Draft Environmental Assessment
Downstream Fish Enhancement for Juvenile Salmonids at Hills Creek, Fall Creek, and Cougar Dams 2013-2020

US Army Corps of Engineers ®
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Abbreviations and Acronyms

APE	Area of Potential Effect
BiOp	Biological Opinion
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
cy	cubic yard(s)
ODEQ	Oregon Department of Environmental Quality
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
ESU	Evolutionarily Significant Unit
FONSI	Finding of No Significant Impact
ft	foot or feet
MSL	Mean Sea Level
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRHP	National Register of Historic Places
ODFW	Oregon Department of Fish and Wildlife
RM	River Mile
RO	Regulating Outlet
RPA	Reasonable and Prudent Alternatives
RM&E	Research Monitoring and Evaluation
SHPO	State Historic Preservation Officer
TMDL	Total Maximum Daily Loads
TDG	Total Dissolved Gas
UWR	Upper Willamette River
USFWS	U.S. Fish and Wildlife Service
WTC	Water Temperature Control
WVP	Willamette Valley Project

1. INTRODUCTION

The Army Corps of Engineers, Portland District (Corps) proposes to drawdown the reservoirs of Fall Creek, Hills Creek, and Cougar Dams below the usual winter drawdown elevations to facilitate downstream volitional migration of juvenile salmon in a manner that is anticipated to result in a decrease in fish injury and mortality that can occur during fish passage under normal operations. The Corps operates and maintains several dams in the Willamette Basin. Proposed actions at three of these thirteen dams are the focus of this draft Environmental Assessment (EA). The three dams include; Cougar Dam (on the South Fork of the McKenzie river), Fall Creek Dam (on the Middle Fork of the Willamette) and Hills Creek Dam (Middle Fork of the Willamette River). These three projects are part of a larger system of 13 multi-purpose dams and reservoirs that are located in the Willamette Basin. The 13 dams and reservoirs work in combination to provide several project objectives for the Willamette Basin, collectively known as the Willamette Valley Project (WVP). These objectives include flood damage reduction, hydroelectric power generation, irrigation, navigation, improved water quality, fish and wildlife enhancement, and water supply and recreation. The Corps' proposed action is to drawdown three reservoirs below their typical winter pool elevations to facilitate downstream passage for juvenile salmonids.

1.1. AUTHORITY

The Willamette Valley Project was authorized by the Flood Control Acts of 1938, 1950, and 1960. The 1950 Act Flood Control Act was critical for the Willamette Project with an increase in the number of projects and scope, much of this outlined in House Document 531. Although there are multiple project authorities pertaining to development of the Willamette Project, House Document 531 remains the overall guiding legislation. As the projects were originally authorized under the various Flood Control Acts, the flood risk management mission is the Corps highest priority.

1.2. LEAD AGENCY

The Corps is the lead Federal agency for compliance with the National Environmental Policy Act (NEPA). As the lead Federal agency, the Corps ensures overall compliance with all associated environmental laws and regulations regarding the proposed federal action and has prepared this draft Environmental Assessment (EA) for compliance with NEPA for fish enhancement actions at the dams over the next seven years 2013-2020.

1.3. PURPOSE OF AND NEED FOR ACTION

Purpose

The purpose of the proposed action is to implement <u>near term</u> changes to the current operations at three dams within the WVP. The proposed action will not involve any structural modifications to the dams but rather utilize existing structural features such as the regulating outlets and modify normal operation practices. This proposed action

would facilitate downstream volitional migration of juvenile Chinook salmon and trout and decrease fish injury and mortality that can occur during fish passage under normal operations. Some of these fish are listed under the Endangered Species Act (ESA). If there is improved downstream passage of juvenile salmon, it is expected that this would also improve both fish productivity and abundance. Associated with this investigational operation are extensive monitoring efforts and analysis of the results of the operational changes and their effect on fish passage at the three dams.

Need

The need for the proposed action is to facilitate downstream passage of ESA listed fish species in a manner that maximizes the number of fish able to move downstream while simultaneously decreases fish injury and mortality. Several species of fish that are native to the Willamette Basin are listed as threatened or endangered under ESA. Anthropomorphic changes over the last century have led to a decline in fish population, habitat and water quality within the Willamette system. Further, passage of juvenile fish through the various Willamette Valley Project dams has had limited success. Most dams have only a few outlets for downstream fish passage. Many of these outlets require juvenile fish to dive deeper into the reservoir than their nature behavior to find an outlet. Further, two of the dams (Hills Creek and Cougar) are equipped with powerhouses. Fish passage through the Francis turbine units at these powerhouses is known to cause injury and mortality. The Corps recognizes these problems and has coordinated with fisheries biologists from National Marine Fisheries Service (NMFS) and Oregon Department of Fish and Wildlife (ODWF) to identify the proposed action as a potential solution.

In addressing this need, the Corps is required to comply with Section 7 of ESA. ESA identifies that federal agencies "…shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purpose of this chapter" (16 USC 1531 (c)). In 2008, NMFS issued a Consultation and Biological Opinion (BiOp) on the Willamette Basin's Flood Control Project. As part of the BiOp several Reasonable and Prudent Alternatives (RPA) were identified to enhance recovery of ESA-listed species. The following RPA from that consultation provide the rationale for near term operational downstream fish passage through the three dams' existing configurations as one method to help conserve listed species:

"…the Action Agencies will carry out interim operational measures to pass downstream migrants as safely and efficiently as possible downstream through Project reservoirs and dams under current dam configurations and physical and operational constraints, and consistent with authorized Project purposes." Please refer to NMFS 2008 BiOp RPA 4.8

Although, the Corps is looking at ways to improve downstream fish passage at all its WVP facilities, downstream fish passage is being evaluated at this time only at the Fall Creek, Hills Creek, and Cougar dams in this draft Environmental Assessment.

1.4. LOCATION

The proposed action would occur at three dams within the Willamette Valley Project. Fall Creek Dam is located at river mile 7.2 of Fall Creek, which is a tributary of the Middle Fork of the Willamette River and is about 20 miles southeast of Eugene, Oregon (OR). Hills Creek Dam can be found at river mile 47.8 of the Middle Fork Willamette River, four miles southwest of Oakridge, OR. Cougar Dam is situated at river mile 4.4 of the South Fork McKenzie River, about 42 miles east of Eugene, OR. See Figure 1-1 below.

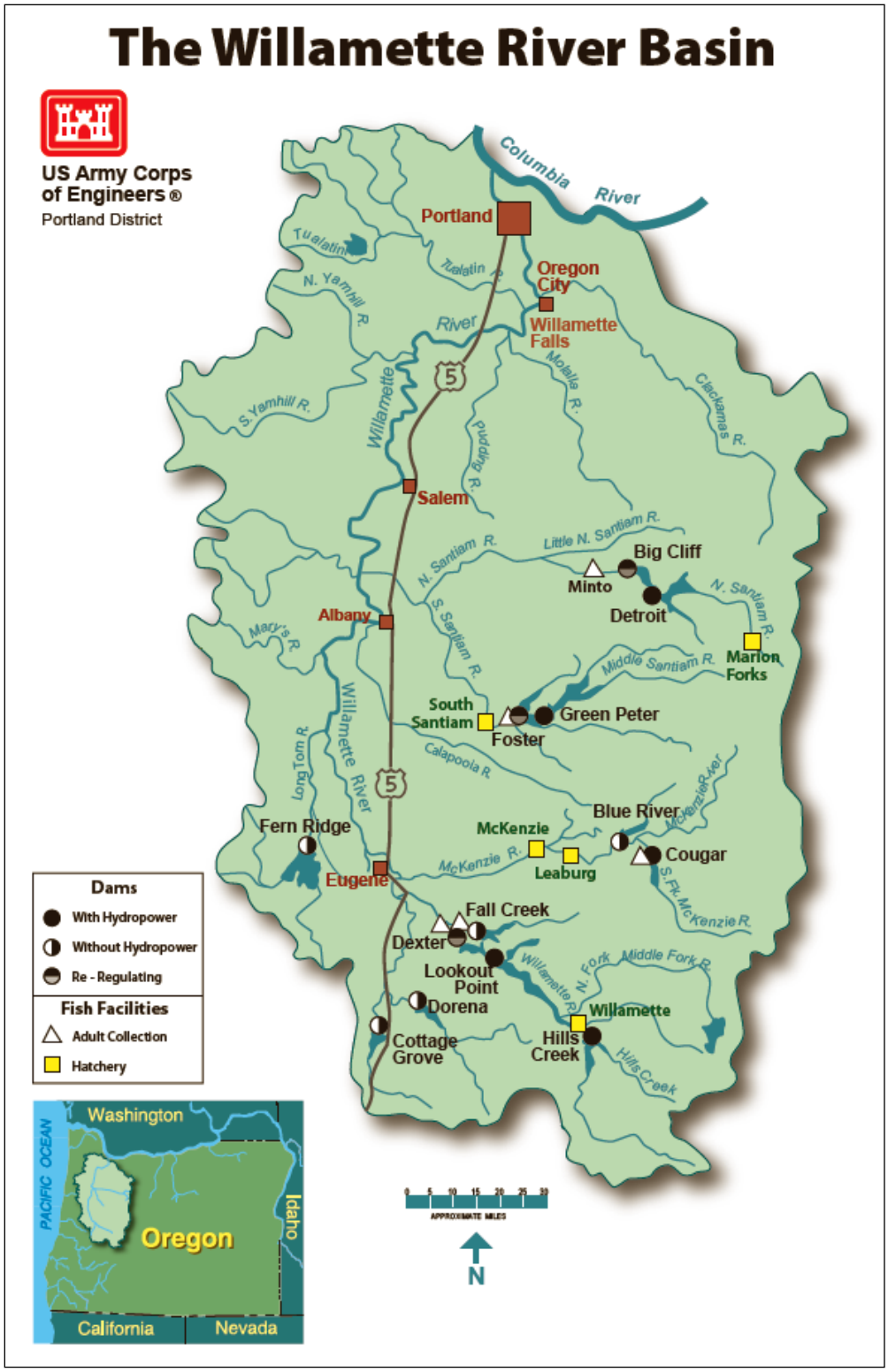


Figure 1-1: Location Map

2. ALTERNATIVES

2.1. NO-ACTION ALTERNATIVE

The no action alternative would be to maintain the status quo in regards to operations at Fall Creek, Hills Creek, and Cougar Dams as identified in the 1980 Environmental Impact Statement (EIS) on the Operation and Maintenance of the Willamette Reservoir System, this EIS is incorporated by reference. These three dams store and release water according to a rule curve that provides guidance to the reservoir regulators on how to manage the water storage in the reservoir to meet the multi-purpose needs. The three reservoirs typically lower water in the reservoirs (i.e., water is evacuated) in the fall to provide space to store high runoff from winter rain events. Rain events cause the reservoirs to rise, and then stored water is evacuated once the flood threat has passed. In the early spring, the reservoirs begin to capture some of the runoff to store water for use in the summer months. Some stored water may also be released downstream in the late spring for fish flow augmentation during drier years. In the Willamette Basin, the conservation season occurs from April through October when the level of water stored in these reservoirs is governed by multipurpose uses taking into consideration biological resources, water quality, power generation, irrigation, municipal and industrial uses, and recreation (Corps 2009). Under the no action alternative, there would be no prioritization of outlets or drafting of reservoir levels for downstream migration. Rather, fish would be routed through turbines or regulating outlets as specified in the water storage rule curve of each dam. Although the No Action Alternative does not meet the purpose and need for action, it is being considered in order to discern the relative effects of the action alternative when compared to taking no action.

2.2. PREFERRED ALTERNATIVE

The preferred alternative consists of similar actions at three separate dams. It is important to note is that the ability to draw the reservoir down to a specific elevation, hold it there continuously, and then refill to a desired elevation is dependent upon rain events before, during, and after the drawdown period. These actions involve deviating from routine operations of releasing and storing water while staying within the existing rule curve of each reservoir. Further, the timing of these actions is anticipated to differ for each reservoir. For example, from 2013 to 2020, the Corps anticipates to draw down water at Fall Creek Reservoir each year and expects to draw down water at Cougar and Hills Creek reservoirs less than annually. Monitoring of water quality and fish passage would occur at all three dams over the seven year period to quantify the effects of the proposed action (refer to Section 3.11 and 4.10 for more detailed discussion). Described below are the changes in operations (flow management and water outlets use) at the three dams. The Corps proposes to implement the preferred alternative over the next seven years (2013 to 2020).

2.2.1 Hills Creek: Drawdown and Prioritize Use of Regulating Outlet for Downstream Fish Passage Improvements

Description. At Hills Creek Dam, the Corps would maintain normal minimum conservation pool and prioritize use of regulating outlets (ROs) during the peak of outmigration to improve downstream fish passage and survival from 15 November to 31 January from 2013 to 2020. In typical years, water passage through the turbines is given priority over the ROs in order to generate hydropower during the winter months. The preferred alternative aims to improve downstream fish passage by giving priority to the ROs rather than the turbines during winter drawdown, since data suggests that ROs are a safer passage route than the turbines at this high head dam. With this alternative, the Corps would not alter the total project outflow rates, but the reservoir would be drawn down an additional 9 feet (to elevation 1439-feet Mean Sea Level (MSL)) to allow juvenile fish better access to the ROs (i.e. normal draw down elevation is approximately 1448-feet MSL elevation, and the invert elevation of the RO is 1409-feet MSL). Also, at this time, it is unknown what the appropriate duration of the Hills Creek drawdown should be (e.g. one week or 3 months). Monitoring during implementation of this drawdown will determine duration goals, which will be aimed at maximizing the number of fish passing downstream with minimal injury and mortality.

2.2.2 Fall Creek: Drawdown and Prioritize Use of Regulating Outlet for Downstream Fish Passage Improvements

Description. This proposed action would draft Fall Creek Reservoir to a lower elevation than what is specified in the Water Control Manual and hold the reservoir at the deeper elevation (680 feet MSL) from late-November through February except during flood events, to improve fish passage and survival during migration. The proposed activity at Fall Creek Dam would be to conduct an annual deep drawdown of the Fall Creek Reservoir during the winters of 2013 to 2020. The proposed drawdown elevation is 680-685 feet MSL, an additional 43-48 feet lower than typical winter pool elevations. The reservoir would be drawn down during the normal annual cycle (i.e. fall-winter) but held down at the proposed elevation of 680-685 feet MSL continuously for a period of approximately 2 weeks before the reservoir would be allowed to fill back up to the minimum conservation elevation (728 feet MSL) for the duration of the flood control season. Lowering the reservoir to elevation 680-685 feet MSL would result in a run-of-the-river scenario, which would facilitate downstream fish passage through the dam.

2.2.3 Cougar: Drawdown and Prioritize Use of Regulating Outlet for Downstream Fish Passage Improvements

Description. The Corps would draft Cougar Reservoir to a lower elevation than what is specified in the Water Control Manual and maintain the reservoir at the lower elevation (1505 MSL) for approximately one month (December). This would be a deeper drawdown than normal for the Cougar Reservoir for the winters of 2013 to 2020 as needed. Through on-going coordination, the Corps would need to determine which

years the proposed action would occur at Cougar Reservoir This draft environmental assessment (EA) assumes an annual drawdown between 2013 and 2020 for the purpose of analyzing environmental impacts. The Corps would draw down the reservoir during the normal annual cycle (i.e. fall-winter) but would attempt to hold the reservoir down at the proposed elevation of 1505 feet (MSL) continuously for a period of approximately 1 month (December) before the reservoir would be allowed to refill under normal operations for the duration of the flood control season. As a result, total project outflows would not change, just outlet priority (turbine or RO). The Corps' first priority is to route the outflow at 100 (cubic feet per second) (cfs) to the turbine unit for station service. The second priority is to route the remaining outflow through the RO. The regulating gates would be operated to within minimum and maximum gate opening requirements. During the evaluation period, monitoring results would be used by the Corps to determine the optimal RO configuration for the following years' drawdown. For example, the regulating outlet gate opening may be adjusted to optimize biological benefit and minimize impacts.

2.3. ALTERNATIVE ELIMINATED FROM DETAILED CONSIDERATION FOR THIS ENVIRONMENTAL ASSESSMENT

The alternative listed below may be implemented in the future and will be addressed in a future NEPA document should the Corps decide to schedule the proposed action. The following alternative that was initially included in the mix of alternatives was removed from consideration for reasons described below.

2.2.4 Delay Refill of Cougar Reservoir/RO Priority

Description. The proposed delayed refill of Cougar Reservoir with RO prioritization is very similar to the winter drawdown proposed at Cougar Reservoir as a preferred alternative, but differs by season. The Corps would maintain a minimum conservation pool elevation from March through May and prioritize use of RO discharge to improve downstream fish passage survival. The Corps would delay refill of the Cougar Reservoir to allow juvenile fish to locate the ROs during spring migration. With the reservoir drawdown, the juvenile fish would not have to dive deeper into the reservoir than is their natural behavior to find an outlet. The operation would delay refill until May 1 instead of February 1, with the pool held at minimum conservation pool (elevation 1,532 feet MSL) until refill begins.

Reason for elimination of detailed consideration: The primary reason for eliminating this alternative from further consideration is that a portable fish collector is currently assembled within the Cougar Reservoir and a drawdown of the reservoir below the normal winter elevations could result in damage to the collector. In addition, this measure would alter average project outflows fairly drastically throughout the year. Outflows would increase in February through April and decrease in May through November. The increased outflows in spring are due to the reservoir being held at an elevation of 1,532 feet, when typically the reservoir would be allowed to fill. Decreased average outflows would occur for the rest of the year because the reservoir would rarely

fill back to full pool. This may impact fish rearing in the summer and expose them to higher in-stream temperatures and lower dissolved oxygen.

3. AFFECTED ENVIRONMENT

The following resources (Air, Noise, Aesthetics, Socio-economics, and Transportation) will not be addressed or analyzed in detail because either the nature of the proposed action would have no impact or would not change the existing condition on these resources:.

3.1. BACKGROUND FOR FALL CREEK, HILLS CREEK, AND COUGAR DAMS

The Corps is responsible for flow management of the Willamette Project and coordinates competing demands for flood risk reduction, power, domestic and irrigation water supply, recreation, and minimum stream flow requirements. All Corps storage projects follow a rule curve that provides guidance to the reservoir regulators on how to manage the water in the reservoir to meet the multi-purpose needs. The Corps storage projects are typically drawn down (i.e., storage is evacuated) in the fall to provide space to store high runoff from winter rain events. Rain events cause the reservoirs to rise and then stored water is evacuated once the flood threat has passed. In the early spring, the reservoirs begin to capture some of the runoff to store water for use in the summer months. Some stored water may also be used in the late spring for fish flow augmentation during drier years. The Corps, together with its partners and customers, determine the order of use for stored water among the various projects and often address environmental variables and other constraints to project operation using real-time adaptive management. (Corps 2009).

The following section provides a brief overview of the three Corps dams that are the focus of this draft Environmental Assessment (Figures 3-1, 3-2, and 3-3).

Fall Creek Dam

Fall Creek Dam is a multi-purpose storage project that operates to meet the authorized purposes of flood damage reduction, irrigation, fish and wildlife management, recreation, navigation, and improved downstream water quality. This dam is a rock fill structure with a gated concrete spillway and two regulating outlets. It is primarily used for flood control. It was completed in 1966. Vital statistics of this dam include; it has a length 5,050 feet, the crest elevation is 839 (MSL) feet, reservoir storage is 125,000 acre feet (maximum), and the regulating outlets are rectangular conduits. The Fall Creek RO gates are 5 feet, 6 inches in width and 10 feet in height. Fall Creek has nine fish horns that allow water to be pulled from various elevations in the reservoir. They were originally put in place to pass fish, but it was later determined that survival was low. The fish horns are now used mainly to supply water for the adult fish collection facility at the base of the dam and for temperature control operations since the openings are located at different elevations in the reservoir.

Figure 3-1: Fall Creek Dam

Hills Creek Dam

Hills Creek Dam is a multi-purpose storage project that operates to meet the authorized purposes of flood damage reduction, irrigation, hydropower generation, recreation, fish and wildlife management, navigation and improved downstream water quality. Hills Creek Dam operates as a base load project which is a dam that provides constant discharge (outflow) throughout the day and night for power generation. This Dam conforms to flow limits and ramping rates (the change in rate at which flow levels occur). The ramping rates have been coordinated with the Services and Corps. Flow and power generation is primarily a function of reservoir levels with respect to the water control diagram and the amount of storage in Lookout Point Reservoir. Minimum outflows from Hills Creek are set at 400 cubic feet per second (cfs) year-round. This

earth and gravel fill dam has a gated concrete overflow section and is gated with converging chute spillway and outlet. Completed in 1961, Hills Creek Reservoir has capacity to store 356,000 acre feet (maximum). The dam is 2,235 feet in length and has a height of 1554 feet (MSL). There are 3 spillway gates of the radial (tainter) type. There is one regulating outlet (RO) with two service gates and entrance conduits at the dam. The invert elevation of the RO is 1409 feet (MSL). The outfall from the RO plunges into a channel at the outlet of the diversion tunnel (see Figure 3-3 below). Hills Creek Dam has two Francis type turbines that are feed by a single penstock and can generate about 30,000 kilowatts of power at peak power.

Figure 3-2: Hills Creek Dam

Figure 3-3: RO Stilling Basin/Plunge Pool at Hills Creek

Cougar Dam

Cougar Dam is a multi-purpose storage project that operates to meet the authorized purposes of flood damage reduction, irrigation, power generation, recreation, fish and wildlife management, navigation, and downstream water quality improvement. The dam is a rockfill structure with a powerhouse and concrete spillway with two tainter gates and two slide gate ROs. The dam is about 450 feet tall with the top of dam at elevation 1,705 feet MSL. The dam was completed in 1963. The power generating capacity is rated at 25,000 total kilowatts. A water temperature control structure was constructed and began operation in May 2005. The 302-foot-high water temperature control (WTC) tower was constructed adjoining the original intake tower and began operation in May 2005 to regulate downstream water temperatures. The original intake tower includes a dry well (with operating equipment, stairs, and elevator), dual RO conduits, a trash structure, and an access bridge. The original intake tower was modified for construction of the WTC tower through addition of a wet well with three adjustable weir gates for selective withdrawal and lower RO and penstock bypass gates. The WTC wet well serves both the power generating facilities and the RO works. There is one RO with two service gates at Cougar with an invert elevation of 1,478.75 feet MSL. The RO gates are 6 feet in width and 12 feet, 6 inches in height.

3.2. LAND USE

Even though Cougar, Hills Creek and Fall Creek Dams are located on different tributaries of the Willamette River (refer Figure 1-1, Location Map), the land use at all three locations is similar. Hills Creek Dam and Fall Creek Dam are on two creeks that flow into the upper Middle Fork Willamette River.

The Middle Fork Willamette sub-basin drains about 1,370 square miles. Four Corps projects were constructed in the sub-basin. Hills Creek Dam is on the Middle Fork Willamette River at river mile (RM) 47.8 and was completed in 1961. Lookout Point (RM 19.9) and Dexter (RM 16.8) Dams are on the Middle Fork Willamette and were completed together in 1955. Fall Creek Dam on Fall Creek (RM 7.9) was completed in 1965. (Corps 2009)

Middle Fork Willamette River Subbasin

Commercial forestry is the dominate land use along the Middle Fork Willamette River. Much of the land in the upper Middle Fork Willamette River Subbasin is in public ownership with the vast majority under jurisdiction of the U.S. Forest Service land. The lower reaches of the sub-basin are dominated by agricultural and urban land uses that constrain the river's ability to meander, and these uses have resulted in the

Figure 3-4: Cougar Dam

removal of much of the riparian gallery forest. Table 1 below compares the land use distribution between historic (1850s post-European settlement) and current conditions

Table 1: Estimated Historical and Current Land Cover Types in the Middle Fork Willamette River Subbasin

Land Use	Historic acres	Current Acres	Acre Change
Agriculture	0	14,288	+14,288
Herbaceous wetlands	59	0	-59
Montane mixed conifer forest	6,305	16,552	+10,247
Open water – lakes, rivers, streams	1,991	6,066	+4,075
Ponderosa pine/interior white oak forest & woodlands	0	26	+26
Urban or residential	0	5,248	+5,348
Westside grasslands	19,032	142	-18,890
Westside lowland conifer-hardwood forest	368,764	378,662	+9,898
Westside oak/dry Douglas-fir forest & woodlands	14,234	546	-13,688
Westside riparian wetlands	12,075	958	-11,117

(Corps 2013a)

McKenzie River Subbasin

The McKenzie River is about 90 miles long and drains an area of about 1,340 square miles (Figure 2-8). Two Corps dams were constructed in the sub-basin: Cougar Dam at river mile (RM) 4.4 on the South Fork McKenzie River was completed in 1963, and Blue River Dam at RM 1.8 on the Blue River was completed in 1968. Multiple smaller diversions/canals and some higher dams are located on the McKenzie River including Leaburg Dam (RM 29) and the Carmen-Smith Hydroelectric Project (RM 82), both owned by the Eugene Water and Electric Board. (Corps 2009)

The McKenzie river watershed is lightly populated; about 70 percent land is in public ownership much of which is managed by the U.S. Forest Service. Over 96 percent of the basin is forested, and just below 4 percent is devoted to agricultural use—mainly on the lower floodplain—and the remainder is residential or industrial. The river is one source of tap water source for the cities of Eugene and Springfield.

3.3. CLIMATE

The Willamette River basin that includes both the McKenzie River and Middle Fork Willamette River subbasins and is characterized by cool wet winters and by warm dry summers. Mean monthly air temperatures in the valley range from about 37.4 to 41 degrees Fahrenheit during January to 63.6 to 68 degrees Fahrenheit during August (Wentz et al.1998 as cited in Corps 2013a). Mean annual precipitation in the Willamette River basin ranges from 20 to 40 inches in the Willamette Valley. About 70 to 80 percent of the annual precipitation falls from October through March, but less than 5 percent falls in July and August (Wentz et al.1998 as referenced in Corps 2013a).

Most precipitation in the Cascade Mountains falls as snow above 5,000 feet; however, the Willamette Valley itself receives relatively little snow. The Cascade Mountains receive about 80 percent of the precipitation that falls on the Willamette River basin, and they store much of this water as snow. Snowfall accumulation exceeds 90 inches in the central Cascades. From late winter to early summer, much of this snow melts, feeding cold fast-flowing streams. (Corps 2013a).

3.4. GEOLOGY

Middle Fork Willamette River

Both Fall Creek and Hills Creek dams are found on the Middle Fork of the Willamette River. The headwaters of this subbasin are distinguished by two major physiographic provinces; the High Cascades and the Western Cascades provinces (USFS 1973). In the High Cascades the geology includes recent deep lava deposits that contribute spring-fed flows to the system, particularly in some tributaries above Hills Creek Reservoir. The western foothills and lower peaks of the Western Cascades province has much older volcanic material including deeply weathered rocks, steep and highly dissected hill slopes, and widespread erosion.

McKenzie River

Cougar Dam is on the South Fork of the McKenzie River that is also located in the Western Cascades. Much of the rock in the area dates back to the early to mid Tertiary Period. It includes volcanic extrusive as well as contemporary intrusive rock (intrusive rock is defined as igneous rock which forms by the crystallization of magma at a depth within the earth). Volcanism caused the eruption of many vents in the form of lavas and pyroclastics and were in turn intruded by igneous dikes, sills and stocks. The area was gently warped and folded and displays a considerable amount of fracturing, some faulting and hydrothermal alteration. (Suchy 1967).

3.5. HYDROLOGY

Middle Fork Willamette River

Both Hills Creek and Fall Creek Dams are tributaries of the Middle Fork Willamette River. The Middle Fork Willamette River subbasin drains an area of approximately 1,360 square miles. The hydrograph in the Middle Fork Willamette River subbasin also reflects the seasonal rainfall, with the majority of runoff occurring during the winter and low flows occurring during July and August. Typically a smaller, secondary peak occurs in May and June because headwater elevations are high enough to develop a seasonal snowpack and melt-water runoff. The majority of the study area is below 1500 feet and therefore, rainstorms are the dominant cause of runoff in the lower subbasin. A portion of the Lower Middle Fork Willamette River and the majority of the Little Fall Creek and Lost Creek Watersheds are above 1500 feet and are subject to rain-on-snow events. These events occur when warm rainstorms rapidly melt accumulated snow creating high runoff events (MFWWC 2002).

Flows in the Middle Fork Willamette River have been controlled by the Lookout Point-Dexter, Hills Creek, and Fall Creek projects since 1954, 1961, and 1965, respectively. These dams are operated similarly in concert with the other Willamette system dams for flood risk management. Flood control operations at the dams have substantially decreased the magnitude and frequency of extreme high flow events in the lower Middle Fork Willamette River. In general, dam construction resulted in higher summer and fall flows and lower spring flows. In the Middle Fork Willamette River subbasin, flows are naturally lowest in the early fall (Corps 2013a). See Table 2 for average monthly flows for the Middle Fork Willamette River.

McKenzie River

Major tributaries in the upper McKenzie River subbasin include the Smith River, Horse Creek, the South Fork McKenzie River, and the Blue River. Cougar Dam is located on the South Fork McKenzie River. The terrain of the upper subbasin is mountainous, with steep ridges and narrow floodplains and terraces in the valleys along the streams. The

hydrology is largely controlled by the subbasin geology. In the upper subbasin, precipitation infiltrates through porous volcanic High Cascades terrain and emerges from large spring complexes that support steady year-round discharge and cool stream temperatures in the mainstem McKenzie River (USGS 2010a). See Table 2 for average monthly flows for the McKenzie River.

Table 2: Average monthly flows on the Middle Fork Willamette and McKenzie Rivers.

Basin	Gage Location (river kilometer)	Average Monthly Discharge (cubic feet per second)		Drainage Area (square miles)	Period of Record
		August	January		
McKenzie River	Coburg (6)	2,263	9,908	1,337	1945 to 1972
Middle Fork Willamette	Dexter (27)	1,845	5,004	1,001	1947 to 2000

From (http://water.usgs.gov/or/nwis/monthly).

3.6. WATER QUALITY

Water quality has been a concern within the Willamette Basin project area since the completion of the dams. Over the years several water quality parameters such as temperature, dissolved oxygen and turbidity exceeded water quality standards. In 2006, the Oregon Department of Environmental Quality (ODEQ) established Total Maximum Daily Loads (TMDL) for stream segments in the Willamette River that do not meet water quality standards and are listed under Section 303(d) of the Clean Water Act. Further, some stream segments in the Middle Fork Willamette River and McKenzie River subbasins do not meet water quality standards. Most of the concern in regards to water quality are focused on temperature, turbidity, dissolved oxygen, dissolved gas saturation and in some of the reservoirs there are toxic algae present during portions of the year. A discussion on the associated water quality issues for each of the 3 dams analyzed in this EA is presented below.

Fall Creek Dam

Flow

Fall Creek Dam does not generate hydropower, and consequently no turbines are associated with it. However it does function as a regulating dam for the Middle Fork Willamette River. The Dam has a variable seasonal minimum flow. From October to March, the minimum outflow is 50 cfs. It then increases to about 80 cfs during April to August and is set at 200 cfs from September 1 through October 15. The normal evacuation rate associated with high water events is 3,800 cfs with a maximum

evacuation rate of 4,500 cfs. During the summer flow augmentation season, project maximum outflow is usually capped in order to balance flow from the various projects. Since 2006, the Corps has limited the maximum down-ramping at all three projects on the Middle Fork Willamette River to follow general ramping rate guidelines of 0.1 foot/hour during nighttime and to 0.2 foot/hour during daytime unless such restriction has been infeasible with existing equipment at the dam (Corps et al. 2007). The result has been adherence to these down-ramp rates at designated flow rates. During the winter high inflow period, the projects may ramp down at rates higher than the recommended 0.1- to 0.2-foot/hour guidance. The allowance is for those cases where unanticipated conditions require flow reductions in order to control downstream control points for human health and safety considerations.

Temperature

Temperature control at Fall Creek Dam is somewhat of an improvement compared to Hills Creek Dam (see section on Hills Creek Dam below). The Dam uses the fish horns to achieve some control over water discharged through the Dam. These fish horns (Figure 3-5) allow for water to be taken from different elevations within the reservoir to mix with water that is passing out of the regulating outlet. For example, warmer surface water can be mixed with deeper, cooler water to try and achieve and more normal outflow in regards to water temperature.

Figure 3-5: Fish Horns (upper left) and regulating outlet (lower center) at Fall Creek Dam. View looking downstream during a drawdown as reservoir water enters the RO.

For the water year 2012, the Corps' main objective for temperature control was to stay within the resource agencies downstream temperature target range while tracking the Fall Creek inflow temperatures, which was done with mixed success. The Fall Creek

Dam has limited ability to affect downstream temperatures due to structural limitations (i.e., fish horn elevations), and operations are modified taking into account environmental conditions and inflow temperatures. In addition, the spillway gates are not used during typical Fall Creek Dam operations due to the western pond turtle and Oregon chub habitat located just downstream of the gates.

Despite these limitations, Fall Creek Dam temperature targets were achieved for a good portion of the spring and summer. Since outflow discharges exceeded the upper fish horn capacity during drawdown, the lower elevation fish horns and RO's were used to release the additional flow. The operation of the RO's during this drawdown released much of the cold water storage in Fall Creek Reservoir. From October to early November, outflow temperatures climbed and were above the 50 ºF maximum target, ranging between 56 to 58 ºF, since there was no accessible cold water remaining in Fall Creek Reservoir to moderate downstream temperatures. As a result, temperatures in the fall and winter were too warm and exceeded targets for spawning and incubation due to the lack of availability of cooler water. Previous temperature data collected shows that thermal conditions in the Middle Fork and Fall Creek below the dams are typically unsuitable for spring Chinook spawning and incubation. (Corps 2013b)
Dissolved Gas

Little data has been collected below Fall Creek Dam on total dissolved gas (TDG), but based on historical data, discharges above 490 cfs have been found to produce near-field TDG saturations that exceed the state water quality standard (Corps 2009).

Algae

Algal blooms are routinely monitored at Fall Creek reservoir by Oregon State Parks. Fall Creek has been listed on the 303(d) list for aquatic weeds or algae (ODEQ 2010). According to their website, only one Harmful Algae Bloom Surveillance (HABS) advisory was issued for Fall Creek Reservoir in 2011. At the following website, the information can be found at:
https://public.health.oregon.gov/HealthyEnvironments/Recreation/HarmfulAlgaeBlooms/Archive/Pages/2011.aspx

Hills Creek Dam

Flow

Hills Creek Dam operates as a base load project. Flow and power generation is primarily a function of reservoir levels with respect to the rule curve and amount of storage in Lookout Point, other streamflow requirements and any special project considerations. Minimum outflows from Hills Creek are set at 400 cfs year-round. The normal high evacuation rate is 6,000 cfs, and the maximum evacuation rate is 8,000 cfs. In cases of unusual and sustained storm events, the project outflow may be increased gradually above the maximum evacuation rate using a prescribed formula to avoid

passing inflow at the peak of the storm due to a full reservoir. (Corps 2009). Since 2006, the Corps has limited the maximum down-ramping at all three projects on the Middle Fork Willamette River to follow general ramping rate guidelines of 0.1 foot/hour during nighttime and to 0.2 foot/hour during daytime unless such restriction has been infeasible with existing equipment at the dam (Corps et al. 2007). The result has been adherence to these down-ramp rates at designated flow rates. During the winter high inflow period, the projects may ramp down at rates higher than the recommended 0.1- to 0.2-foot/hour guidance. The allowance is for those cases where unanticipated conditions require flow reductions in order to control downstream control points for human health and safety considerations. (Corps 2009).

Temperature

Hills Creek Dam influences water temperature in the mainstem Middle Fork Willamette (MFW) between the dam and Lookout Point Lake. Hills Creek releases to the MFW are generally cooler than inflows in the spring and summer and warmer than inflows in the fall and winter (Corps 2000). For the water year of 2012, outflow water temperatures from June through August were up to 10 °F cooler compared to unregulated inflow temperatures. However, by mid-September through the remainder of the year, the outflow temperatures became warmer than inflow. By October 5, 2012, outflow temperatures peaked to 62 °F and were up to 15 °F warmer than inflow (Corps 2013b). Data collected 13 miles below Hills Creek Dam, below the mouth of the North Fork Middle Fork Willamette, show that average water temperatures have been as much as 6°F cooler than historical temperatures during the summer and as much as 4°F warmer in the fall (Corps 2000). In fall, the release temperatures from Hills Creek Dam exacerbate forebay temperatures in Lookout Point Lake by contributing larger volumes of warm water into Lookout Point Lake than would typically be available. At times water temperature effects decrease downstream of Hills Creek Dam with the moderating effect of tributary inflows (Corps 2000).

Turbidity

Hills Creek is similar in its stratified structure to other deep Willamette reservoirs and is also distinctive in that a turbidity gradient and large amount of turbidity (up to 60 Jackson Turbidity Unit) persist throughout the summer. Water released from Hills Creek during summer is considerably more turbid than summer inflows (Corps 2009). The main sources of this turbid material are the watershed streams and the reservoir shoreline, with the watershed itself being the main contributor. Some inorganic matter is also present at the pool surface but is not a major contributor to overall reservoir turbidity. Wind wave action is the main mechanism whereby shoreline materials enter the pool.

Dissolved Gas

A limited amount of TDG data has been collected below Hills Creek Dam in recent years. In May 2008, the Corps collected TDG in the tailrace of Hills Creek Dam for

approximately three hours. During this time, regulating outlet discharges ranged from 2,450 to 4,020 cfs, and all near-field TDG saturations measured exceeded the state water quality standard (105% or 110%, dependent upon water depth and proximity to fish hatchery intakes). (Corps 2009)

Algae

The Portland District Corps works closely with outgrant partners that lease parks and the US Forest Service (USFS) to monitor algal blooms at various reservoirs that include recreation. The most common of these has been a cyanobacteria (blue-green algae) that occurs on a regular basis in the Hills Creek, Lookout Point, Dexter, and Fall Creek Reservoirs. These reservoirs have all been newly listed on the 303(d) list for aquatic weeds or algae (ODEQ 2010). According to their website, health advisories for Hills Creek were issued by Oregon Harmful Algae Bloom Surveillance (HABS) program based on cell counts or toxicity levels in the years 2008 and 2009. Cyanobacteria can cause a variety of water quality concerns, including the potential to produce toxins (Corps 2009). The extent of the blooms over the surface of the lake has been variable where the blooms may occur on only a portion of the reservoir at one time (FERC 2013).

Cougar

Flow

For the past several years, the Corps has attempted to meet flow targets established in cooperation with the Oregon Department of Fish and Wildlife for downstream fish protection. Cougar's minimum outflow is 300 cfs, except during June 1-30 when it is 400 cfs. During high flow conditions, the typical maximum evacuation rate at Cougar is 5,000 cfs and the maximum evacuation rate is 6,500 cfs. In cases of unusual and sustained storm events, Cougar's outflow may be increased gradually above the maximum evacuation rate using a prescribed formula to avoid passing inflow at the peak of the storm due to a full reservoir. Capacity of the outflow through the turbines ranges between 900 and 1,100 cfs; which compounds the Total Dissolved Gas issues, it is preferable to keep Cougar outflow below 2,000 cfs when the rule curve permits. (Corps 2009).

Temperature

Since 2005, Cougar Dam was equipped with a selective withdrawal structure, water temperature control tower (WTC), that provides benefits on the mainstem McKenzie River for water temperatures. Operation for temperature control requires selectively withdrawing water from different elevations in the pool to meet target outflow water temperatures. Decisions on flow distribution are based on outflow and data from temperature instrumentation on the face of the structure. The objective of the structural temperature control operations is to improve temperatures downstream of the project by providing temperatures that are warmer in the summer and cooler in the fall than what is

typical from pre-WTC project operations. Operations of the Cougar Water WTC have provided more suitable thermal conditions in the South Fork McKenzie for native spring Chinook salmon. Adult migration and holding conditions appear adequate to meet the biological needs for this species life stages. (Corps 2013b). USGS has concluded that changes in dam operations have been used in recent years to greatly decrease temperature in the south fork of the McKenzie River (2010b). While the WTC has resulted in some much needed water quality benefits, there still persist some effects on water temperature from the Dam.

In water year 2012, outflow water temperatures continued to meet resource agencies downstream target temperatures for most of the year. The exception was the first week of May and most of June when outflow temperatures were as cool as 4 °F below target temperatures due to cold inflow temperatures. Temperatures in 2012 resulted in an estimated first emergence time of December 18 for fish that spawned on September 1. Temperatures dropped below 45°F on November 9 and remained below this value throughout the incubation period for data used through January 22, 2013. The incubation period for spring Chinook typically extends into spring.

Dissolved Gas

Past water quality monitoring at Cougar Dam has shown that the regulating outlet (RO) discharges between 500 and 700 cfs can produce TDG production above the 110% State of Oregon water quality standard below Cougar Dam. During November 1970, Monk and others (1975) measured TDG levels from 97.8% to 124.1% saturation near the base of Cougar Dam, TDG levels from 99.5% to 115.7% saturation at a site 3,000 feet downstream, and TDG levels from 103.4% to 108.6% saturation at a site 2.7 miles downstream. In April 2006, the Corps tested TDG levels under a range of regulating outlet and powerhouse discharge operations at Cougar (Corps 2013b). This study found that regulating outlet discharges greater than 575 cfs produced near-field TDG saturations that exceeded the state water quality standard. These saturations typically degassed to background levels about 2.8 miles (4.5 kilometers) downstream from the dam.

For water year 2012, from July through October, hourly TDG saturation levels ranged from about 100 to 105% TDG saturation, which are below the water quality standard of 110%. However, the water quality standards were exceeded often (~125 hours) during the summer operations in early July and mid- August when the RO was utilized instead of the powerhouse to discharge flow. Typically, nearly 900 cfs was being discharged through the ROs when the exceedances of about 111% occurred. During the month of November more TDG exceedances occurred since RO discharges were more frequent and higher, ranging from about 900 cfs to 1400 cfs, with corresponding TDG ranging between 111% - 115% TDG. There were also a few outlying hours that were as high as 120% TDG while total outflow and RO outflow increased to about 4,000 cfs and powerhouse flow was shut off.). (Corps 2013b).

Spawning survey data is indicating that spring Chinook are not spawning in high concentrations immediately below Cougar Dam as was the case prior to the construction and operation of the Cougar Adult Fish Trap. Spawning is now concentrated further below Cougar Dam in the South Fork McKenzie in braided side channels in areas less influenced by elevated TDG (Corps 2013b).

Algae

Algal blooms have been a problem at Cougar Reservoir in the past. According to their website, health advisories for Cougar were issued by HABS program based on cell counts or toxicity levels in 2011 for 35 days.

3.7. VEGETATION

In a large sense the vegetation at Fall Creek, Hills Creek and Cougar Dam have a lot of similarities. That is, all are located on the west side of the Cascades Mountains at either low to mid elevations and are included within a temperate coniferous forest with Douglas fir/western hemlock as the predominant tree species. All three dams are located in the Western Hemlock Zone as described by Franklin and Dyrness (1973). Another common element with all the dams is that forest practices are the dominant land use with numerous clearcuts and logging roads surrounding the reservoirs. On closer examination, landscape characteristics such as aspect, soil type, elevation and precipitation allow for variability of the vegetation pattern at each of the projects. The remainder of this section focuses on vegetation at each of the Specific projects.

Fall Creek Dam

Extensive riparian gallery forests once dominated floodplains in the region but have since been largely replaced by agricultural land and residential development. Some riparian forests still exist along the margins of Fall Creek below the dam. Common tree species include bigleaf maple, black cottonwood, red alder, Oregon white oak, and Oregon ash. The uplands to the west are part of the Valley Foothills ecoregion, a transitional area between the Willamette Valley and the Cascade Mountains. The Valley Foothills ecoregion is characterized by mixed oak woodlands, grasslands, and Douglas fir forests, although this ecoregion has been extensively converted to pasturelands, vineyards, orchards, tree farms, and residential development. (FERC 2013).

Lands to the east of the dam consists of extensive and highly productive coniferous forests managed for both commercial and recreational uses. Dominant tree species include western hemlock, Douglas-fir, and western red cedar. Mixed coniferous forests cover the hillsides surrounding Fall Creek dam and reservoir. Douglas-fir is the principal overstory species, but hemlock, red cedar, cottonwood, alder, and maple are also common. Most of the forests in the area have been harvested previously, creating a patchwork landscape of tree stands where stand age and conditions vary considerably. Downstream of the outlets, riparian gallery forests remain relatively intact along the margins of Fall Creek. (FERC 2013) See Figure 3-6.

Figure 3-6: Below Fall Creek Dam, the riparian corridor includes Alder, black cottonwood, Douglas fir, western red cedar, and grass meadows.

Hills Creek Dam

The slopes above Hills Creek Dam are predominately coniferous forest or clear cuts. The forests are primarily composed of Douglas fir, western red cedar and western hemlock. Deciduous species include big leaf maple and black cottonwood. The understory includes various willow species, vine maple, alser, dogwood, rhododendron, salal, a mixture of ferns and blackberry. (USFWS 1958).

Open meadow slope/rock garden/cliff sensitive plant habitat lies above the Hills Creek Reservoir Public Use area on east and west aspect hillsides. Forested and open roadside habitats are found immediately above the reservoir. Several sensitive vascular and non-vascular plants potentially reside in these areas. (Corps 2010).

Cougar Dam

Cougar Dam vegetation composition is very similar to the other two dams under discussion. Many of the slopes around the reservoir are comprised of mainly a coniferous overstory that includes Douglas fir, western hemlock and western red cedar. Typical understorty vegetation includes; red alder, vine maple, Pacific dogwood, willows rhododendron, and Oregon grape. Hillside slope around the project tend to be steep with slopes greater than 20 to 30%. Scattered stands of bigleaf Maple, and black

cottonwood can be sound along the south fork of the McKenzie river. Prior to the 1950's, the area was dominated by old growth forest. (J. Noyes et al. 1985)

3.8. WILDLIFE

As noted in the previous section there is similar vegetation and habitat types at the three dams that are the focus of this Environmental Assessment. It is not surprising then that all three dams have similar wildlife assemblages as well.

Fall Creek Dam
The varied landscape in the vicinity of Fall Creek dam supports a diverse assemblage of wildlife, including state and federal species of concern. The reservoir provides breeding, foraging, and migratory stopover areas for waterfowl, shorebirds, and raptors. Shallow waters and nearby wetlands provide habitat for birds; amphibians and reptiles, such as the northwestern pond turtle, frogs, and salamanders; and mammals, such as mink and beaver. At least one bald eagle pair nests along the shoreline of the reservoir, and an osprey pair nests approximately 0.5 mile downstream from the project along Fall Creek. Numerous hawk, falcon, and owl species nest and/or forage in nearby Douglas-fir forests and oak woodlands. Resident and migratory songbird communities are typical of the Willamette Valley and the West Cascade Mountains. (FERC 2013).

Black-tailed deer and Roosevelt elk occur in nearby forest, woodland, and savannah-like habitats. Other game species in the area include ruffed grouse, ring-necked pheasant, California quail, mountain quail, and wild turkey. Other mammals in the area include black bear, coyote, bobcat, cougar, red fox, raccoon, numerous bat species, and several mice, vole, and shrew species. Western gray squirrels may use nearby oak woodlands and mixed oak-conifer forests. (FERC 2013).

Hills Creek Dam
Habitat in the vicinity of Hills Creek Dam provides a variety of functions for wildlife such as rearing, refuge, feeding and breeding. It also supports both State and Federal species of concern. Below Hills Creek Dam, the Corps developed a 130-acre wildlife and wetland area which provides breeding habitat for rare amphibians and the western pond turtle. Wildlife near the dam includes game species such as Roosevelt Elk and black tailed deer. Upland birds consist of blue and ruffed grouse, band-tailed pigeons and mourning doves. Typical forest passerine birds include creepers, nuthatch, a variety of woodpeckers, Steller's jays, crows and the occasional raven. Typical large carnivores are comprised of black bear, cougar, bobcat and coyote. Smaller mammals include raccoons, possum, skunks beaver, mink, otter, rabbits and a variety of rodents (rats, mice, voles shrews ect.) (USFWS 1958).

Cougar Dam
Cougar Dam has many of the same species that have been already listed as threatened and endangered at Fall Creek and Hills Creek Dam with the exception that there is probably spotted owl in the remnant old growth forest near the reservoir (see Table 3 below). In 1985, Oregon Department of Fish and Wildlife conducted a study (Noyes et.al. 1985) on habitat loss at the project area due to construction of the dam. This study focused on 16 wildlife species that were probably impacted by construction of the Dam. These species included Roosevelt Elk, black-tailed deer, black bear, cougar, river otter, and beaver. Bird species consisted of Barrow's and common goldeneye, bufflehead, common merganser, harlequin duck, yellow warbler, American dipper, northern spotted owl, bald eagle and Osprey. The report concluded that the Cougar Dam project inundated, altered or affected over 3,000 acres of land and river in the McKenzie river drainage. (J. Noyes et al. 1985)

3.9. FISHERIES

Fishery populations as well as fishery habitat have been modified in both the McKenzie and Middle Fork Willamette River subbasins. The construction of High Head Dams in the Willamette River system has substantially altered the hydrologic and thermal regimens in the mainstem and tributaries (NMFS, USFWS 2008). The 13 dams that comprise the WVP, as well as others constructed throughout the Willamette system have had a profound effect on resident fish species and their distribution to the point where several species are listed under the Endangered Species Act. It is not the intent of this EA to document all of the changes and associated impacts. A more complete story on the impacts of the WVP can be found in the Supplemental Biological Assessment prepared by the Corps in 2007 and the Biological Opinions prepared by NMFS and USFWS in 2008, which are incorporated by reference in this EA. The focus of this EA is on finding ways to improve one feature for native fish at three of the WVP projects: down-stream migration. While all native fish species are important to the local ecology, the focus in recent years has been on the recovery of listed species under ESA. Increasingly, spring Chinook have been the focal point with the assumption that what benefits Chinook will also benefit the other species such as bull trout and steelhead. The Corps considers all native fish to be important, but there is a preponderance of attention on Chinook in the following section.

Fish in the project area
A number of native and non-native fish species are present in the Middle Fork and McKenzie subbasins of the Willamette River, including spring Chinook salmon, rainbow trout, cutthroat trout, bull trout, and mountain whitefish. Table 3 shows both residence and introduced species that have been captured in recent fisheries surveys near the dams.

Table 3: Native and Introduced fish species present at three Willamette River Dam projects (X indicates that the species is present).

Native Fish Species			
Common Name	Hills Creek	Fall Creek	Cougar
Cuttthrout trout	X	X	X
Rainbow trout	X	X	X
Bull Trout	X	X	X
Chinook	X	X	X
Steelhead	X	X	X
Mountain Whitefish			X
Northern Pikeminnow		X	
Dace	X	X	X
Redside shiner	X	X	
Sculpin	X	X	X
Largescale Sucker	X	X	
Oregon Chub	X	X	
Introduced Fish Species			
Common Name	Hills Creek	Fall Creek	Cougar
Largemouth Bass	X	X	X
Crappie	X	X	
Brown Bullhead	X	X	
Bluegill	X	X	

Source: (Keefer 2012, Monzyk 2012)

Historically, the Middle Fork Willamette River and McKenzie River subbasins of the Willamette River supported viable populations of spring Chinook salmon, bull trout, Oregon chub, and cutthroat trout. The upper Middle Fork Willamette River may have supported the largest spring Chinook stock in the upper Willamette basin (WRI 2004). Steelhead are not thought to have been present in the Middle Fork Willamette River subbasin historically, although there were likely large resident rainbow trout populations. (Corps 2013a). The Mckenzie River subbasin still supports a resident steelhead fishery.

Although native winter steelhead may have occasionally been present in the Middle Fork Willamette River subbasin, it no longer supports an independent population, and the UWR steelhead DPS does not include steelhead in this subbasin (Myers et al.2006 as cited in Corps 2013a). However, some winter steelhead are observed each year at Fall Creek and below Fall Creek Dam (ODFW 2002 as cited in Corps 2013a).

Bull trout were thought to be extirpated from the Middle Fork Willamette River, the North and South Forks of the Santiam River, and the Clackamas River. No bull trout were identified during extensive surveys in the Middle Fork Willamette River subbasin in the early 1990s (NPCC 2004a as cited in Corps 2013a). As cited in Corps (2013a) Buchanan et al. (1997) listed bull trout as probably extinct. A plan to rehabilitate bull trout in the upper Middle Fork Willamette River subbasin was approved by the Willamette Basin Bull Trout Working Group in 1997. Beginning in 1997, bull trout fry

from Anderson Creek in the McKenzie River subbasin were reintroduced into four cold-water springs and four creeks above Hills Creek Reservoir by the Forest Service and ODFW (NPCC 2004a as cited in Corps 2013a). Monitoring has shown good growth and survival of juvenile bull trout in the release sites (ODFW 2001 as cited in Corps 2013a). Adult bull trout are once again present in the Middle Fork Willamette River subbasin.

The McKenzie River sustains the most abundant population of natural origin spring Chinook salmon in the Upper Willamette Basin. Average abundance based on otolith and coded wire tag analysis for 2002-2006 for natural origin fish that passed Leaburg Dam is 3,509 adults (McLaughlin et al. 2008). Cougar Dam is estimated to have blocked 16 % of the historic spawning habitat in the entire McKenzie River subbasin; this habitat is currently considered to be some of the best in the basin (ODFW 2005, NMFS 2008). Recent estimates of available spawning habitat indicate that over 90% of South Fork McKenzie River habitat is located above Cougar Dam (R2 Resource Consultants 2009 as cited in Corps 2009).

Fish access, downstream migration and mortality

Several of the fish mentioned in this EA have portions of their life history that are migratory in nature as they travel downstream and ultimately to the ocean to rear and return up-river to spawn. The presence of many dams and diversion within the Willamette River basin makes this migration problematic. When the WVP was originally conceived, fish passage was not considered, but a hatchery system was included to mitigate the lost of access to natal streams and spawning grounds.

Downstream fish migration through the WVP has its own unique difficulties as fish leave the redds in streams above the reservoirs and work their way through the dams. Most of the WVP dams were not constructed with either upstream or downstream migration facilities. The only possibility for downstream access occurs either through turbines or dam regulating outlets. Fish use of turbine and regulating outlet passage routes at Willamette dams are linked to reservoir elevation and depth to water intakes, which can seasonally fluctuate by tens of meters. Surface-oriented species, including emigrating juvenile salmonids, primarily use such routes when reservoirs are drawn down and sounding depths reduced. These conditions do not necessarily occur when smolts are physiologically prepared to emigrate. Instead, water passing through turbines and regulating outlets during low elevation, high discharge winter conditions can entrain large numbers of salmon smolts plus passively drifting and pelagic species such a juvenile crappie and bluegill. (Keefer et al. 2012).

Hydro-acoustic and screw trap results both indicate the highest Chinook salmon dam passage rates occur during winter. High dam passage rates coincided with relatively high river discharge from low reservoir elevations. That is, fish passage at dams increased as reservoir elevation dropped. This passage timing was likely related to river flow (discharge) and route availability, rather than physiological cues (i.e., smoltification). Presumably, these fish were cued by high flows to emigrate during a period with ready access to RO and turbine passage routes. These data highlight affects of flood damage reduction operations on the life history timing for Chinook

salmon in the Middle Fork Willamette River. Specifically, data indicate juvenile Chinook salmon were excluded from passage when they were physiologically prepared, and cued to migrate during a period that is not historically advantageous. (Corps 2012).

Mortality and injury are byproducts of juvenile migration through dams. Because each dam has a different purpose as well as different site conditions, each dam has been constructed with dissimilar features. The following section discusses the peculiarities of passage and survivability at each of the three projects that are the focus of this EA. Studies discussed in this analysis will describe different mortality rates at the same dam but these rates of mortality vary, the important point is that there is some level of mortality and injury at each of the projects during juvenile outmigration.

Fall Creek

The weight of evidence indicates that dams seasonally inhibit downstream migration, trap some migrants in reservoirs for extended periods and then present mortality risks (Keefer et al. 2012). At Fall Creek Dam juvenile downstream passage is facilitated by an extended drawdown of the reservoir in the winter months. Fall Creek's construction did include downstream juvenile passage through a series of fish horns; however, due to their design, the fish horns provided low collection efficiency and high injury/mortality. The fish horns are still used today when the adult fishway is open (~15 March - 15 October) to provide attraction flow into the fish ladder and for overall downstream temperature control. The fish horns are not used outside of the fish ladder operational season. Marginal spawning and rearing areas are available downstream from Fall Creek Dam. Spawning has been documented below the dam, but successful hatching and rearing has been very limited. Egg mortality has been near 100% and surviving fry emerge prematurely because of warm water discharged from the dam in fall and winter (Sullivan and Rounds 2004 as cited in Corps 2012).

Most Chinook exit the reservoir through the RO structure as age 0+ fish during the following fall and winter when reservoir elevations are lowest and some surface attraction to the RO intake occurs. Observations from studies of smolt passage timing suggest that Chinook smolts are distributed towards the surface of the reservoir. Surface oriented distributions are common among juvenile Chinook salmon passing downstream through reservoirs and dams.

Sampling for fish in streams above the reservoir, collection rates were highest in late winter through mid-summer, coincident with juvenile Chinook salmon emigration (mostly February-May). Few fish of any species were trapped at above-reservoir sites from September-January. Collection rates indicate juvenile Chinook salmon entered reservoirs as pools were rapidly filling in early spring through early summer (Keefer et al. 2010 as cited in Corps 2012). Increasing depth to RO intakes during this time likely prevented downstream passage for many salmon subyearlings; especially, for yearling smolts that would likely have continued outmigrating had passage routes been more attractive (flow cues) and accessible.

Conservative estimates of juvenile Chinook salmon mortality rates, from fish passed downstream through all Middle Fork Willamette River dams, ranged from 8% to 59% and differed noticeably among sites and years (see Keefer et al. 2010 as cited in Corps 2012). With all years and species combined, dead fish made up ≤2% of all Fall Creek and North Fork Willamette River trap samples above reservoirs. In contrast, total mortality below dams was 36% (Fall Creek) and 39% (Hills Creek). Of all the species of fish sampled, crappie represented a large portion of the total fish population. They also represented the largest single species mortality rate and largely determined total mortality estimates below Lookout Point Dam and Fall Creek Dam. Chinook salmon had an annual mortality of about 25% below the dams (Keefer et al. 2012). Large Chinook salmon were far more likely than small salmon to be killed during dam passage. Lethal injuries included decapitation, swim bladder ruptures, and blunt force trauma similar to those widely reported in turbine passage studies (Keefer et al 2012).

Studies conducted in 1991 noted 41% mortality through the regulating outlet (Downey 1992 as cited in NMFS 2008). Rates of injury and potential delayed mortality have not been documented. Downey (1992) also reported 68.3% mortality through the “fish horns” associated with the “downstream migrant system” from the Fall Creek forebay to the Fall Creek Dam downstream migrant facility (cited in NMFS 2008). Rates of injury and potential delayed mortality have not been documented.

Hills Creek

Natural-origin spring Chinook are at extremely low levels in the Middle Fork Willamette subbasin relative to pre-Corps dam estimates. The total number of adult natural-origin Chinook for the Middle Fork Willamette River and Fall Creek is currently less than 500 fish. Concern has been raised that the subbasin no longer sustains a wild population presumably due in part to high pre- spawning mortality rates as well as a lack of access to historical spawning grounds (NMFS 2008).

Hills Creek Dam was built without fish passage facilities. ODFW began releasing hatchery-origin adult spring Chinook salmon above Hills Creek Reservoir in 1993 and has occasionally released hatchery-reared Chinook fingerlings into the reservoir. Keefer and others (2010) synthesized screw trap data from 2003-2010 estimating fish passage, timing, population sizes, and dam related mortality. Screw trap collection rates below Hills Creek Dam were consistently highest in the fall and early winter for all species, including spring Chinook salmon.

Beidler and Knapp (2005) summarize a study conducted at Hills Creek dam by Larson (2000 as cited in NMFS 2008). In the fall of 1999, Larson estimated mortality rates for juvenile Chinook passing through the turbines and regulating outlets of 59% and 32%, respectively. This assumes a direct mortality rate from Hills Creek forebay to tailrace of 60%. Rates of injury and potential delayed mortality have not been documented.

Total downstream dam passage mortality for juvenile Chinook salmon was conservatively estimated to be in excess of 50% (ca. 53%) at Hills Creek Dam (Keefer et al. 2010).

Cougar dam

The peak of outmigration from Cougar Dam occurs between November and February. Based on fork lengths, juveniles outmigrating during this time period were comprised mainly of sub-yearling species with yearlings outmigrating between February through July. (Romer et al. 2012).

Although Cougar Dam's construction included both upstream and downstream passage facilities, low adult returns due to inadequate migration temperatures caused by the dam and inefficient collection and high mortality of juveniles led to the eventual closure of both the facilities. Hatchery-origin adults have been transported above the dam since 1993 in an effort to enhance upstream habitat through the delivery of marine derived nutrients. This outplanting benefits bull trout located in the headwaters area of the South Fork McKenzie subbasin. A new adult fish collection facility was completed in 2010. (Corps 2012).

Until 2010, only hatchery adult spring Chinook were passed above Cougar Dam. Currently, both natural and hatchery-origin spring Chinook are being transported above Cougar Dam to help evaluate re- introduction of spring Chinook above the dam. Rotary fish traps and the presence of piscivorous birds in the tailrace showed that these releases were producing juveniles that were passing the dam (Taylor 2000, Beidler and Knapp 2005 as cited in Corps 2012). Draft results of the genetic pedigree study confirm that most of the adults returning to Cougar trap at the base of the dam are progeny of out-planted hatchery fish (Britt et al. 2012, Sard et al. 2012 as cited in Corps 2012).

Juvenile salmonids exiting the reservoir have two passage route options by which they can navigate through Cougar Dam once they enter the WTC, either by the turbine penstock (tailrace) or the regulating outlet (Romer et al. 2012). The route juvenile Chinook select through Cougar Dam appears to be dependent on the amount of flow through each route (Romer et al. 2012). In most WVP dams, larger fish incur higher mortality when they pass through dams with turbines. This may not be the case at Cougar Dam because fish exiting the tail race must get beyond a trash rack cover with 2 inch vertical gap (Romer et al. 2012).

Over the years there have been few studies on downstream migration mortality through the dam (Taylor 2000, Romer et.al. 2012). There is some disagreement about the optimal outlet and mortality rate estimates. Some of this confusion is understandable; studies are often short duration (one or two years), and flow conditions through the Dam change. In the case of Cougar, there has been an upgrade with construction of the WTC that is intended to improve conditions for fish temperature and migration. Migration of Chinook coincide with low average pool heights. These migrations may have occurred because the depth of the penstock openings is shallower during the weeks with low average pool heights. During the 1998-1999 field season, approximately 80% if the Chinook migrated out the regulating outlet, presumably, because the opening is shallower than the penstock opening. (Taylor 2000)

Mortality associated with the turbine and regulating outlet passage was estimated at 7.1% and 32% respectively for1998-1999. Increased mortality can be partially explained by a two centimeter increase in mean fork length and strong positive relationship between length and mortality (Taylor 2000).

Survival studies at Cougar in 2009 and 2010 showed high mortality through the turbines (~40%) and relatively high survival through the RO (~85% to 95%). These rates do not include additional mortality from barotrauma, and thus are likely underestimates of total losses, especially for the turbines. (Corps 2012.)

One study shows there might be greater fish mortality exiting through the regulating outlet as opposed to the penstock tailrace. In a trial conducted by Romer et. al. (2012) mortality in the RO appeared to be about 32% while mortality in the tailrace was about 11%. The causes of death also appeared different depending on the route. (Romer et al 2012). Another study conducted between 1998 to 1999 by Taylor (2000) found about 23% mortality through the RO and between 10 to 20% mortality through the tailrace. This study was done prior to construction of the WTC.

3.10. Threatened and Endangered Species

Section 7 of the Endangered Species Act requires a federal agency to consult with NMFS and USFWS if they are proposing an action that may affect listed species or their designated habitat. In this case, the ESA listed species were upper Willamette Chinook and steelhead for NMFS, and bull trout, Oregon Chub, northern spotted owl, and Oregon spotted frog for USFWS (refer to Table 4). In 2000, the Portland District, Corps of Engineers consulted with these agencies for the operation of the Willamette Valley Project (WVP). The purpose of the consultation was to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of designated critical habitat. As part of the consultation process the Corps prepared a Biological Assessment. In 2007 while continuing the consultation process, the Corps also submitted a supplemental Biological Assessment. The following year (2008) both NMFS and USFWS provided two separate Biological Opinions (BiOp). Each of the BiOps had coordinated reasonable and prudent alternatives (RPAs). The BiOPs included recommend RPAs to the proposed operation of the WVP to avoid jeopardizing or adversely modifying habitat to ESA listed species.

Table 4: Threatened and Endangered Species Listing

SPECIES	LISTING STATUS	CRITICAL HABITAT
NMFS		
Upper Willamette River Chinook	Threatened 3/24/1999 & 6/28/05	Designated on 02/16/00 & 09/02/05
Upper Willamette River Steelhead	Threatened 3/25/99 & 1/5/06	Designated on 2/16/00 & 09/02/05
USFWS		
Columbia River Bull Trout	Threatened 06/10/1998	Designated on 9/26/05
Oregon Chub	Endangered 10/18/93	None
Northern Spotted Owl	Threatened 06/26/90	Designated on 6/26/90
Oregon Spotted Frog	Proposed as threatened on 8/28/13	Proposed for critical habitat 8/28/13

An RPA is an action, identified during formal consultation, that can be carried out consistently with the project purpose (in this case the operation of the WVP), is within the scope of the agency's legal authority, is economically and technologically feasible, and would avoid jeopardizing the continued existence of ESA-listed species and the destruction or adverse modification of their designated critical habitats (2008 NMFS BiOp).

These RPAs are supposed to address structural and operational changes at the WVP projects and improvements in Corps programs that affect salmonid habitat downstream of the dams and that allow upstream and downstream fish passage that are needed to address the effects of the WVP, thereby increasing the viability of the affected populations and the functioning of the primary constituent elements of their designated critical habitat. (2008 NMFS BiOp)

In their 2008 BiOp, NMFS concluded that for UWR Chinook salmon and UWR steelhead, lack of passage is one of the single most adverse effects on both the fish and their habitat. In its jeopardy and destruction and adverse modification of critical habitat analyses, NMFS identified the need for more specific measures with associated time frames. Specific passage measures are necessary to address the effects of the WVP. Therefore, NMFS and USFWS included specific passage measures to be completed and operational by set deadlines. (2008 NMFS BiOp)

The magnitude of effect of these interim measures is difficult to predict because insufficient data is available to determine where these measures would take place and how successful they would be in providing downstream fish passage for juvenile Chinook and juvenile and kelt steelhead. Such measures would likely be initiated for a short time period as part of a research monitoring and evaluation (RM&E) study to determine potential effectiveness of the measure before an annual or longer term commitment is made (please refer to Sections 3.11 and 4.10 for more detail information about RM&E). However, until interim measures are evaluated to assess fish passage

effectiveness, NMFS can only assume that these measures will result in an unquantified improvement in fish survival. This increased survival would benefit the populations of UWR Chinook and UWR steelhead in the subbasins where interim measures are used. (2008 NMFS BiOp).

The weight of evidence indicates that dams seasonally inhibited downstream migration, entrapped some migrants in reservoirs for extended periods and then presented passage mortality risks. Some salmon almost certainly residualised in reservoirs for a year or more, and mortality was high when these larger fish eventually passed dams. (Keefer et. al. 2012)

The focus of the Corps actions on improving downstream juvenile fish migration revolves around two methods. The first is to reduce reservoir levels at the three projects to lowest practicable elevation to aid fish in finding an outlet. While the second method is to orient the fish to the outlet (either regulating outlet or tailrace) that has the lowest rate of injury or morality which is usually the regulating outlet. There are four RPAs (three in this section and another under the monitoring section) that are relevant to the proposed actions in this environmental assessment. The following section provides the specific RPA and the rationale behind it.

RPA 4.8 <u>Interim Downstream Fish Passage through Reservoirs and Dams</u>: Until permanent downstream passage facilities are constructed or operations are established at Project dams and reservoirs in subbasins where outplanting of UWR Chinook salmon and steelhead is underway, the Action Agencies will carry out interim operational measures to pass downstream migrants as safely and efficiently as possible downstream through Project reservoirs and dams under current dam configurations and physical and operational constraints, and consistent with authorized Project purposes.

RPA specifically for Fall Creek Dam:
RPA- 4.8.1 <u>Fall Creek Drawdown</u>: Beginning in Water Year 2008, the Action Agencies will adjust timing of storage and release of flow at Fall Creek Reservoir to promote downstream passage of juvenile Chinook salmon through the reservoir and dam. Drawdown will be to at least elevation 714.0 by the end of November each year, and the Action Agencies will hold the reservoir at this elevation during all of December and January except during flood events, and possibly longer. The Action Agencies will conduct monitoring and evaluation studies to determine the effectiveness of the operation and to assist in deciding whether or not to continue the operation in future years. The depth and timing of the drawdown may be adjusted in subsequent years, based upon monitoring results, with NMFS' agreement. During this operation, when inflow is less than Project minimum flow objectives and the reservoir is at or below 714.0', then outflow will equal inflow and this will not be considered a deviation from flow objectives.

Rationale

Past studies have indicated that juvenile spring Chinook salmon migrate from Fall Creek Reservoir primarily during November, and that smolts passing through the regulating

outlet under conditions of lower reservoir elevations survived at higher levels than when the reservoir was held high (see Section 4.2.3 Middle Fork Willamette Baseline). Also, smolts migrating late in the season under conditions of very low head appeared to sustain lower injury or mortality rates compared to passage under high reservoir levels. If the reservoir is drawn down to an elevation below minimum conservation pool, NMFS would expect increased survival of juvenile Chinook salmon emigrating during November.

The effect of this measure will be to improve downstream fish passage survival through Fall Creek dam and reservoir, increasing productivity of the Fall Creek Chinook salmon population and ultimately resulting in increased abundance and improved spatial distribution. Another effect of this measure will be to minimize adverse effects on critical habitat by providing a component of the primary constituent element, "migration corridors free of obstruction."

RPA for downstream passage at Cougar, Hills and Fall Creek Dams:

RPA 4.10 <u>Assess Downstream Juvenile Fish Passage through Reservoirs:</u> The Action Agencies will, in coordination with and review by the Services, assess juvenile fish passage through the following Project reservoirs:

1. *Cougar*

2. *Lookout Point and Dexter*

3. *Detroit and Big Cliff*

4. *Green Peter and Foster*

5. *Fall Creek*

6. *Hills Creek*

These evaluations will be developed consistent with the RM&E process described below in RPA measure 9 (RM&E). The Action Agencies must seek NMFS' review of evaluation proposals. Comments submitted by NMFS on draft evaluation proposals must be reconciled by the Action Agencies in writing to NMFS' satisfaction prior to initiating any research-related activities anticipated in this RPA. The proposals must identify annual anticipated incidental take levels by species, life stage, and origin for each year. The Services will inform the Action Agencies whether they agree with the proposed studies, reports, and NEPA alternatives. The Action Agencies will begin these studies in 2008; field investigations, study reports, and NEPA analyses, if necessary, will be completed by December 31, 2015. (2008 NMFS BiOp)

Rationale

Juvenile fish (and kelts) need to emigrate through reservoirs, or be transported around them, in order to continue their downstream migration and complete their life cycles. Effects are unique at each reservoir: fish may pass satisfactorily through some reservoirs, but have problems, such as loss by predation or residualism (failure to continue migrating) at others. For instance, preliminary results at Fall Creek and Cougar indicated juvenile Chinook salmon were able to safely migrate through the reservoirs, yet studies at Green Peter in the 1980s showed few fish released near the head of the reservoir reached the dam. (2008 NMFS BiOp)

There is little information on fish use, migration rates, and survival in the Willamette Project reservoirs. Most of the information on Project reservoir fish passage has been inferred from fish traps placed below reservoirs. The kinds of studies that are needed would vary among reservoirs, depending on existing information and characteristics of each reservoir and the species that use it. (2008 NMFS BiOp)

RPA for downstream fish passage at Cougar Dam:
4.12.1 Cougar Dam Downstream Passage: The Action Agencies will investigate the feasibility of improving downstream fish passage at Cougar Dam through structural modifications as well as with operational alternatives, and if found feasible they will construct and operate the downstream fish passage facility. (NMFS 2001 BiOp)

Rationale
The effect of this measure will be to provide improved downstream fish passage at Cougar Dam, increasing spatial distribution by providing safe access to and from historical habitat. By addressing the primary impediment to population growth and spatial distribution for the McKenzie Chinook salmon population, this measure will support increased abundance and productivity of this core population, reducing the likelihood that the Proposed Action will cause jeopardy.

With respect to critical habitat, this measure will address the Habitat Access pathway by improving access past a physical barrier, and thereby improve the status of primary constituent elements for spawning, rearing, and migration of the McKenzie Chinook salmon population. (2008 NMFS BiOp)

Upper Willamette River (UWR) Chinook
The UWR Chinook salmon ESU includes all naturally spawned populations of spring-run Chinook salmon in the Clackamas River and in the Willamette River and its tributaries above Willamette Falls, Oregon, as well as UWR Chinook from seven artificial propagation programs (NMFS 2008). Upper Willamette River Chinook salmon is currently at a high risk of extinction (NMFS 2008). Although the annual returns of Chinook to the basin have been strong in the late 1990s and early part of this decade, the vast majority of fish are of hatchery origin and numbers of unmarked fish continue to decline. Analyses of returns to spawning areas during 2002-2006, a period of relatively high marine survival, suggest an annual run of natural-origin UWR Chinook averaging about 5,000 adults above Willamette Falls, with most of these fish (with a possible exception in the McKenzie subbasin) unlikely to be more than a few generations

removed from a fish hatchery. These hatchery-influenced natural returns represent only about 2% of the ESU's historic abundance above the falls. The return of 2008 was the lowest return of adult Chinook (14,141 adults) since fish counting began in 1946. (Corp 2009). The Middle Fork population of UWR Chinook salmon is considered to be at very high risk of extinction, based on an analysis of its recent abundance, productivity, spatial structure, and diversity (McElhany et al. 2007 as cited in Corps 2009). The NMFS listed five major limiting factors for UWR Chinook and they include:

- Reduced access to spawning/rearing habitat
- Degraded water quality
- High water temperature
- Lost or degraded floodplain connectivity
- Reduced streamflow (NMFS 2008)

In its final designation of critical habitat for UWR Chinook, NMFS included the mainstem Middle Fork Willamette, including extensive mainstem reaches and tributaries above Dexter, Lookout Point, and Hills Creek dams. NMFS also included the North Fork Middle Fork Willamette and Salt Creek above Lookout Point dam, as well as Fall Creek and many tributaries above and below Fall Creek dam (NMFS 2008).

Upper Willamette Steelhead

The UWR winter steelhead is currently at a moderate risk of extinction. Since Willamette steelhead have more widespread spawning habitat in the tributaries unaffected by Corps dams, their risk of extinction is not as high as Chinook salmon (NMFS 2008). Winter steelhead numbers for the entire ESU are 5,819 adults and individual populations within subbasins remain at low abundance (NMFS 2008). Winter steelhead passage counts for Willamette Falls were 4,830 and 2,813 for years 2008 and 2009, respectively (Corps 2009). The NMFS listed five major limiting factors for UWR steelhead and they include:

- Reduced access to spawning/rearing habitat
- Degraded water quality
- High water temperature
- Lost or degraded floodplain connectivity
- Reduced streamflow (NMFS 2008)

Critical habitat for UWR steelhead- the South Fork McKenzie, Hill Creek, or Fall Creek are not included as critical habitat for UWR steelhead. For the three dams discussed in this EA there is no critical habitat for Steelhead.

Columbia River bull trout

Bull trout are currently only found in the McKenzie and Middle Fork Willamette rivers and their tributaries, but historically were also documented in the Clackamas, North Santiam, and South Santiam subbasins (USFWS 2008). Bull trout presently found in the Middle Fork Willamette are the result of reintroduction efforts, transferred as fry from 1997-2007 from the McKenzie River (USFWS 2008). Factors cited as most limiting to bull trout include altered hydrology and water temperatures, impeded migration and access to

habitat, lack of large wood in streams, increased sedimentation, water pollution, loss of off-channel habitat, competition and/or hybridization with non-native fishes, and angling pressure (USFWS 2002 as cited in Corps 2009).

In the Upper Willamette Basin, the USFWS designated the following reaches, located in the McKenzie and Middle Fork subbasins, as critical habitat for bull trout:

- Mainstem Middle Fork Willamette River from its confluence with the mainstem Willamette River upstream to Hills Creek Dam, excluding reservoir reaches;
- A short reach of the mainstem Willamette River connecting the Middle Fork and McKenzie rivers;
- The mainstem McKenzie River from its confluence with the Willamette River upstream to its confluence with the South Fork McKenzie and sporadically on reaches upstream;
- The South Fork McKenzie River upstream to Cougar Dam, and Blue River upstream to Blue River Dam;
- A short section of Swift Creek above Hills Creek reservoir in the Middle Fork Willamette River subbasin.

In 1996, the Oregon Department of Fish and Wildlife evaluated the status (risk of extirpation) of the Willamette River bull trout populations and rated them as follows: Middle Fork Willamette River as high risk, South Fork McKenzie River as moderate risk, Anderson Creek/mainstem McKenzie River as moderate risk, Trail Bridge Reservoir as high risk, and the Santiam and Clackamas Rivers as probably extinct (Buchanan et al. 1997 as cited in Corps 2013a). In the final listing rule (63 FR 31647), three bull trout subpopulations in the Willamette River basin were identified: (1) McKenzie River and tributaries above Trail Bridge Dam, (2) McKenzie River and tributaries downstream of Trail Bridge Dam, and (3) South Fork McKenzie River and tributaries above Cougar Dam. All three extant populations exhibit a fluvial or adfluvial life history form. Bull trout were once thought to be extirpated from the Middle Fork Willamette River, the North and South Forks of the Santiam River, and the Clackamas River.

Oregon Chub

Oregon chub live in quiet water areas such as backwaters and sloughs, and are endemic to the Willamette Basin. Due to loss of habitat and other factors, the Oregon chub was listed as endangered in 1993. Oregon chub are not separated into distinct population segments (DPS) and no genetic data have been collected to indicate the existence of different segments. Mixing was more likely for downstream than upstream populations (USFWS 1998 as cited in Corps 2009).

Oregon chub were found historically throughout the Willamette River basin between Oregon City and Oakridge, in the Clackamas, Molalla, South Santiam, North Santiam, Luckiamute, Long Tom, McKenzie, Mary's, Coast Fork Willamette, Middle Fork Willamette, and mainstem Willamette rivers. The largest populations of Oregon chub are found in the Middle Fork Willamette subbasin.

Abundance of Oregon chub appears to be related presently to the degree of connectivity of habitat to the river (Scheerer 1999 as cited in Corps 2009). Isolated habitats appear to contain the greatest densities of chub. Habitats that are more frequently and directly connected appear to be more accessible to competing and predatory non-native fish species, and there is an inverse relation between non-native species' and Oregon chub population size.

The decline of Oregon chub has occurred for a number of reasons. The most important include habitat alteration and loss (through side channel elimination, increased sedimentation of quiet water habitat, and reduced water quality), the introduction and spread of non-native fish and amphibious species that prey on or compete with chub, and population fragmentation through the construction of dams and influences on habitat distributions. (Corps 2009).

There is no critical habitat for Oregon Chub.

Northern Spotted Owl:
The northern spotted owl is a federal and state threatened species. Spotted owls are generally associated with old-growth forests and require multilayered canopies. Some upland coniferous forests in the Middle Fork subbasin may be suitable nesting habitat for the spotted owl. Other habitats may provide foraging or dispersal habitat for the species. Several spotted owls have been located near Fall Creek Lake. Additional spotted owl activity centers are likely found at or near the Hills Creek project on Willamette National Forest lands as well in remnant old growth forest located near Cougar Dam (Corps 2000). Three northern spotted owl activity areas were described in the 1994 BA (Corps 1995). Two of these sites were located more than a mile from Cougar Dam, and the third site was in the Rush Creek watershed, approximately three- fourths mile from the project area. A fourth spotted owl activity area was established in the Rush Creek watershed in 1998. Nesting was confirmed at this site in 1998 but not in 1999. The nest was located less than one-half mile from the Rush Creek diversion tunnel intake. (Corps 1999). In 2000, a Biological Assessment prepared by the Corps for the operation of the entire Willamette Project, the Corps determined the operation and maintenance of the project would not likely adversely affect the Northern Spotted Owl, the USFWS concurred with the Corps determination. (USFWS 2008).

All three dams (Cougar, Fall Creek, and Hills Creek) are located near or in critical habitat for the Northern Spotted Owl.

Proposed for listing:

Oregon Spotted Frog

Oregon spotted frog has six major genetic groups including the central Cascades of Oregon. Critical habitat that is proposed for this species includes Lane County, Oregon.

The Oregon spotted frog is of medium size and can appear to be brown, tan or olive green with some small to large black spots on the back, sides, and legs. Spots are often irregular shapes with fuzzy edges and light centers. Through much of the Pacific Northwest the lower belly and the undersides of the rear legs are usually colored by an orange or orange- red pigment. (Leonard 1993).

Spotted frogs are very aquatically oriented, living in marshes, permanent ponds, lake edges and slow streams where there is dense aquatic vegetation. They prefer shallow slower water to breed in. Breeding occurs in early to mid spring (February to March at low elevations and April to May at higher elevations), with eggs laid on aquatic vegetation such as reeds. Predators include the introduced bull frog as well as the introduced warm water fish species such as large and small mouth bass. (Corkan 1996.)

Federal Species of Concern

Northern Red-legged Frog
The northern red-legged frog is a federal species of concern and is listed by Oregon DFW as sensitive-vulnerable. Red legged frogs are typically found near permanent waters associated with stream pools, marshes, ponds, and other quiet water bodies. On rare occasions, they travel into adjacent upland forests and meadows during wet weather. Summer refuge sites include small mammal burrows and moist leaf litter in riparian areas. Breeding typically occurs between March and July and lasts 1 to 2 weeks. Eggs are attached to stiff stems near the surface of the water and hatch in about 5 to 7 weeks. Larvae metamorphose into adults in 11 to 20 weeks. A breeding population of northern red-legged frogs is known to occur in wetlands associated with the Fall Creek spillway channel. (FERC 2013)

Western Pond Turtle
The Western Pond Turtle is a federal species of concern that is not listed under the federal ESA. A petition for listing under the ESA was found not to be warranted in 1993 because of the species' widespread distribution and lack of evidence for broad-scale threats. The western pond turtle is classified in Oregon as a Strategy Species under the Oregon Conservation Strategy (OCS) and as a Sensitive-Critical species (ODFW 2006, 2008). However, it is of interest to note that a population of Western Pond Turtles exists at the Hills Creek Reservoir that is unusually healthy relative to other local populations within the Willamette River Basin. Corps wildlife biologists at the Hills Creek project have implemented management actions aimed at increasing habitat suitability, increasing recruitment into the breeding population, providing connectivity among populations, and reducing the loss of adults through mortality and illegal removal of turtles by the public in an effort to contribute to conservation of western pond turtles.

The Golden and Bald Eagle Protection Act

Bald Eagle
The bald eagle is a state threatened species but was delisted from the federal ESA on July 9, 2007. Bald Eagles are still protected under the Golden and Bald Eagle Protection Act. Bald eagles breed and reside year-round throughout the Willamette Basin, and are mostly associated with forested rivers and lakes. They nest mainly in large Douglas fir or cottonwood trees. During summer, Oregon eagles feed mainly on fish (live or dead), then augment this in other seasons with waterfowl and sheep (carrion).

Eagle Rock is a 200-acre sensitive area managed for the protection of bald eagles near the Lookout Point Reservoir. The eagles frequently forage in Dexter Lake especially in the winter months and in the nest initiation season. They also have been observed flying over Lowell Butte to forage in Fall Creek Lake and fishing in the river below Dexter Dam. Bald eagles have been observed at Fall Creek and nest sporadically in conifer stands around the lake. Bald eagle territories also are found on Forest Service land at Hills Creek. (Corps 2013a)

3.11. MONITORING

Monitoring is a component of each alternative and is a routine occurrence at the many WVP locations. The frequency of monitoring has increased since the release of the 2008 Biological Opinions. The reason for monitoring and the methods are wide ranging. This EA will focus on the rational and techniques of monitoring for fish and water quality. The focus of monitoring will be on surveying of juvenile salmon as they migrate downstream to the ocean.

In the Biological Opinion for Upper Willamette Chinook and Steelhead, NMFS outlined a number of RPAs that would facilitate the recovery of listed species (2008). In the same document they identified several RM&E methods that would assist in evaluating the benefits of the various RPAs as well as help identify if species were recovering and at what rate. RM&E actions, which include reservoir drawdowns for downstream juvenile fish passage, are a necessary tool for providing data critical to adaptive management. This monitoring information will allow adaptive management decisions to be made to ensure the long-term persistence of listed fish species in the Willamette Basin, as well as the ability to respond to changes in environmental conditions. Its implementation will also ensure that managers have information to determine the effectiveness of proposed actions to improve downstream fish passage (NMFS 2008).

RM&E studies outlined in the 2008 BiOp would have direct effects on both UWR Chinook and UWR steelhead that are used in field studies. Fish may be trapped, examined, released, confined, re-located, marked or tagged and subjected to related handling operations, subjected to the administration of pharmacological agents, including anesthetics, subjected to capture by electrofishing, propagated, transported

between stream basins, killed or injured during test and control conditions, and affected in diverse other ways. (NMFS 2008.)

Under the RM&E, the Corps and other agencies (such as ODFW) will monitor and evaluate the effectiveness of various aquatic measures; including fish passage, water quality, habitat quality and quantity (NMFS 2008). As part of these efforts, monitoring reports that describe the work and the results will be prepared and publicly distributed.

Typical monitoring and sampling methods will include rotary screwtraps (and other out-migration) traps, hydro-acoustic, transponders are typically operated to gain information on natural population abundance, species composition, survivability and productivity. Based on experience in Columbia River tributaries the mortality of fish captured/handled/released at rotary screw type juvenile fish traps would be expected to be two percent or less on target species in the Willamette River Basin (NMFS 2008). Usually water quality parameters are also taken. These include flow rates, temperature, dissolved gas, turbidity and dissolved oxygen.

The various monitoring and evaluation activities for anadromous fish measures would usually cause many types of take (as defined by ESA §3(19) - The term ‘‘take’’ means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (NMFS 2008). As part of the BiOp an assessment of take has already been considered. The proposed actions discussed in this EA are expected to take listed UWR Chinook salmon and steelhead. The activities include, but are not limited to, the following: evaluating fish passage through reservoirs and various outlets at dams; evaluating alternative fish passage facilities, screens, and other bypass systems; evaluating effects of alternative flow scenarios, flow pulses, minimum and maximum flow levels, and of various ramping rates;) determining stock composition, population trends, and life history patterns; evaluating habitat restoration projects evaluating alternative methods for achieving temperature control on fish and fish habitat below; investigating migration timing and migratory patterns; investigating fish behaviors in streams, reservoirs and off-channel areas; (12) evaluating fish spawning below dams; (13) monitoring and mitigating the effects of Corps dams; evaluating effects of water diversions on fish; conducting total dissolved gas experiments; and investigating effects of alternative reservoir levels on fish passage and survival. (NMFS 2008).

3.12. CULTURAL RESOURCES

The evaluation of cultural resources generally follows guidance and definitions provided in the National Historic Preservation Act (NHPA) of 1966. Section 106 (36 CFR 800) of the NHPA requires all Federal agencies to consider the potential effects of their projects and undertakings on historic properties either eligible for or currently listed on the National Register of Historic Places (NRHP): http://www.cr.nps.gov/nr/. Historic properties are defined as prehistoric or historic archeological or non archeological districts, sites, buildings, structures, or objects. An additional resource type eligible for the NRHP are traditional cultural properties (TCPs). These are defined by the National Park Service as properties or places eligible for inclusion in the NRHP because of their

association with cultural practices or beliefs of a living community that: a) are rooted in that community's history, and b) are important in maintaining the continuous cultural identity of the community (NPS NRB 38). Often TCP's are associated with Native American Tribes who once occupied and utilized the area. Native American Tribes possess unique and traditional knowledge regarding the existence and continuing use of TCP's, information that can often times not be shared with individuals outside of their communities.

The NHPA requires federal agency's to define an area of potential effects (APE), an area in which the action has the potential to effect historic properties. The APE is evaluated for historic properties, most often through a process of extensive archeological survey, historic and technical records research, and discussions with relevant Native American Tribes or other individuals potentially possessing knowledge of historic properties or TCP's. The agency must then determine the potential effect of the project on known historic properties within the APE. Finally, the agency is responsible for consulting with the State Historic Preservation Officer (SHPO) and relevant Native American Tribes and other interested parties regarding the determination of the APE, the evaluation of the APE for cultural resources, and the effects determination of the action on any historic properties within the APE.

Known cultural resources in the Willamette River Basin and its tributaries include both prehistoric and historic archaeological sites, historic buildings and structures, and the remains of settlement and development activities. There has currently been no TCP's identified within or near the three areas of this study. Limited archeological surveys have taken place both near and within the Fall Creek Reservoir drawdown zone (Cole 1968). Recent archeological investigations just on the downstream side of Fall Creek Dam identified intact, buried cultural resources almost 1 meter in depth in an area previously thought disturbed (Purdy et al 2009). Cultural resources identified within the Fall Creek reservoir consist of prehistoric and historic archeological sites. These prehistoric sites include open air lithic scatters, possible seasonal or temporary campsites, and two potential quarry sites. The historic sites consist of historic home sites, trash dumps, historic artifact scatters, and a historic spring house. None of these cultural resources has been evaluated for eligibility for listing to the NRHP.

No cultural resources surveys have taken place within the drawdown zones at Cougar and Hill Creek Reservoirs. The closest inventories consist of archeological surveys conducted on nearby US Forest Service lands. Identified archeological sites include prehistoric lithic scatters, rock shelters, and historic homestead and logging era sites. The extent and amount of historic properties at these areas is currently unknown.

3.13. RECREATION

The three Corps dams that are the focus of this EA currently provide many recreational opportunities for the outdoor enthusiast. The reservoirs associated with the Dams, and the rivers provide opportunities for recreational boating including water-skiing, swimming, fishing, kayaking, and canoeing. There are several parks, campgrounds and boat ramps located at the reservoirs. The primary providers of recreational facilities at

each of the reservoirs include; the Corps, Lane County Parks, Oregon Parks and Recreation Department and the Forest Service's Willamette National Forest. Many of the campgrounds are open only partly during the year, typically from May 1st to September 30th. While much of the recreation is aquatically oriented, there are some other outdoor options available such as hiking and hunting that occur near project lands including the Eugene to Pacific Crest Trail. The following list describes recreational features at the three reservoirs:

Fall Creek Lake: At full capacity this reservoir is about 1,800 acres. Fall Creek Lake has a moderate level of recreational facilities. The lake is heavily used for water- based recreation, especially boating, fishing, swimming, and water-skiing. Facilities include drinking water, restrooms, picnic sites, campgrounds and boat ramps.

Hills Creek Lake: Recreational use at Hills Creek is constrained by a lack of facilities, difficult access, and high degree of reservoir fluctuation. The reservoir at full storage is about 2,735 acres. Visitors are attracted mainly for fishing and camping. The lake is surrounded by the Willamette National Forest and all parks are operated by the Middle Fork Ranger District. Recreational amenities at Hills Creek includes; camping, picnicking, boat launch and drinking water.

Cougar Lake: The scenic 1,280 acre reservoir has restrooms, drinking water, campgrounds hiking trails, boat launches and visitor viewpoints. Most of the recreation features are managed by USFS.

4. ENVIRONMENTAL CONSEQUENCES

4.1. LAND USE

The no action alternative
Under the no action alternative no work is proposed, the project area would remain in a similar state as the current condition. No change in land use would occur in the immediate term.

The preferred alternative
Under this alternative there would be no change to current land use in the project vicinity due to the nature of the proposed action.

4.2. CLIMATE

The no action alternative
Under the no action alternative no work is proposed, the project area would remain in a similar state as the current condition. There would be no impact on climate as a result.

The preferred alternative
The small change in dam operations proposed under preferred alternative would have no impact on the local climate.

4.3. GEOLOGY

The no action alternative
Under this alternative there would be no work proposed. The current geology and geologic process would remain the same.

The preferred alternative
The most likely geologic processes that could be altered as a result of this project are erosion and sedimentation. Increased erosion can be expected from drawing down the reservoirs deeper than typically is done. For Fall Creek, the draw down will be done to the same elevation as in 2012. For Hills Creek, the draw down is about 12 feet below what is normally done in the winter. For Cougar dam, the drawdown is expected to be about 25 feet below current operations. The draw downs would be of short duration with erosional impacts and increased sedimentation for short duration. Under the preferred alternative, long term impacts to geology are expected to be negligible.

4.4. HYDROLOGY

The no action alternative
Under this alternative there would be no work proposed. The current hydrologic regime and rule curve would remain the same.

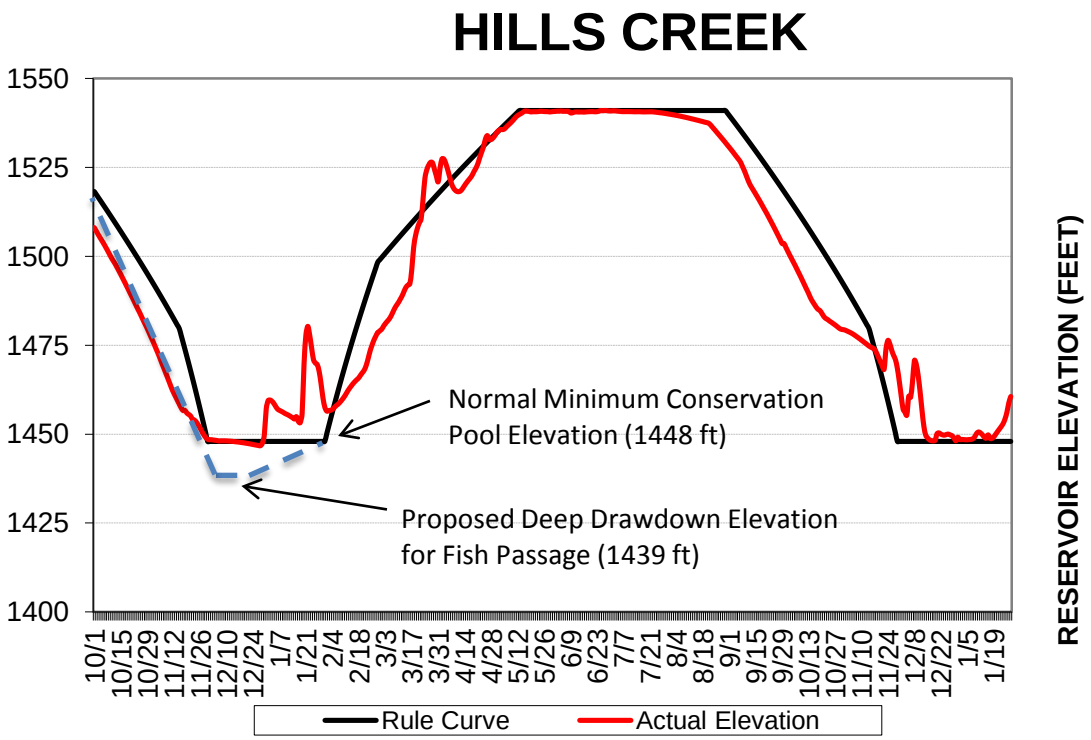
The preferred alternative
Hydrology under the preferred alternative would change slightly over the current condition as reservoir levels are brought slightly deeper then the norm to facilitate downstream fish passage. The intent of lowering reservoir elevation is to provide better access to outlets for downstream migration. The table below shows the proposed changes in reservoir elevation for each dam.

Table 5: Proposed changes to reservoir elevations during drawdown

Project Name	Current min pool elevation (Mean sea level)	Proposed Drawdown elevation (Mean sea level)	Change (in feet)
Hills Creek Dam	1448	1439	9
Fall Creek Dam	728	680	48
Cougar Dam	1532	1500	32

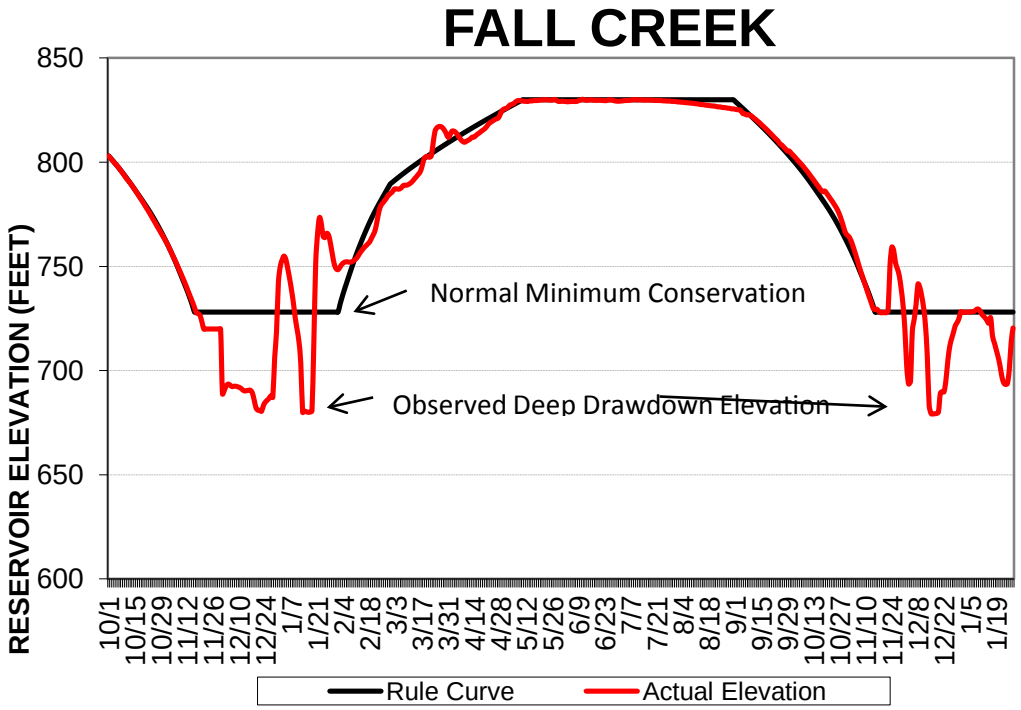
The section below evaluates the potential changes as a result of implementing the preferred alternative at each of the projects;

Hills Creek
The reservoir would be lowered an additional 9 feet over the current condition. Priority will be given for the regulating outlet over the turbine for discharge. Under the preferred alternative the regulating outlet discharge would increase during the months of November through January, while turbine flow would decrease over baseline. Total project outflow would not be modified and the water control diagram would be followed as usual. Impacts to flood damage reduction are not expected under this measure (Corps 2012). The graph below illustrates the difference between normal operation and what is proposed under the preferred alternative.



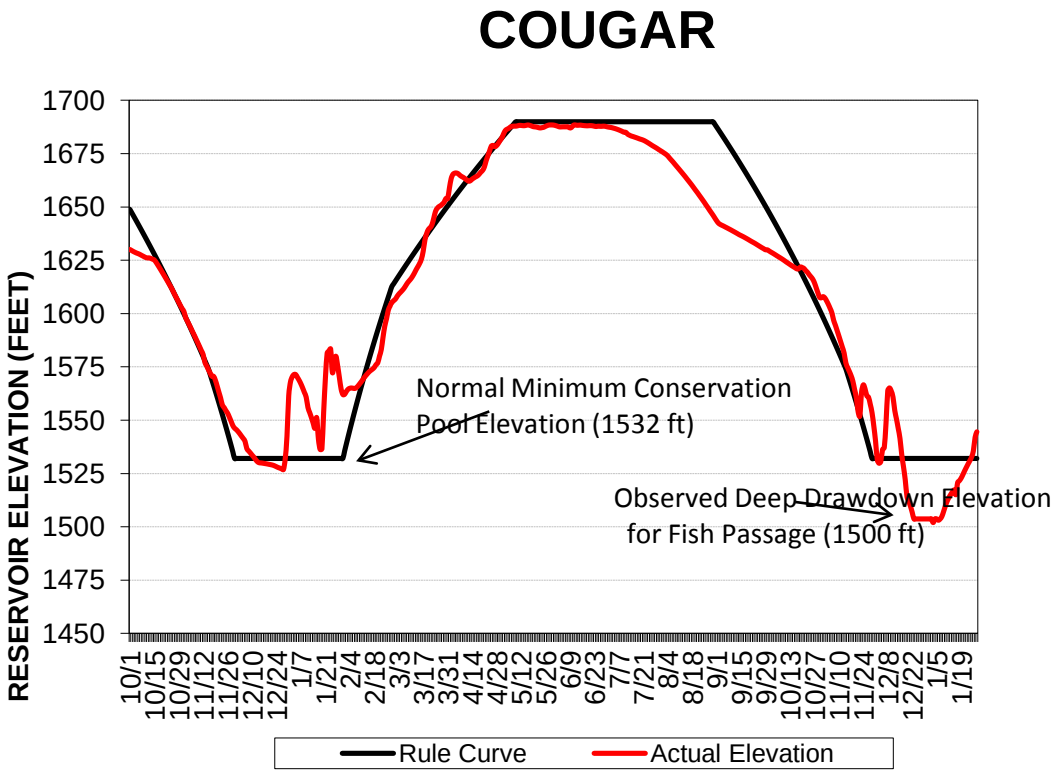
Fall Creek
Under the preferred alternative bankfull or flood stage flows are expected to lessen slightly under the proposed operation. Total project outflows from Fall Creek reservoir are expected to increase during the fall months in order to reach deeper elevations by mid-November. Flows during the spring are also expected to decrease as water is held back to refill Fall Creek reservoir. Since Fall Creek lacks a powerhouse and the spillway is only used during emergency situations, all project flows would be released from the regulating outlets. Under this measure, Fall Creek reservoir is likely to refill each summer for at least 50% of the water years simulated, and about as often as baseline. Field studies have indicated that this operation would not necessarily need to be implemented for months at a time, as drawing the reservoir down for 4 or 5 days consecutively passed sub-yearlings effectively through the dam in 2011 (Corps 2012). The reservoir would be lowered an additional 48 feet over the current condition. The

graph below illustrates the difference between normal operation and what is proposed under the preferred alternative.



Cougar

For the preferred alternative the average outflow increases slightly in March through May and July and August primarily because of the minimum regulating outlet gate opening restrictions. There also was a slight decrease in average outflow in October and November. Because of higher outflows in July and August, the reservoir elevation is lower than baseline. Therefore, in October and November when the reservoir is drafted, less water is required to be released, accounting for the decrease in average outflow. Additionally, under this alternative the priority for the first 100 cfs is to the turbines (Corps 2012). The remaining discharge would be through the regulating outlet. The drawdown is 32 feet lower than the norm. The graph below illustrates the difference between normal operation and what is proposed under the preferred alternative.



4.5. WATER QUALITY

The no action alternative
Water quality conditions would be the same under current operations.

The preferred alternative
The Corps expects that there would be some short term localized impacts to water quality as a result of the proposed drawdown at the three dams. The most likely water quality parameters affected are turbidity, suspended particulates and bedload, temperature and total dissolved gas. In the section below, the potential for water quality impacts will be addressed by the individual projects.

Hills Creek

Total Dissolved Gas (TDG)

TDG would be exceeded due to the increased use of ROs. The estimates are based on very little empirical data collected below Hills Creek. If this operation is prioritized for implementation, TDG monitoring would be conducted to gain a better understanding of the link between RO operations and downstream TDG production (Corps 2012). To minimize the impact of TDG, outflow through the RO would be kept under 500 cfs. Total

dissolved gas would be monitored downstream of the Dam to evaluate levels of gas saturation. If TDG exceeds the water quality criteria then the Corps would consult with the resource agencies and ODEQ. As a result, it is not predicted that TDG levels would be considered problematic because outflows would be kept under 500 cfs and short term.

Turbidity

Since the reservoir pool elevation is only dropping an additional nine feet over baseline, this small change in elevation would minimize sloughing and erosion in the reservoir. It is not expected that this measure would increase turbidity over background levels within or downstream of Hills Creek Reservoir (Corps 2012). Thus, the resulting impact would be minor and temporary.

Temperature

Since draw down is occurring shortly after reservoir turn over, it is expected that the water would be well mixed and unstratified. This measure would be implemented during the winter season when reservoir water temperatures are cool and isothermal (Corps 2012). This measure is not expected to negatively impact downstream water temperatures

Algae

Algae growth in the reservoir should not be affected during the winter due to cool temperatures and shortened daylight hours.

Fall Creek

Total Dissolved Gas

Based on limited historical data, this measure likely would create downstream TDG that exceeds the state water quality standard, however these exceedances are not expected to be any greater than what typical dam operations produce (CORPS 2012). To minimize the impact of TDG, outflow through the RO would be kept under 500 cfs. Total dissolved gas would be monitored downstream of the Dam to evaluate levels of gas saturation. If TDG exceeds the water quality criteria then the Corps would consult with the resource agencies and ODEQ.

Turbidity

Fall Creek reservoir was drawn down to elevation 690 feet MSL in 2010. During this operation, high turbidity levels were visually noted and shoals formed immediately downstream of the Dam. In 2011 and 2012, the reservoir was drawn down 10 feet lower, and turbidity was monitored just downstream of Fall Creek Dam. During these

drawdowns, the effect to turbidity was large amounts of sand, gravel and woody debris were eroded from the reservoir, restoring natural geomorphologic processes to the Fall Creek reach just below the dam (Corps 2012). A sediment study report is pending from the USGS for Fall Creek Dam and is expected in winter of 2013.

In 2011, redd surveys indentified six redds in Fall Creek reach below the dam. These redds were likely buried through sediment transport. It should also be noted that water temperatures peaked to 62.5°F during fall 2011, so it is likely that up to 50% of downstream redds had already experienced mortality (Corps 2012). The general conditions of NWP 4 requires that the proposed action would not cause burial/smothering of high quality redds. The redds found to occur downstream of the dam are considered by Corps and ODFW fisheries biologists to be within “low” quality spawning habitat as opposed to the higher quality spawning habitat upstream of the head of the reservoir. ESA-listed salmonids that arrive at the Fall Creek Adult Fish Collection Facility are trapped, hauled, and released at sites upstream of the head of the reservoir. Further, fine sediment material that visually accumulated immediately downstream of Fall Creek Dam were observed to flush from the area after subsequent winter storm events. The Corps will share the results of sediment and water quality monitoring data with ODEQ.

Temperature

Reservoir turnover typically occurs during early to mid-November at Fall Creek Reservoir. For this reason, water temperatures would not be negatively impacted by this operation since release temperatures would be uniform regardless of where or how water is released from Fall Creek Dam (Corps 2012).

Algae

Algae growth in the reservoir should not be affected during the winter due to cool temperatures and shortened daylight hours.

Cougar

Total Dissolved Gas

Prioritizing use of the RO will likely double the estimated average number of days exceeding 110% TDG annually. TDG would be exceeded during winter and spring and during spring Chinook incubation and rearing However, empirical data suggests that this supersaturated water degasses within a few kilometers from the dam, potentially impacting only a small reach of habitat (Britton and Barko 2006 as cited in Corps 2012). This operation is not expected to impact the functionality of the Cougar WTC tower.

In April 2006, the Corps tested TDG levels under a range of regulating outlet and powerhouse discharge operations at Cougar (Britton and Barko 2006 as cited in Corps 2012). This study found that regulating outlet discharges greater than 575 cfs produced near-field TDG saturations that exceeded the state water quality standard. These saturations typically degassed to background levels about 2.8 miles (4.5 kilometers)

downstream from the dam (Corps 2009). To minimize the impact of TDG, outflow through the RO would be kept under 500 cfs. Total dissolved gas would be monitored downstream of the Dam to evaluate levels of gas saturation. If TDG exceeds the water quality criteria then the Corps would consult with the resource agencies and ODEQ.

Turbidity

During the month of December 2012, a reservoir drawdown study was conducted at Cougar Dam to observe potential improvements to fish passage by drawing the lake surface down closer to the ROs. Overall, water quality conditions were monitored during the study, but as expected, turbidity did not increase. Not only are annual sedimentation rates low in the Cougar Reservoir, but the drawdown was small and did not cause bank sloughing or channel cutting in the upper reservoir (Corps 2013b). Based on this, turbidity in the South Fork McKenzie River is expected to be at baseline or slightly higher under the proposed action.

Temperature

Reservoir turnover typically occurs during early to mid-November at Cougar Reservoir. Cougar Dam also has the water temperature control tower that allows for mixing of different temperature water if need be. For these reasons, water temperatures would not be negatively impacted by this operation since release temperatures would be uniform

Algae

Algae growth in the reservoir should not be a problem during the winter due to cool temperatures and shortened daylight hours.

4.6. VEGETATION

The no action alternative
Under this alternative there would be no work proposed so the existing vegetation would remain the same

The preferred alternative
Under the preferred alternative they would be a small change in Dam operation, the existing rule curve will be modified but these small changes in flow and flow timing would have no effect on vegetative conditions at the project areas.

4.7. WILDLIFE

The no action alternative
Under this alternative there would be no work proposed. The current condition for wildlife would remain the same.

The preferred alternative
Under the preferred alternative, there would be a minor change in reservoir elevation at pool extent at Fall Creek and Cougar. This change to reservoir pool may have a small temporary effect to waterfowl that would normally utilize the area. This effect would be relatively short in duration (about a month). As part of the normal rule curve the reservoirs at Fall and Cougar Dams are normally in flux at this time of year (December to January). Water fowl are capable of dispersing to other nearby water bodies. The impact would be negligible and temporary in nature.

4.8. FISHERIES

The no action alternative
Under this alternative there would be no work proposed. The current condition for fish would remain the same.

The preferred alternative
Under the preferred alternative it is anticipated there would be a beneficial impact to downstream migrant salmonids. As reservoirs are drawn lower, the opportunity to find an outlet to migrate through improves. Also there is an opportunity to direct flows primarily through regulating outlets as opposed through turbines which would reduce injury and increase survivability. Below dams, Chinook salmon mortality was associated with reservoir elevation and river discharge in addition to fish size. Mortality increased with increasing reservoir elevation above Hills Creek and Lookout Point dams but decreased as elevation increased above Fall Creel Dam. Similarly, mortality decreased as discharge increased below Fall Creek and Hill Creek dams but the opposite was true below Lookout Point Dam (Keefer et.al. 2012). The vast majority of salmon passed dams in late fall and winter when reservoirs were drawn down near annual lows (Keefer et. al. 2012).

The following describes the changes due to prioritization of outlets and reservoir drawdown at each of the three projects:

Fall Creek
As a trial, the drawdown for fish passage was implemented at Fall Creek Dam in 2010 and 2011. In 2010, the reservoir was drawn down to elevation 690 feet. Keefer and others (2011) indicated that capture rates of juvenile Chinook in screw traps were highest below Fall Creek Dam at the lowest reservoir elevations. From November 20-24, 2011, Fall Creek reservoir was drawn down to elevation 680 feet. This lowered the lake elevation 10 feet lower than the previous year. During this passage operation, it was estimated that upwards of 20,000 spring Chinook salmon sub-yearlings were passed through the dam, averaging about 25 millimeters larger than sub-yearlings past in previous years. Based on screw trap studies conducted by Corps biologists, the largest number of fish passed once Fall Creek reservoir was drawn down below minimum conservation pool elevation. From a biological perspective, this fish passage operation has been very successful (Corps 2012).

Based on the above, the number of days that in-tributary BiOp flows would not be met under this measure are not likely to drastically change from baseline. It has been shown that smolts migrating from the reservoir via the ROs survive best when Fall Creek pool elevations are below normal winter minimum levels and RO discharges are less than 500 cfs (Downey 1992). Smolts showed a decrease in the mortality rate from 70% to approximately 40% under low-flow and low-head migration. Piscivorous fish (bass, crappie, and blue gill) are flushed from the reservoir, leaving fewer competitors and predators in the reservoir to interfere with the next year class of salmon (Corps 2012).

While this sounds as an improvement over the current condition there is still some injury and mortality associated with implementing this alternative. Please see the discussion on "take" in section 4.9 below.

Hills Creek
The days that BiOp flow targets were not met would not change under this measure since the volume of water released from Hills Creek would not change and only the outlet would be used. For Hills Creek the regulating outlet will have priority over the turbine during drawdown. Increased fish survival would be likely based on recent screw trap data collected at other Willamette dams (Corps 2012). There will be some level of injury and mortality associated. Please see the discussion on "take" in section 4.9 below.

Cougar
In general, it is unlikely that this proposed action, as compared to baseline, would greatly affect the number of days that BiOp flow targets are not met. From a biological perspective, impacts from TDG should be minimal or non-existent due to the depth compensation that juvenile salmonids would experience under the proposed operation (Corps 2012). As discussed in section 3.9 of this assessment, there is a variety of estimates of mortality for juveniles passing through Cougar Dam. This also holds true for which outlet is best. Regardless of the outlet priority and what elevation is reservoir is drawn down too, there will be some associated injury and mortality predicted to occur. Please see the discussion on "take" in section 4.9 below.

4.9. THREATENED AND ENDANGERED SPECIES

The no action alternative
Under this alternative there would be no work proposed. The current condition for endangered species would remain the same.

The preferred alternative
Under the preferred alternative, fish passage through the three dams would improve allowing more salmonids to migrate downstream. By facilitating migration there would be some mortality and injury associated with the action. Based upon previous studies (Keefer et. al. 2010, 2012, Downey 1992) that evaluated fish mortality as they migrate through dams, it is likely that there will be a taking's for migratory listed species (UWR

Chinook, UWR steelhead, and Columbia River bull trout). There will be likely no adverse effect to Oregon Chub because most of the local populations are to be found in pools adjacent to the mainstem of the creeks in front of the dams. Chub will be monitored during the proposed action. There will be no impact to the northern spotted owl and Oregon spotted frog because their habitat would not be affected. Critical habitat for listed species will not be impacted from the proposed action because the proposed action of drawdown would not impact critical habitat.

NMFS and USFWS have allowed for a take while accomplishing the reasonable and prudent alternatives described in their Biological Opinions published in 2008 as evidenced by the Incidental Take Statement issued in conjunction with the BiOp. The proposed action will not increase the amount of take from that authorized in the ITS.

Take

Section 9(a)(1) of the ESA prohibits any taking (to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to engage in any such conduct) of endangered species without a specific permit or exemption. Protective regulations adopted pursuant to Section 4(d) of the ESA extend the prohibition to threatened species. Harm is defined to include significant habitat modification or degradation that results in death of or injury to listed species by significantly impairing behavioral patterns such as spawning, rearing, feeding, and migrating (50CFR §222.102; NMFS 1999f). (NMFS 2008).

An incidental take statement specifies the impact of any incidental taking of endangered or threatened species. It also provides reasonable and prudent measures that are necessary to minimize these impacts and sets forth terms and conditions with which the Corps must comply in order to implement the reasonable and prudent measures. (NMFS 2008).

To monitor the impact of incidental take, the Corps must report the progress of the action and its effect on each listed species to NMFS, as specified in this incidental take statement (50 CFR§402.14(i)(3)). (NMFS 2008).

These are the maximum amounts or extents of take that NMFS anticipates will occur as a result of the RPA and Proposed Action. If actual take exceeds an amount or (geographic and temporal) extent specified here, it is likely that the authorized incidental take allowed under this Opinion has been exceeded by some indeterminate amount. NMFS will evaluate the best science available and determine whether authorized take has, in fact, been exceeded and if reinitiation of consultation is required.

As the RPA and proposed action are implemented, incidental take in the forms of adult and juvenile passage mortality and due to adverse water quality and quantity conditions is expected to decline. (NMFS 2008)

NMFS anticipates that the continued operation of the Willamette Project dams and reservoirs under the proposed action and reasonable and prudent alternatives will result

in incidental take of the species considered in this. Effects of the proposed action; and Effects of the RPA, or UWR Chinook salmon and UWR steelhead, which spawn and/or rear in several of the subbasins with Project dams, effects will include juvenile and adult passage mortality as well as effects on habitat conditions below the dams (i.e., in the tributaries and mainstem Willamette and in the lower Columbia River). (NMFS 2008).

NMFS expects, at most, the (quantifiable) amounts of incidental take of UWR Chinook and steelhead due to project passage, including trapping, transporting, and outplanting adults as well as juvenile passage, in the North Santiam, South Santiam, McKenzie, and Middle Fork Willamette subbasins shown in table below. The maximum (quantifiable) amounts of incidental take of UWR steelhead adults (including kelts) and juveniles are shown in Table 11.1-2.

Earlier in the Opinion (Section 9.11), NMFS determined that the RPA and Proposed Action, combined, are not likely to result in jeopardy to any of the 13 ESA-listed species. Thus, the effect of the amount and extent of take associated with these actions is fully considered in Chapter 9 of the Opinion. (NMFS BiOp 2008)

Table 6: Allowable take for downstream fish passage.

Sub basin	Feature	Life stage	Amount of Take
McKenzie	Downstream passage at Cougar Dam	Juveniles (primarily produced by hatchery origin spawners)	Mortality: up to 18.1% of fish passing through the turbines and up to 32% of those passing through the regulating outlet
Middle Fork	Downstream passage at and Fall Creek Dam (regulating outlet)	Juveniles	Mortality up to 41% (Downey 1992)
Middle Fork	Downstream passage at Hills Creek Dam	Juveniles (primarily produced by hatchery origin spawners)	Mortality: up to 60% of run

The Corps will monitor for downstream fish passage at the three dams that are the focus of this environmental assessment. If they approach the take limit they will notify the resource agencies and consult on how best to proceed through reinitiation of consultation. Any further NEPA compliance documentation that may be required will also be prepared.

4.10. MONITORING

The no action alternative
Under this alternative the current level of monitoring would continue.

The preferred alternative
Under the preferred alternative there would be an increase in fish and water quality monitoring. Monitoring is an essential component of the preferred alternative. Water quality monitoring would include an evaluation of water temperature, total dissolved gases, and turbidity. In order to evaluate the effectiveness of downstream fish migration it will be necessary to capture and handle fish at the downstream end of the projects. Typically, screw traps are employed but other methods such as netting may also be used. The Corps in cooperation with agencies like NMFS and USFWS have developed protocols on how to capture and handle fish. The trapping, capturing, or collecting and handling of juvenile fish using traps is likely to cause some stress on listed fish. However, fish typically recover rapidly from handling procedures. The primary factors that contribute to stress and mortality from handling are excessive doses of anesthetic, differences in water temperature, dissolved oxygen conditions, the amount of time that fish are held out of water, and physical trauma (NMFS 2008).

Research monitoring and evaluation studies under the preferred alternative would have direct effects on both UWR Chinook and UWR steelhead that are used in field studies. Fish may be trapped, examined, released, confined, re-located, marked or tagged and subjected to related handling operations, subjected to the administration of pharmacological agents, including anesthetics, subjected to capture by electrofishing, propagated, transported between stream basins, killed or injured during test and control conditions, and affected in diverse other ways. (NMFS 2008).

The services anticipated the need for monitoring the effectiveness of reasonable and prudent alternatives and developed an RPA to specifically address what kind of monitoring should be accomplished. RPA 4.11 in the 2008 NMFS BiOp states:

4.11 <u>Assess Downstream Juvenile Fish Passage through Dams:</u> At Cougar, Lookout Point and Dexter, Detroit and Big Cliff; Foster and Green Peter, Fall Creek, and Hills Creek dams, the Action Agencies will, in coordination with and review by the Services, do the following:

1. Assess passage survival and efficiency through all available downstream routes, including turbines, spillways, regulating outlets, hatchery water supplies, etc., noting injury and mortality through each route.

2. Identify and propose alternatives for reducing juvenile mortality passing through the routes noted above, including, but not limited to, operational and structural modifications.

Rationale/Effect of RPA 4.11: The effect of having a lack of effective downstream fish passage facilities is described in the Effects sections for the major subbasins with Project dams. However, there is little existing information on downstream fish passage through various routes at Project dams. Studies are needed to determine the proportion of fish moving through existing outlets (turbines, regulating outlets, spillways,

sluiceways), and their survival and injury rates through each outlet. In order to determine the likely effectiveness of downstream fish passage alternatives, studies are needed to evaluate vertical and horizontal distribution of fish as they reach the face of the dam, and to evaluate biological, technical and engineering issues associated with design of passage facilities (NMFS 2008).

This information is key to designing effective passage facilities. The kinds of studies that are needed would vary among dams, depending on existing information and characteristics of each dam and the species that use it. The focus of studies would be to develop and evaluate alternative fish passage concepts that would guide site- specific decisions and identify priorities among Project dams on the most effective downstream passage methods at each dam where it is deemed feasible and likely to be effective. (NMFS 2008).

The effect of this RPA will be to provide site-specific information regarding downstream fish passage at Project dams, informing key decisions related to downstream fish passage facilities. This information is a necessary first step in fish passage design. Improved downstream fish passage will ultimately increase spatial distribution by providing safe access to and from historical habitat (NMFS 2008).

Take

As careful as fishery biologists can be, there is always some small level of harm and mortality when handling many fish. The Corp employs experienced biologist who are familiar with monitoring methods and have developed protocols to minimize impacts to the resource. Incidental take from fish passage RM&E will include harassment, handling, injury, and mortality of adults at trapping sites; handling and mortality of adults during transport; juvenile injury and mortality during project passage; and juvenile trap mortality at the lower end of the study site. The amount or extent of take expected from each these activities is shown in table below.

Table 7: RM&E take.

Sub basin	Feature	Life stage	Amount of Take
McKenzie	Fish passage RM&E (screw traps and nets)	Juveniles	Mortality: up to 1%
Middle Fork	Fish passage RM&E (screw traps and nets)	Juveniles	Mortality: up to 1%

(NMFS 2008)

During the ongoing monitoring events Corps biologist will keep track of monitoring mortality and consult with the resource agencies if they approach the take limit.

4.11. CULTURAL RESOURCES

The SOR EIS states fluctuating reservoir shorelines can directly impact archeological sites in three reservoir areas: 1) the exposed beach 2) the location of wave impact, and 3) inundated areas ((BPA et al 1995:4-134 - 4-136). A variety of impacts can occur to cultural resources in any of the three areas during reservoir drawdown operations. Fluctuating flow, current, and water levels often cause wave action, exposure, and repeated inundation of cultural resources, potentially causing affects.

Additional types of impacts that can occur in these areas include wind and water deflation of archeological deposits; repeated cycles of inundation (wetting) and drying causing deterioration to organic materials; wind generated wave action can cause erosion and deflation of archeological material; changing underwater currents due to surface water level fluctuation can cause displacement of archeological material or slumping. Also, reservoir drawdowns can subject surface archeological materials to looting, vandalism, illegal off road vehicles, and animal impacts such as burrowing, wallowing or the establishment of temporary game trails.

The potential exists for all of these impacts to occur to the known and unknown cultural resources within the three drawdown zones currently under study. However, the condition and extent of intact cultural resources at these locations is unknown. A determination of eligibility for the NRHP of the 34 identified archeological sites within the drawdown zone at Fall Creek has not been completed. Consultation regarding the APE for the deep drawdown at Fall Creek with the Oregon SHPO and affected tribes has been initiated. Five of the known archeological sites at Fall Creek are being assessed for condition, impacts, and eligibility to the NRHP during this deep drawdown. However, the analysis cannot be completed beforehand due to the inaccessibility of these resources deep within the reservoir. The results of this assessment will help inform the agency in its effects determination and completion of the consultation process with SHPO and Native American Tribes.

4.12. RECREATION

The no action alternative
Under this alternative there would be no work proposed. The current condition for recreation would remain the same.

The preferred alternative
For the preferred alternative the following changes to recreation could be expected;

Hills Creek
Increased impacts to recreation would not be expected under this measure and Packard Creek boat ramp would be available throughout the year (Corps 2012).

Fall Creek
Under this proposed alternative, no impact to recreation would occur because during winter, the parks and boat ramps are closed for use (Corps 2012).

Cougar
Impacts to recreation from this measure would primarily occur during September since the reservoir would likely be drawn down faster this time of year as compared to baseline conditions (Corps 2012). The impact would be minimal to recreation.

5. UNAVOIDABLE ADVERSE EFFECTS

There are a few unavoidable adverse effects associated with the preferred alternative. The main unavoidable impact would be the potential mortality of juvenile fish as they migrate downstream through the dams. Both the NMFS and USFWS recognized this when they allowed for a "take" for the proposed action. In section 6.8 of this Environmental Assessment there is a take associated with each of the Dams where the downstream passage is to occur. The Corps would attempt to minimize fish mortality where possible by optimizing flows during draw down. Monitoring of both water quality and fish abundance at the projects sites would provide a status on how downstream migration is working. If monitoring at a project site demonstrates that fish mortality is approaching the take limit, then the Corps would reinitiate consultation with NMFS and USFWS and determine the appropriate actions to take and remedy the situation.

One other unavoidable adverse effect is the potential for changes in water quality downstream of the three dams. Water quality parameters such as turbidity, suspended particulates and total dissolved gas may increase temporarily during the drawdown. At Cougar and Hills Creek dams, these water quality parameters are not expected to increase substantially above normal background levels for the winter months. At Fall Creek, while the normal background levels of turbidity and suspended particulates downstream of the dam are observed to increase during the winter months, a visually observable increase in these water quality parameters is expected while the reservoir is being actively drawn down and held at a run-of-river scenario. The Corps will try to minimize these impacts by controlling flow. An increase in turbidity and suspended particulates would be anticipated should a large rain even occur while the reservoir bed is exposed. These impacts will be short term in nature with subsequent winter storm events providing flows that are anticipated to effectively flush accumulated sediment.

6. CUMULATIVE IMPACTS

***Cumulative impact**" 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 other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."* (40 CFR 1508.7)

Considerable changes has occurred to the McKenzie and Middle Forks of the Willamette River has occurred since Euro-American settlement began around 1850s.

Prior to this time much of the Willamette basin and its tributaries would have been dominated by Western Hemlock forest. Starting around the 1850s with the advent of European settlement the landscape began to change. Table 1, in section 3.2 provides a good example of the types of alterations that took place as well as the scale. The major incremental transformation that have occurred over time in the study area included deforestation that has been converted to agricultural and urban development, construction of dams and revetments, water withdrawals and removal of wood from the rivers. These effects have changed vegetative patterns, altered the hydrology and geomorphology of the rivers disconnecting the rivers from their floodplains. As a result riparian and off-channel habitats have been greatly reduced resulting in effects to species population. The listing of several species under the Endangered Species Act offers one indication of the severity of alteration.

Evaluating cumulative effects also includes the evaluation of potential future actions. As such, they include the effects of Corps actions as they implement the RPAs of the 2008 Biological Opinions from USFWS and NMFS. Cumulative effects would also include collaborative endeavors such as participating in ESA recovery plans as well as any habitat restoration projects within the Willamette Valley under the Corps restoration authorities (such as section1135 and 206 under the Water Resource Development Act and General Investigations). The proposed trap and haul facility at Fall Creek Dam and fish collection facility proposed at Cougar Dam are two examples of projects that are proposed for the near future. As with the implementation of many projects, either changes in operations or construction, there are usually short term impacts. As noted in this document, some of these impacts may result in temporary water quality impacts and harm or even mortality to ESA listed species (as long as the projects are done in consultation with the Services and a “take“ is provided) as projects are executed, but in the long term positive cumulative effects can be realized and assist in the recovery of listed species can be accomplished. The proposed project that is the focus of this environmental assessment is one of many projects the Corps anticipates to accomplish provided that the appropriate authorities are used and the needed resources are available. Implementation of this proposed action coupled with the other restoration actions being taken in the Willamette Valley should benefit the listed species in the long term despite initial takes that may occur with the drawdowns.

7. COORDINATION

The draft Environmental Assessment will be issued for a 15-day public review period. The Public Notice has been sent to interested persons, agencies, and groups, including, but not limited to those parties shown below. The draft Environmental Assessment is available for review on the Portland District’s website (http://www.nwp.usace.mil/).

National Marine Fisheries Service
U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Forest Service

Bureau of Land Management
Confederated Tribes of the Warm Springs Reservation
Confederated Tribes of the Grand Ronde Community of Oregon
Columbia River Inter-Tribal Fish Commission
Oregon Department of Environmental Quality
Oregon Department of Fish and Wildlife
Oregon Department of Parks and Recreation
Oregon State Historic Preservation Office

8. ENVIRONMENTAL COMPLIANCE

8.1. FEDERAL STATUTES

American Indian Religious Freedom Act

The American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996) establishes protection and preservation of Native Americans' rights of freedom, belief, expression, and exercise of traditional religions. Courts have interpreted the American Indian Religious Freedom Act to mean that pubic officials must consider Native Americans' interests before undertaking actions that might impact their religious practices, including impact on sacred sites.

The preferred alternative is not expected to have any effect upon Native Americans' rights of freedom of belief, expression, and exercise of traditional religions.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668d) prohibits the taking, possession or commerce of bald and golden eagles, except under certain circumstances. Amendments in 1972 added to penalties for violations of the Act or related regulations.

The proposed action would slightly modify reservoir operations. No activities are proposed such as construction that could result in harassment of bald and golden eagles. Therefore, the proposed project would not result in any impacts to bald and golden eagles that would result in a takings or a need for a permit.

Clean Air Act

The Clean Air Act requires states to develop plans, called State Implementation Plans (SIP), for eliminating or reducing the severity and number of violations of National Ambient Air Quality Standards (NAAQS) while achieving expeditious attainment of the NAAQS. The Act also required Federal actions to conform to the appropriate SIP. An action that conforms with a SIP is defined as an action that will not: (1) cause or contribute to any new violation of any standard in any area; (2) increase the frequency or severity of any existing violation of any standard in any area; or (3) delay timely

attainment of any standard or any required interim emission reductions or other milestones in any area.

The proposed action would slightly modify reservoir operations. There are no activities that would generate emissions. The proposed project, thus, would have no impacts to air quality.

Federal Water Pollution Control Act

The Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) is more commonly referred to as the Clean Water Act (CWA). This act is the primary legislative vehicle for Federal water pollution control programs and the basic structure for regulating discharges of pollutants into waters of the United States. The CWA was established to "restore and maintain the chemical, physical, and biological integrity of the nation's waters." The CWA sets goals to eliminate discharges of pollutants into navigable waters, protect fish and wildlife, and prohibit the discharge of toxic pollutants in quantities that could adversely affect the environment.

A temporary increase above background turbidity is anticipated for the drawdown of Fall Creek Reservoir due to the change from an impounded lake to a return to a run-of-river scenario. Corps concludes that the project is functionally analogous to Nationwide Permit (NWP) 4 (Fish and Wildlife Harvesting, Enhancement, and Attraction Devices and Activities) pursuant to Section 404 of the Clean Water Act. NWP 4 allows for discharges of fill material into waters of the United States associated with fish enhancement activities. The discharge will not cause the loss of any wetlands or the impoundment/semi-impoundment of waters of the United States. The sediment that comprises the reservoir bed of Fall Creek and Cougar Reservoirs have been analyzed and found to be below screening levels for all chemicals of concern per the Sediment Evaluation Framework (May 2009; http://www.nwp.usace.army.mil/Portals/24/docs/environment/sediment/2009_SEF_Pacific_NW.pdf). Therefore, the sediment is free from toxic pollutants in toxic amounts. Prior to initiation of a drawdown of Hills Creek Reservoir, those sediments would be analyzed per the Sediment Evaluation Framework as well. An evaluation of sediment release associated with the drawdowns and the impacts on fish are included with the research, monitoring, and evaluation plan for each of the three reservoirs discussed in this EA.

During drawdown the Corps would conduct water quality monitoring per the requirements of the NWP 4 and coordinate results with ODEQ. In addition, the general condition 3 of NWP 4 requires that the proposed action would not cause burial/smothering of high quality redds. The redds found to occur downstream of the dam are considered by Corps and ODFW fisheries biologists to be within "low" quality spawning habitat as opposed to the higher quality spawning habitat upstream of the head of the reservoir.

Coastal Zone Management Act

Under the Coastal Zone Management Act of 1972 (16 USCA 1451-1465), Sec. 307(c)(1)(A), "[e]ach Federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs."

The proposed actions at the three dams are not located within a coastal zone.

Endangered Species Act

The Endangered Species Act (16 U.S.C. 1531-1544), amended in 1988, establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the habitat upon which they depend. Section 7(a) of the ESA requires that Federal agencies consult with USFWS and NMFS, as appropriate, to ensure that proposed actions are not likely to jeopardize the continued existence of endangered or threatened species or to adversely modify or destroy designated critical habitats.

Because the proposed action would implement RPA 4.8 of the NMFS and USFWS 2008 BiOps to enhance downstream fish passage through reservoir operational modifications, this proposed project is in compliance with the ESA.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (MSA), (16 U.S.C. 1801 et seq.) requires Federal Agencies to consult with NMFS on activities that may adversely affect Essential Fish Habitat (EFH). EFH is defined in as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). Affected portions of the Willamette and Columbia rivers and several affected Willamette basin tributaries serve as migratory corridors for anadromous salmonids, including Chinook and coho salmon. Portions of affected Willamette basin tributaries also serve as spawning and rearing habitats for Chinook and coho salmon. (2008 NMFS Bi Op) The McKenzie River up to Cougar Dam is designated as EFH for unlisted Chinook and coho. The Middle Fork Willamette up to Dexter Dam is designated as EFH for unlisted Chinook.

NMFS stated in their 2008 BiOp that the Corps adopt and implement the terms and conditions of the BiOP as EFH conservation measures. Because the proposed action would implement RPA 4.8 of the NMFS 2008 BiOp to enhance downstream fish passage through reservoir operational modifications, this proposed project is in compliance with MSA.

National Environmental Policy Act

NEPA (42 U.S.C. 4321 et seq.) requires that Federal agencies consider the environmental effects of their actions. It requires that an Environmental Impact Statement (EIS) be included in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment. The EIS must provide detailed information regarding the proposed action and alternatives, the environmental effects of the alternatives, appropriate mitigation measures, and any adverse environmental effects that cannot be avoided if the proposal is implemented. Agencies are required to demonstrate that these factors have been considered by decisionmakers prior to undertaking actions. Major Federal actions determined not to have a significant effect on the quality of the human environment may be evaluated through an Environmental Assessment (EA).

In accordance with the NEPA, federal projects are required to disclose potential environmental impacts and solicit public comment. This draft EA for the Downstream Fish Enhancement for Juvenile Salmonids at Three Willamette Valley Dams would be released for a 15 day public review period.

National Historic Preservation Act

Section 106 of the NHPA (16 U.S.C. 470) requires that Federal agencies evaluate the effects of Federal undertakings on historical, archeological, and cultural resources and afford the Advisory Council on Historic Preservation opportunities to comment on the proposed undertaking if there is an adverse effect to an eligible Historic Property. The lead agency must examine whether feasible alternatives exist that would avoid eligible cultural resources. If an effect cannot reasonably be avoided, measures must be taken to minimize or mitigate potential adverse effects.

As mentioned in Section 4.11, a determination of eligibility for the NRHP of the 34 identified archeological sites within the drawdown zone at Fall Creek has not been completed. Consultation regarding the APE for the deep drawdown at Fall Creek with the Oregon SHPO and affected tribes has been initiated. Five of the known archeological sites at Fall Creek are being assessed for condition, impacts, and eligibility to the NRHP during this deep drawdown. However, the analysis cannot be completed beforehand due to the inaccessibility of these resources deep within the reservoir. The results of this assessment will help inform the agency in its effects determination and completion of the consultation process with SHPO and Native American Tribes.

Safe Drinking Water Act

The Safe Drinking Water Act protects drinking water and its sources, including- rivers, lakes, reservoirs, springs, and ground water wells. This Act does not regulate private wells that serve fewer than 25 individuals. The project is consistent with this Act because the projects do not supply drinking water.

Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act (16 U.S.C. 1271-1278) of requires Federal agencies to protect the free-flowing condition and other values of designated rivers and consult with the federal agency charged with administering the Act. Segments of the McKenzie and Willamette Rivers have been designated as wild and scenic river; however the project sites are not in one of the designated river segments.

8.2. EXECUTIVE ORDERS

Executive Order 11990, Protection of Wetlands

Executive Order 11990 encourages Federal agencies to take actions to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands when undertaking Federal activities and programs. No wetlands would be impacted by the proposed action as a result of the proposed operational changes at the dams. Actions proposed by the Corps are consistent with Executive Order 11990.

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations

Executive Order 12898, dated February 11, 1994, requires Federal agencies to consider and address environmental justice by identifying and assessing whether agency actions may have disproportionately high and adverse human health or environmental effects on minority or low income populations. Disproportionately high and adverse effects are those effects that are predominately borne by minority and/or low income populations and are appreciably more severe or greater in magnitude than the effects on non-minority or non-low income populations.

The project does not involve siting a facility that would discharge pollutants or contaminants, so no human health effects would occur. The sediment that comprises the reservoir bed of Fall Creek and Cougar Reservoirs have been analyzed and found to be below screening levels for all chemicals of concern per the Sediment Evaluation Framework. Prior to initiation of a drawdown of Hills Creek Reservoir, those sediments would be analyzed per the Sediment Evaluation Framework as well. The preferred alternative would not have a disproportionate adverse impact on low-income or minority populations since the preferred alternative would modify reservoir operations at the dams and total project outflow rates would not be affected. Therefore, the project is in compliance with this order.

Executive Order 11988, Floodplain Management

Executive Order 11988 requires Federal agencies to avoid, to the extent possible, the long and short-term adverse impacts associated with the occupancy of the floodplain, and to avoid direct and indirect support of floodplain development where there is a practicable alternative. In accomplishing this objective, “each agency shall provide

leadership and shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains."

The proposed action would result in a modification of reservoir operations of the prioritization of outlets; however total project outflow rates would not be affected. In the event flood risk became of concern, the proposed project would be discontinued. Thus, the proposed action is in compliance with this executive order.

9. LIST OF PREPARERS

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