights). It does not prevent FERC from ordering PacifiCorp to implement decommissioning requirements proposed by state and local agencies, including other state permits and permits from Klickitat County or Skamania County.

4.5.1 Affected Environment

For the proposed action (dam removal), the affected area analyzed would be the area from the Northwestern Lake Bridge extending to the Underwood In Lieu Fishing Access Site adjacent to the Columbia River. Both Klickitat and Skamania Counties, on the east and west sides of Northwestern Lake and the White Salmon River, have land use jurisdiction. The US Forest Service manages lands upstream from the reservoir as part of the Lower White Salmon National Wild and Scenic River area. The US Forest Service also manages the Columbia River Gorge National Scenic Area, which extends over the entire area below the Condit Dam. The discussion below includes land use and critical areas.

Under Klickitat County's Shoreline Master Program, proposed construction activities within 200 feet of a jurisdictional shoreline (such as Northwestern Lake) would require a shoreline substantial development permit. This program lists the proposed action area as a conservancy environment. The purpose and intent of a conservancy environment is to protect, conserve and manage existing natural resources and/or unique, valuable, aesthetic, historic and cultural areas in order to achieve sustained resource utilization and provide recreational opportunities.

4.5.2 Impacts

The primary action not previously analyzed would be the use of the flowline alignment to deposit the concrete from the dam, rather than at the originally proposed Staging Area 3. After the flowline is removed, the concrete blocks and rubble removed from the dam would be hauled and deposited along the flowline alignment and then covered with sediment hauled from the drained reservoir (possibly supplemented with material originally excavated from the flowline alignment and left in adjacent berms) and revegetated. During the better part of a year, construction activities would occur within the 200-foot shoreline zone designated as a conservancy area.

However, construction BMPs would apply stringent erosion control measures to protect the river from sedimentation or other effects. When the work is completed and the area restored to native vegetation, the natural resources that were compromised by the construction of the dam and flowline would be on a trajectory of recovery to natural conditions. The project and its results should be well within the guidelines of the conservancy designation. With less activity needed SA-3, it should have fewer impacts on neighbors and facilities than were originally proposed.

4.5.3 Mitigation Measures

PacifiCorp has updated several plans and proposed construction BMPs to address impacts from the proposed action. Some of those measures address impacts to land use and critical areas. No new mitigation measures are proposed.

4.5.4 Significant Unavoidable Adverse Impacts

If the PacifiCorp Sediment Assessment, Stabilization, and Management Plan (PacifiCorp Energy 2008a), Erosion Control Plan (PacifiCorp Energy 2008b) and Revegetation and Wetlands Management Plan (PacifiCorp Energy 2009b), and other mitigation measures are implemented, no long-term unavoidable significant adverse impacts to land use/critical areas are anticipated. There would be short-term significant unavoidable adverse impacts to sites along or near the reservoir that would be used for work areas, construction staging or for disposal, and from the access roads that would be built in several locations.

Table 3
Mercury Concentrations in Columbia River Basin Salmonids and Stream Sediments in the Vicinity of the White Salmon River and Bonneville Pool

Sample Location	State	River Mile[a]	Reference[b]	Total Organic Carbon (%)	Mercury Concentrations (mg/kg) in Sediment and Fish Tissue				
					Sediment	Fish	Chinook	Steelhead	Rainbow
Fifteen Mile Creek Basin	OR	192.0	Inouye 1991			0.219			
Mayer State Park	OR	180.8	Inouye 1991	0.6–2.3	0.03–0.09				
Klickitat River Mouth	WA	180.4	EIM 2008			0.266–0.51			
Klickitat River Mouth	WA	180.4	Inouye 1991				0.1–0.5	0.05–0.12	
Bingham Boat Basin and Marina	WA	170.8	Inouye 1991	1.3–1.7	0.08–0.13				
Port of Hood River	OR	169.0	Inouye 1991	1.2–2.5	0.05–0.09				
Hood River Marina	OR	169.0	Inouye 1991	0.74–0.76	0.03				
Hood River	OR	169.0	Inouye 1991				0.1–0.19		
White Salmon River Basin	WA	168.3	Kleinfelder 2007b		0.142 (avg.)				
White Salmon River Mouth	WA	168.3	Inouye 1991		0.72				
White Salmon River In Lieu Site	WA	168.3	Kleinfelder 2008a	1.2	0.72–1.20 (0.96 avg.)				
Northwestern Lake	WA	168.3	EIM 2008						0.295
Northwestern Lake	WA	168.3	EIM 2008						0.243
Northwestern Lake	WA	168.3	Inouye 1991		0.78				0.185–0.308
Northwestern Lake	WA	168.3	Kleinfelder 2007b	0.86–1.64	0.02–2.03 (0.724 avg.)				
Little White Salmon River	WA	162.6	Inouye 1991		0.014		0.08–0.15		
Wind River Boat Ramp	WA	154.7	Inouye 1991	1.5–3.7	0.04–0.05				
Wind River Mouth	WA	154.7	Inouye 1991	0.1–1.4	0.03–0.05				
Wind River	WA	154.7	Inouye 1991		0.054		0.08–0.15		
Government Cove	OR	151.6	Inouye 1991	1.7–3.7	0.08–0.13				
Herman Creek	OR	150.7	Inouye 1991	1.0–6.0	0.02–0.08				
Rock Creek Mouth	WA	150.0	Inouye 1991	0.2–5.8	0.04–0.07				
Bonneville Dam	OR	146.5	Inouye 1991	1.5–1.6	0.2				

a. River Mile represents the Columbia River Mile where sediments were collected or where the tributaries drain into the Columbia River.
b. See Section 5.0, References