# *Final Environmental Assessment for Mud Mountain Dam Upstream Fish Passage, Pierce County, Washington*

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## Executive Summary

This document is an environmental assessment (EA) prepared by the Seattle District, U.S. Army Corps of Engineers (Corps) for construction and operation of Mud Mountain Dam Fish Passage Facilities on the White River near Buckley, Washington. The current facilities located at river mile (RM) 24.3 will be replaced with a new fish barrier structure at the same location and a fish trap-and-haul facility on the opposite bank from the existing fish trap. This EA is intended to satisfy public involvement and disclosure requirements under the National Environmental Policy Act of 1969 (NEPA). The document describes the project and likely effects on terrestrial resources, aquatic resources, federally listed species under the Endangered Species Act (ESA) and effects on the human environment arising from the construction and operation of the proposed project. This document serves as the basis for the preparation of a Finding of No Significant Impact (FONSI).

The existing White River barrier structure is located at RM 24.3 on the White River, which is a tributary to the Puyallup River 10.4 miles above the Puyallup's mouth at Puget Sound. The White River is a large, powerful stream fed in its headwaters by glaciers on Mount Rainier. The river's name derives from its characteristically high turbidity, which gives its waters a milky color, and the river transports a great deal of sediment, especially at high flows. The existing barrier structure was constructed in 1912 to provide for water diversion to operate the Puget Sound Energy (PSE) White River Hydropower Project (WRHP). The Corps entered into an agreement with Puget Sound Energy in 1941 to construct a temporary fish trap and haul facility co-located at the then named White River Diversion Dam. With approval of the Chief of Engineers, on 2 February 1948, USACE utilized the authorization provided by the 1936 Flood Control Act to enter into an agreement to acquire an easement from PSE for use of the Buckley site as a permanent fish trap location. PSE subsequently transferred ownership of the facilities to Cascade Water Alliance (CWA), a municipal and industrial (M&I) water supply consortium of local cities and water utilities which took over ownership of the existing barrier structure and all related PSE facilities, including water rights, on December 18, 2009. The Corps and CWA executed an operating agreement in 2010 to continue on-going maintenance of the barrier structure for the purposes fish trap-and-haul operations.

## Summary of Impacts

Environmental impacts from the proposed project include both short-term and long-term changes to the baseline condition. Short-term impacts are episodic and principally associated with construction of the replacement fish passage structure. They may include increased turbidity, and temporary and permanent wetland and riparian losses due to staging and associated construction of facilities. During construction there is also a potential for stress or injury to fish associated with altered flow patterns or encounters with temporary rock structures or other cofferdam types. Some temporary impediment of upstream and downstream migration of fish might occur since construction of the proposed project will occur over several years, with some work needing to be done outside of the established fish construction window. Despite appropriate containment and control measures (best management practices), there is always a remnant potential for leaks or spills of chemicals including fuels, lubricants, concrete materials, adhesives, and other chemicals. A bald eagle nest is located nearby the proposed project and will be monitored to assess potential impacts due to construction and operation. During construction, the existing adult fish collection facility will remain operational; however, it is possible that trap efficiency may be temporarily reduced due to changing flow characteristics, nearby noise or other construction related activities.

The project produces long term benefits. The new fish passage structure will collect and pass significantly more fish, it will provide better attraction flows to the right bank and better reliability, as well as better ability to pass sediment and other material through the new barrier structure. More fish will be able to access upstream spawning areas, potentially increasing salmonid populations in the watershed. Additionally there will be reduced potential for stranding of juveniles due to flow manipulation caused by the dam repairs.

**Alternatives Considered**

For the MMD fish passage facility, the right or left bank locations were evaluated by the H&H/Fish Biologist Working Group which determined that, strictly from the standpoint of fish attraction and minimizing the risk of not meeting the 95 percent attraction criteria, an entrance on the left bank was preferable to a right bank location. However, this group also noted that an entrance on the right bank could also meet the 95 percent attraction criteria. The right bank was also expected to have enough available area to collect, load and transport 60,000 fish in one day. The group concluded that additional information was needed to determine if there was enough available area for processing fish on the left bank. Given this uncertainty the decision was made to proceed with a design for the fish trap facility on the right bank.

***TABLE OF CONTENTS***

## APPENDICES

River Barrier Structure and Fish Collection Facility (White River Headworks) Buckley, Washington

## *LIST OF FIGURES*

## *LIST OF TABLES*

## *LIST OF ACRONYMS AND ABBREVIATIONS*

APE – Area of Potential Effect
BA – Biological Assessment
BiOp – Biological Opinion
CFR – Code of Federal Regulations
cfs – Cubic Feet per Second
Corps- Seattle District, US Army Corps of Engineers
CWA – Cascade Water Alliance
EA – Environmental Assessment
EFH – Essential Fish Habitat
EPA – US Environmental Protection Agency
ESA – Endangered Species Act
FERC – Federal Energy Regulatory Commission
FONSI – Finding of No Significant Impact
FWCA – Fish and Wildlife Coordination Act
H&H – Hydraulics and Hydrology
H&H/Fish Biologist Working Group – Corps, NMFS, USFWS, WDFW, MIT, PTI, CWA
HTRW – Hazardous Toxic or Radioactive Waste
ITS – Incidental Take Statement
LWD – Large Woody Debris
MIT – Muckleshoot Indian Tribe
MMD – Mud Mountain Dam
MOA – Memorandum of Agreement
NEPA – National Environmental Policy Act
NHPA – National Historic Preservation Act
NMFS – National Marine Fisheries Service
NTU – Nephelometric Turbidity Units
DAHP – Department of Archeological and Historical Preservation (Washington State)
pH – Percent Hydrogen
PHS – Priority Habitat and Species, designated by the State of Washington
PL – Public Law
PME – Probable Maximum Event
PTI – Puyallup Tribe of Indians
PM – particulate matter
PSE –Puget Sound Energy
RCW – Revised Code of Washington
RM – River Mile
RPA – Reasonable and Prudent Alternative
SASSI – Salmon and Steelhead Stock Inventory
SIP – State Implementation Plan
TDS – Total Dissolved Solids
TMDL – Total Maximum Daily Load
TPU – Tacoma Public Utility
USACE – US Army Corps of Engineers
USFWS – US Fish and Wildlife Service

WAC – Washington Administrative Code
WDOE – Washington Department of Ecology
WDFW – Washington Department of Fish and Wildlife
WRIA – Water Resource Inventory Area
WRHP – White River Hydroelectric Project
WWTIT – Western Washington Treaty Indian Tribes

# 1 INTRODUCTION

This document is an environmental assessment (EA) prepared by the Seattle District, U.S. Army Corps of Engineers (Corps) for construction and operation of Mud Mountain Dam Fish Passage Facilities on the White River near Buckley, Washington. The current barrier structure and fish trap-and-haul located at river mile (RM) 24.3 will be replaced with a new fish barrier structure at the same location and a fish trap-and-haul facility on the opposite bank of the current fish trap. This EA is intended to satisfy public involvement and disclosure requirements under the National Environmental Policy Act of 1969 (NEPA). The document describes the project and likely effects on terrestrial resources, aquatic resources, federally listed species under the Endangered Species Act (ESA) and effects on the human environment arising from the construction and operation of the proposed project. This document serves as the basis for the preparation of a Finding of No Significant Impact (FONSI).

## *1.1 Authority*

Congress authorized construction of MMD for flood risk management through the Flood Control Act of 1936 (Public Law. No. 74-738). The Flood Control Act of 1938 (PL No. 75-761) provided that operation and maintenance of the dam would be by the Corps. Originally the dam was designed as a concrete arch dam, which would have allowed upstream passage for fish through an unregulated sluice. During design after authorization, geological investigation revealed that a concrete arch dam was not feasible at the site and the Corps switched to a rolled earthfill dam design. The rolled earthfill design did not allow for upstream fish passage through the dam. Without a fish passage facility, MMD would block access to spawning and rearing areas for fish upstream of the dam. On June 1, 1939, the Chief of Engineers responded to local concerns and Seattle District and North Pacific Division recommendations by approving use of a trap-and-haul system to provide upstream fish passage.

The Corps planned to use a temporary fish trap with trucks hauling fish during construction with a permanent trap and inclined railway to be installed at MMD itself. In 1941 the Corps entered into an agreement with Puget Sound Power and Light (now known as Puget Sound Energy [PSE]) to establish the temporary trap at the White River Hydroelectric Project (WRHP) diversion. In 1948, the Chief of Engineers approved an agreement with Puget Sound Power and Light and the State of Washington for the permanent fish trap-and-haul facility co-located with the WRHP diversion structure.

The Corps has the authority for construction at completed projects when the purpose of the work is the continued operation of the project. The Corps may make “reasonable changes and additions to project facilities within project boundaries as may be needed to properly operate the project or minimize maintenance” (ER 1165-2-119 § 8). The Corps has authority to construct the proposed fish passage facility as necessary for proper operation of MMD. The purpose of the current investigation is to provide a recommendation to remedy problems related to the effectiveness and efficiency of fish passage under the original authorization for the project.

## *1.2 Project Location*

The White River is located in western Washington, with its headwaters originating on the Emmons Glacier of Mount Rainier, approximately 60 miles southeast of Seattle, Washington. The White River lies in the Puyallup River Basin and is a tributary to the Puyallup River which ultimately drains to Commencement Bay on Puget Sound near the City of Tacoma. Mud Mountain Dam is located at river mile 29.6 (distance upstream of the outlet) on the White River, approximately 25 miles southeast of Tacoma, Washington (Figure 1). The project location is centered on the fish trap-and-haul facility owned and operated by the Corps, located outside the City of Buckley, Washington, on the left bank of the river (looking downstream) at river mile 24.3 (Figure 2). In accordance with the Agreement for Construction of Fishway and Appurtenant Facilities for Mud Mountain Dam (the 1948 Agreement), the Corps' Buckley fish trap-and-haul facility is co-located with the CWA barrier and intake which leads to a flume which conveys water to Lake Tapps. The existing fish barrier structure is owned by CWA and they maintain it on behalf of the Corps through a Cooperative Agreement between the Corps and CWA (dated October 2010; most recently amended August 2014 [the 2010 Cooperative Agreement]). The Corps has an easement from CWA for access and operation of the trap-and-haul facility. Immediately opposite the existing Corps fish trap on the right bank of the river, the Muckleshoot Indian Tribe (MIT) owns and operates a fish hatchery for Endangered Species Act (ESA)-listed Spring Chinook salmon, steelhead, and potentially other salmonid species. The release site for the trap-and-haul facility is located on the river's right bank approximately 5 miles upstream of the MMD on the White River at river mile 35.

## *1.3 Background*

Construction of MMD was authorized by Congress through the Flood Control Act of 1936 as a single-purpose project to manage flood flows on the White and Puyallup Rivers. Construction of the dam began in 1939 and was eventually completed in 1948, following construction delays incurred as a result of World War II. The dam provides flood risk management to the homes and businesses of approximately 400,000 people downstream. The dam regulates flooding by holding back water from heavy rains and melting snow in the reservoir, and releasing it slowly back into the river immediately following flood events. The flood season extends from mid-October through March. Unless water storage is required for flood flows, the reservoir is empty year-round, conveying the normal flow of the White River through two tunnels, a 9-foot tall horseshoe-shaped tunnel and a 23-foot-diameter tunnel which both pass through the base of the dam.

Maintaining the migration routes of Pacific salmon and other freshwater fish has historically been an important issue in the Pacific Northwest for cultural, ecological, conservation, and economic reasons. Protection, conservation and management of anadromous fish (fish that spawn in freshwater and rear in the ocean) is a statutory responsibility of National Marine Fisheries Service (NMFS) and protection of fish and wildlife in Washington State is a statutory responsibility of the Washington Department of Fish and Wildlife (WDFW). Fish passage has evolved into an additional legal responsibility for Federal agencies following the approval of the Endangered Species Act (ESA) in 1973. Several species of salmon and freshwater fish were listed as endangered or threatened in the White River in following years, as well as designation of their critical habitat. Facilitating the passage of fish into important upstream habitat became an integral part of ESA recovery plans throughout the region. The ESA also provided additional responsibilities to Federal agencies to consult with the NMFS and/or the US Fish and Wildlife Service (USFWS) when actions undertaken may affect listed species. Such actions can include new Federal projects or ongoing operations of existing projects such as MMD.

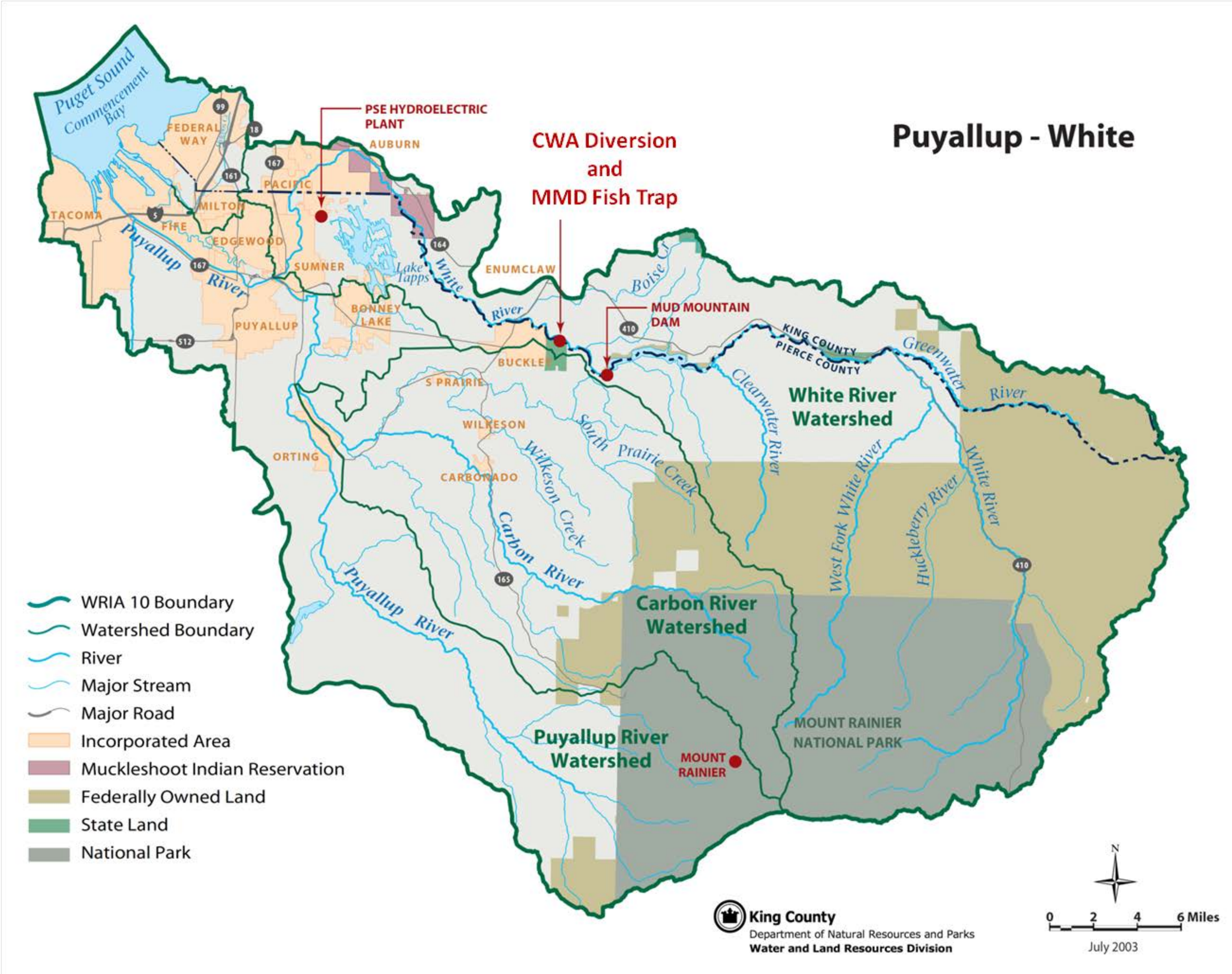


**Figure 1. White River and Puyallup River Watersheds.**


**Figure 2. Existing Project Features on the White River**

The White River Hydroelectric Project included a low-head, timber crib diversion dam (now referred to as a fish barrier structure or barrier structure) on the White River to partially divert river flows (up to 2,000 cfs diversion maximum per PSE's water rights) to hydropower facilities located at the outlet of Lake Tapps Reservoir. When originally constructed in 1912, the diversion dam included a fish ladder that provided upstream passage for adult salmon. This fish ladder was removed in conjunction with the fish trap construction in 1941, whereby the diversion structure has since created a barrier to the volitional upstream migration of salmon, essentially acting as a functional fish barrier structure that diverts salmon into the Corps trap-and-haul fish facility. CWA took over the structure in 2009 along with an accompanying water right with a diversion maximum of 1000 cfs.

The trap-and-haul facility was initially intended to serve as a temporary measure that would be operated by the Washington Department of Fisheries in the interim while the Corps investigated the feasibility of permanent fish passage at Mud Mountain; however, due to the change in design of MMD, the 1941 trap-and-haul facility has remained as the only means to pass fish upstream of MMD, and the facility has remained essentially unchanged for over 70 years. The original fish passage facility was anticipated to address a much lower number of fish during a shorter window of operations than current operations. A supplement to the 1939 Chief's Report dated 22 May 1939 states that the Washington "*Department of Fisheries and the Department of Game state that there is an annual run of Chinook salmon occurring between April and July, a run of steelhead trout between March and July, and a run of sea trout in October. They estimate the number of fish in the annual run of salmon and steelhead varies between 2500 and 4000 each year.*" There is, however, a caveat which states that an actual count had never been made to that point so the numbers provided should be considered an approximation.

In recent decades, changes in the White River basin including installation of fish-friendly outlet works at MMD, increased minimum White River flow requirements at the Buckley Diversion, conservation hatchery programs, and installation of improved fish screening on CWA's diversion flume have resulted in improved conditions in the White River for resident and anadromous fish.

Today, anadromous and freshwater resident fish species are present in the river at virtually all times of the year; however, annual migration runs and subsequent the Corps operations at the facility primarily occur from March to November (Figure 3), although monitoring of the facility occurs essentially year-round. Species migrating during the winter months include steelhead, bull trout and coho salmon. Major runs include steelhead, spring and fall Chinook salmon, coho salmon, pink salmon, chum salmon, and bull trout. Fish species with ESA protection in the White River basin include fall and spring Chinook (listed 1998), steelhead (listed 2006), and bull trout (listed 1999). Puget Sound Coho is listed as a species of concern, and pink salmon are included with the others as protected, having certain habitat protections under the Magnuson-Stevens Act that requires consultation if Essential Fish Habitat may be affected.

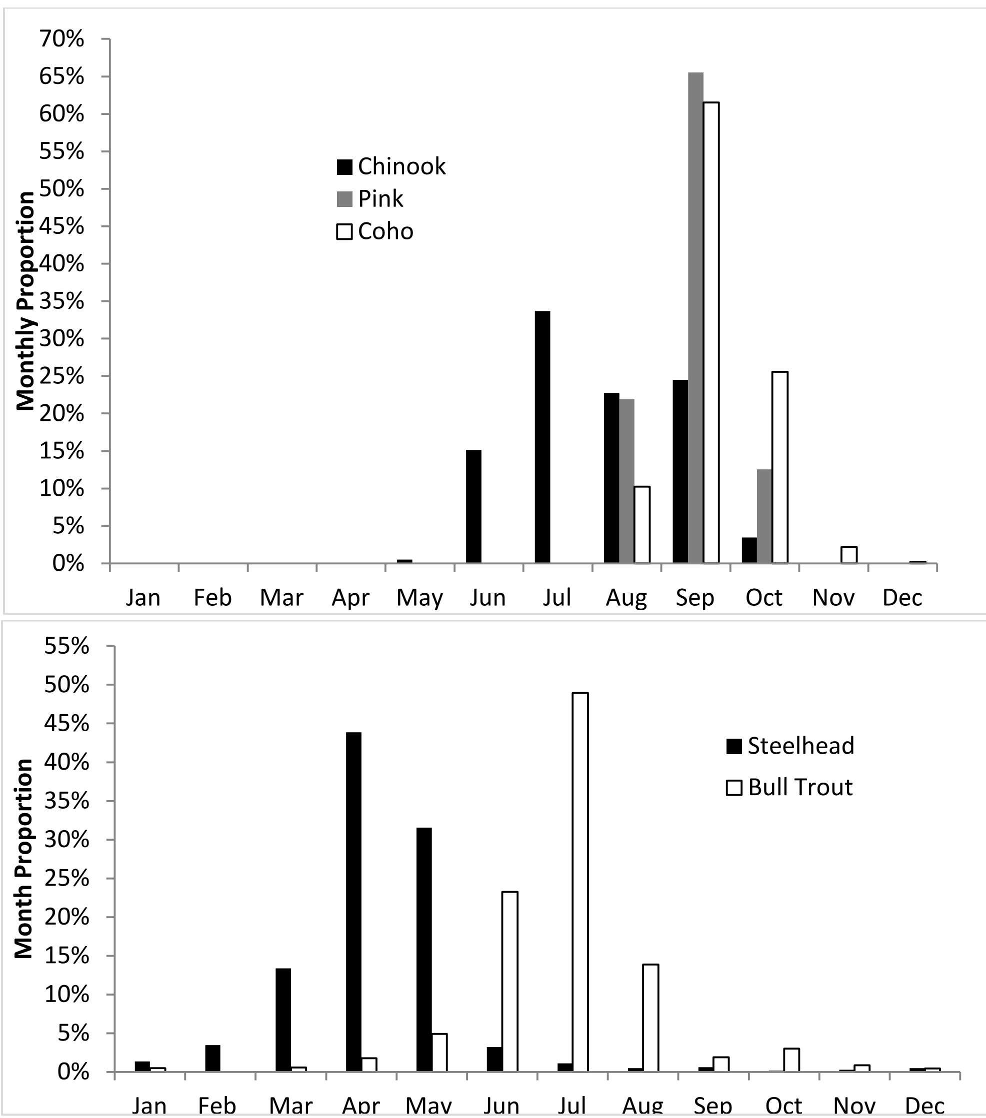


**Figure 3. Run timing of ESA-listed species and pink salmon collected at the MMD fish trap.**

In October 2014, the National Marine Fisheries Service (NMFS) provided a Final Biological Opinion (BiOp) with a Reasonable and Prudent Alternative Action (RPA) that mirrored the purpose and need of this EA: the construction of a new fishway and barrier structure for MMD. RPA Action Item 3 provided direction to replace the existing fish trap and barrier structure. The criteria for RPA Action Item 3 included recommendations for: (1) fish trap location, on which bank; (2) how to size the facility to handle current and future run numbers of ESA-listed and non-listed salmon (annual and daily transport capacity); (3) consideration of how to manage flows to attract fish; and (4) consideration of how to effectively pass river sediment and debris. The proposed action will also address the requirements outlined in RPA Action Item 3. In addition, NMFS also required as RPA Action Item 2 the completion of extensive interim repair to the barrier with replacement of the entire wooden apron with steel and concrete, which must be completed by summer 2015.

### 1.3.1 Existing Project Features

#### 1.3.1.1 Buckley Fish Trap-and-Haul Facility

Located six miles downstream of the Corps MMD on the White River near the town of Buckley, the fish trap-and-haul facility (Figure 4 and Figure 5) was constructed in 1941 and is owned and operated by Corps. The operational activity at the trap is primarily focused on upstream salmon migration and the fish trap is used to trap adult salmon, steelhead, bull trout and other migratory fish throughout the year. Fish are prevented from migrating beyond the fish trap by the presence of a barrier structure (further described below) co-located at the trap-and-haul facility which blocks passage upstream and directs attraction flows to the fish trap. At the trap, fish are collected, placed in a truck, transported around and upstream of MMD, and then released by unloading the fish onto a flume which conveys the fish directly into the river. Because MMD does not hold a standing pool of water outside of flood events, fish must be transported from the trap site and released into the river approximately five miles upstream of MMD at RM 35 where water surface elevations are more consistent and suitable for fish release. This method of fish passage is also known as trap-and-haul which is characteristic of the existing facility. Fish migrating downstream, (including out-migrating juvenile fish, adult salmonids and resident fish) are able to pass directly through MMD and over the Buckley barrier structure without assistance. Recent monitoring results of the 9-ft tunnel suggests that survival of juvenile fish that pass through the tunnel may be lower than expected, and operation of the two tunnels at MMD is managed as a conservation measure to optimize juvenile fish passage survival (NMFS BiOp 2014).

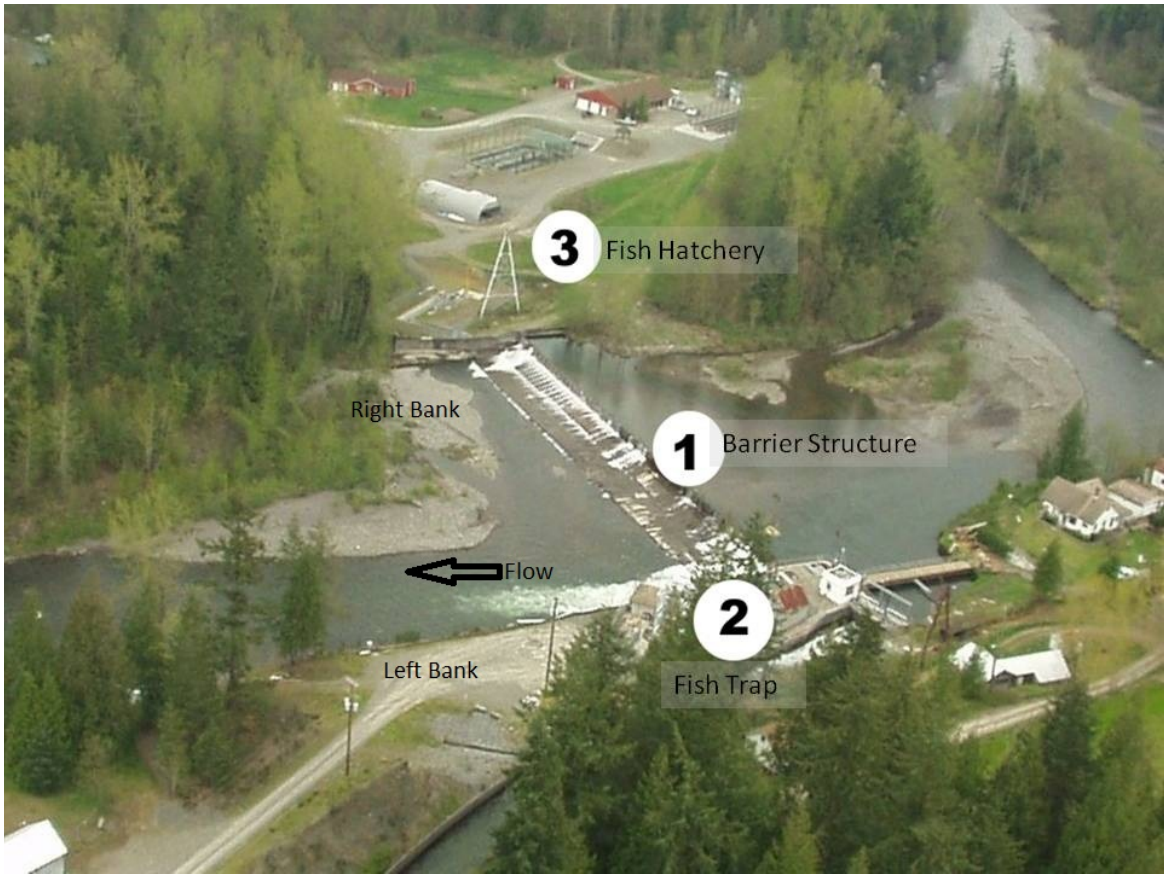


**Figure 4. Buckley fish trap-and-haul facility.**

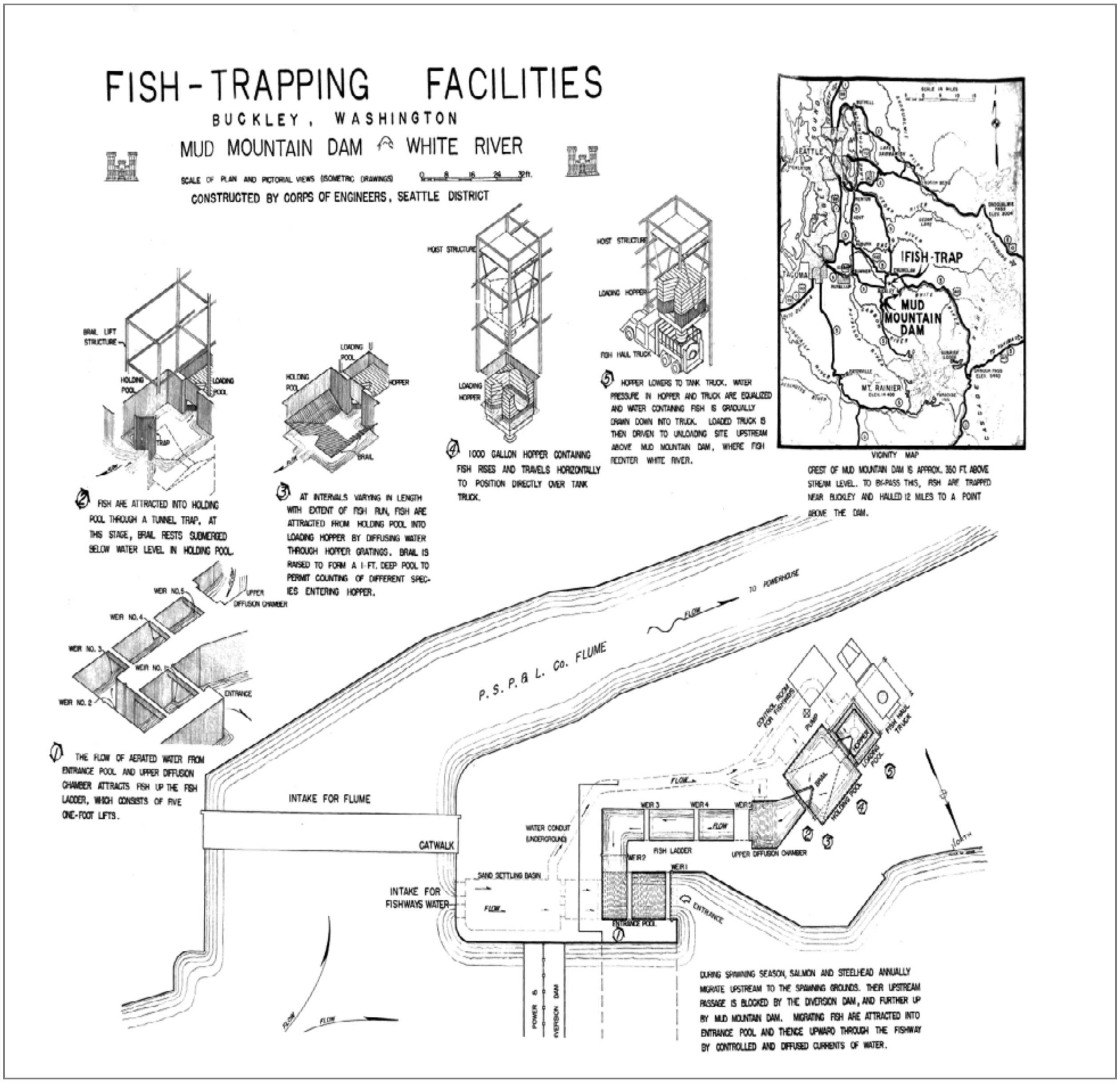


**Figure 5. Buckley fish trap-and-haul operations.**

As discussed above, when the fish passage facility was sited at the current location, fish passage operations considered passage of several thousand fish each year. In recent years, actual numbers of fish passed at the facility have exceeded this number by up to several orders of magnitude.

Concerns regarding ESA compliance have been compounded in recent years by returns of large numbers of non-listed fish, specifically pink salmon, which arrive in numbers beyond the fish trap capacity in odd numbered years (Figure 6). The capacity limitations of the fish trap combined with the large influx of fish over a short period of time results in delays in passage at the fish trap, increases in mortality, increased financial burden of operations, and has raised concerns of resource agencies and tribal interests. In 2007, there were approximately 128,000 pink salmon and 13,000 coho salmon that were transported from the current trap and haul facility to habitat above MMD. In 2011 the number of pink salmon transported had increased to 622,000 and coho salmon increased to approximately 24,000.

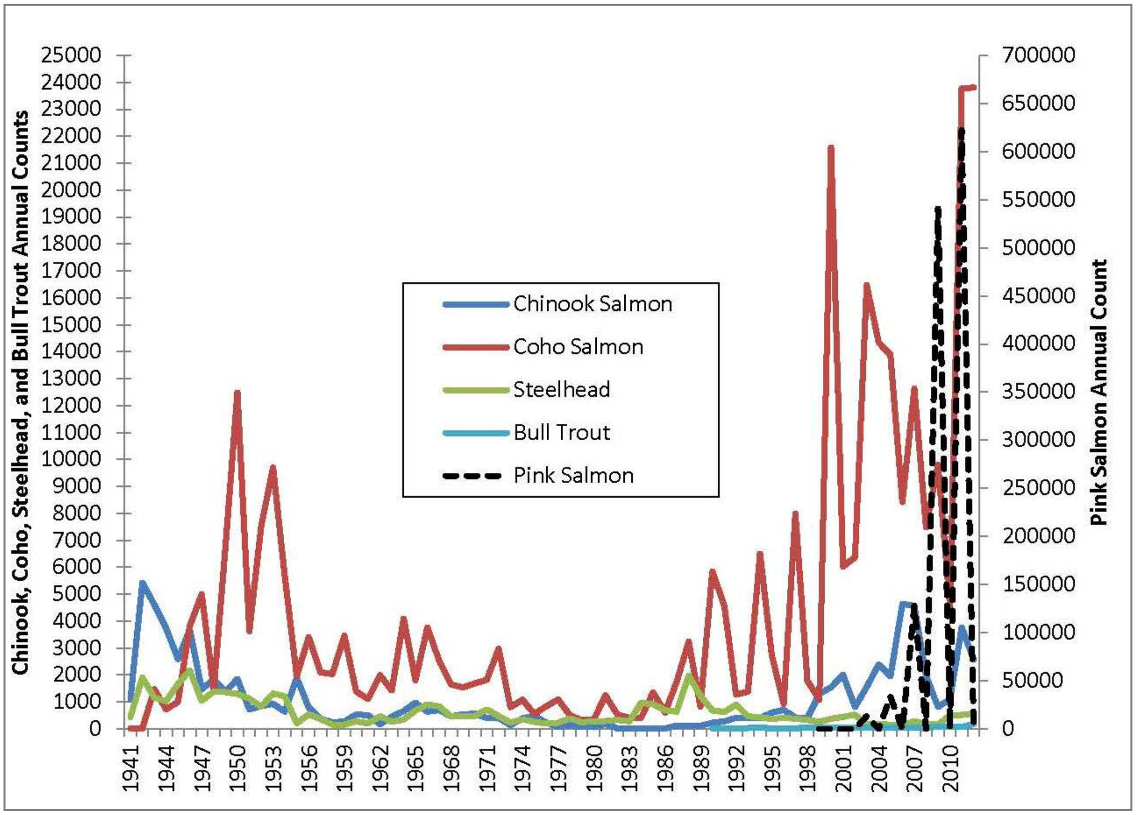


**Figure 6. Fish counts at Buckley, WA 1941-2012.**

### 1.3.1.2 Buckley Barrier Structure

The Buckley barrier structure (Figure 4 and Figure 7) was originally built between 1910 and 1912 by Puget Sound Power and Light (now PSE) to divert water to Lake Tapps for hydropower use, and is currently owned and operated by CWA for the purposes of municipal and industrial water supply (the hydropower project has been abandoned, see below). The structure is not listed in the National Inventory of Dams (NID) database but is consistently referred to as the "diversion dam" in historic documentation. As mentioned previously, for the purposes of this report, the structure will be referred to as the barrier structure or fish barrier structure. The presence of the barrier structure at the site provided a convenient location to co-locate fish trap-and-haul operations at the site given the need to block fish migration for the purposes of collection and transport (described in the Buckley Fish Passage Facility discussion above). Prior to integration between the Corps and PSE facilities, PSE owned and operated a fish ladder at the site to facilitate migration of fish species to the river reaches upstream. This fish ladder was demolished with the construction of the fish trap in order to repurpose the barrier structure as a migration barrier for the trap-and-haul operations.

The barrier structure consists of a concrete crib with timber and gravel inserts and 4-foot high flashboards installed on top of the crib structure to achieve an 11-foot overall height. While the barrier structure was designed by PSE to divert water to Lake Tapps, it was integrated by the Corps into the construction of the trap-and-haul facility with the addition of concrete abutments at each end. Since the construction of the fish trap in 1941, the barrier structure has provided a block to the upstream migration of fish and helps route them to the Corps fish trap for transport upstream. The barrier structure also provides a water level head differential that allows the trap-and-haul to operate with gravity flow as the source for attraction flows. Throughout the project life, the Corps relied on PSE to maintain the barrier structure as an integral part of Corps fish trap-and-haul operations to hydraulically manipulate the flows required for attraction, collection and to maintain an upstream migration barrier to route fish to the trap.

Although maintained over time by various entities, the barrier structure is now over 100 years old and has exceeded its design life, yet remains integral for fish trap-and-haul operations on the White River. The existing structure and the repair process to maintain structural function both present significant reliability issues for ensuring continued upstream fish passage. The existing crib structure is in a deteriorated condition beyond its expected project life. The timber flashboards of the barrier structure must be manually replaced following moderate to high river flows which has proven to be expensive, time consuming, as well as both a safety and environmental concern. Individual flashboards typically collapse in flows in excess of 4,000 to 6,000 cfs (Figure 7). At Buckley, 4,000 cfs corresponds to a 90 percent annual chance of exceedance or a 1.1-year flow frequency event and the boards are typically replaced at least once a year (Figure 8) and they may be replaced multiple times in one season depending on the magnitude of river flows. Periodic destruction of elements of the barrier structure from seasonal flows also means the barrier, and by proxy the fish trap, may not be functional when needed. Repairs to the barrier commonly require significant flow reductions on the White River from MMD over 29 miles of river, which has additional impacts on fish and the aquatic ecosystem.

Given the age and condition of the barrier structure, a future catastrophic failure is a major concern. The most likely failure scenario at the barrier structure would be from erosion of the superstructure (the barrier foundation) by water movement and bedload abrasion. The barrier structure flashboards are supported by a foundation consisting of a concrete crib with wooden and gravel inserts which incur damage and erosion from annual high flows. The river thalweg is located on the left side of the river, which carries the majority of the flow and bedload, and is also where most erosion is evident at the site. Erosion near the barrier is highest during floods, and especially during bedload movement, which initiates at flows over about 7,000 to 8,000 cfs (50 percent annual exceedance). While PSE formerly performed periodic repairs to the foundation, CWA does not currently perform foundation repairs under the agreement between CWA and the Corps. If left to continue to erode there will be no structural support under the flashboards, and the barrier will no longer function to serve as a barrier to fish migration or to provide adequate head differential necessary to generate attraction flows needed for the fish trap.

In 1983, PSE filed an application with the Federal Energy Regulatory Commission (FERC) for relicensing of the Lake Tapps Hydropower Project which included the White River diversion flume and replacement of the barrier structure. The White River diversion flume conveys water to Lake Tapps for hydropower and the barrier structure assisted in providing the necessary water to the diversion. Public opposition to the project was conveyed to FERC and included comments from resource agencies, tribes, and property owners. In 1997, FERC issued a license for the Lake Tapps Hydropower Project, which was followed by hearing requests from the Federal and state resource agencies as well as PSE. Between 1997 and 2003, PSE continued operation under a stay granted by FERC while developing a settlement agreement and completing ESA consultation. In November 2003, due to environmental and other concerns raised during their consultation process, PSE determined that pursuing the license was no longer a viable option and therefore abandoned operations and use of the barrier structure. PSE gave the Corps notice that operation of the barrier and hydropower facilities would cease at the end of the FERC-granted stay on January 14, 2004. In response to this action, PSE and the Corps entered into an interim operating agreement for the period of December 29, 2003 to September 30, 2005, under which the Corps would compensate PSE, subject to funding availability, to continue operation of the barrier structure, thereby ensuring adequate flows and operation of the Corps fish trap-and-haul facility. PSE subsequently transferred ownership of the facilities to CWA, a municipal and industrial (M&I) water supply consortium of local cities and water utilities which took over ownership of the existing barrier structure and all related PSE facilities, including water rights, on December 18, 2009. The Corps and CWA executed an operating agreement in 2010 to continue on-going maintenance of the barrier structure for the purposes fish trap-and-haul operations. The current agreement between the Corps and CWA expires in 2015 but may be terminated by either party with 60 days written notice. Maintenance is generally hired out to contractors working on behalf of CWA, and reimbursed by the Corps. The Corps currently pays the full cost of maintenance to CWA to keep the barrier structure functional for fish trap operations. However, although CWA continues to use the White River diversion flume to divert water into Lake Tapps, in a letter dated October 2012, CWA notified the Corps that they do not require the existing barrier in order to meet existing or future water supply requirements and may not be willing to continue to maintain the structure.

**Figure 7. Replacement of the flashboards at the barrier structure**

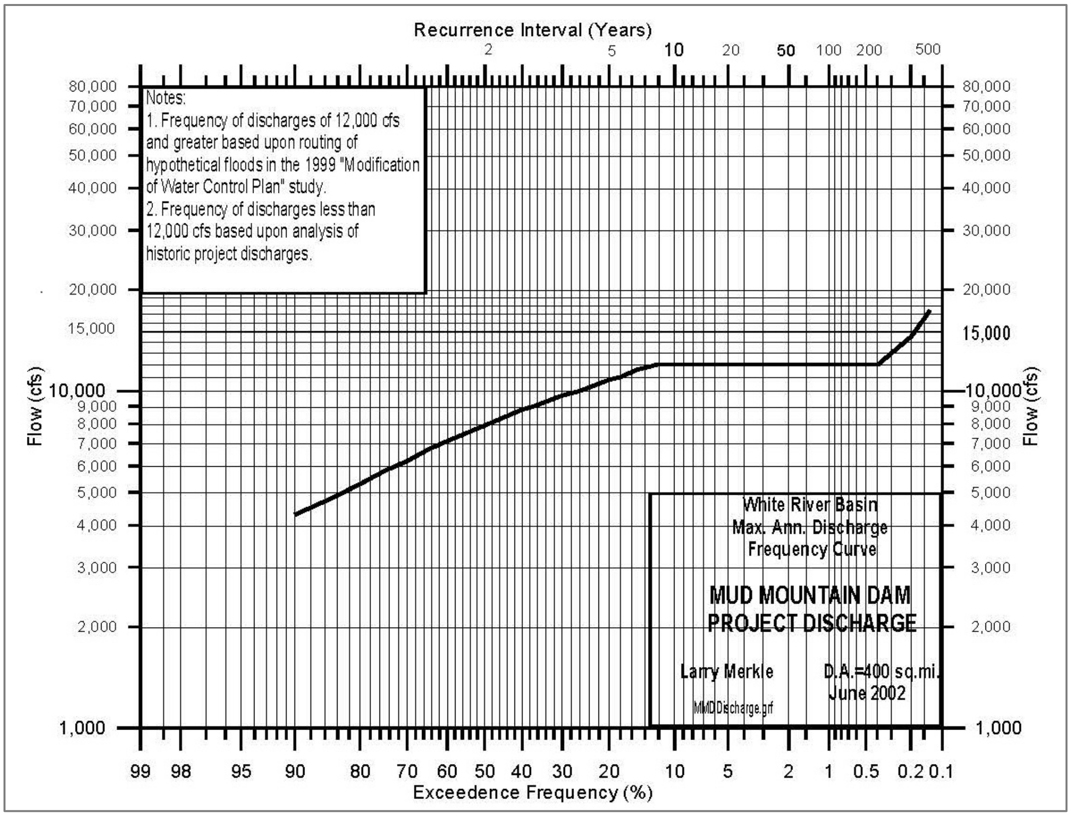


**Figure 8. Mud Mountain Dam Outflow Frequency Curve, Maximum annual Discharge, Buckley, WA (USACE).**

Once the flashboards collapse, coordination with the resource agencies must take place on the timing and method to replace the flashboards in order to minimize impacts to migrating salmon while ensuring that the flashboards are repaired in time to serve as a migration barrier and a water management feature for attraction flows at the trap entrance. Repairs can only be conducted during low flow conditions (500 cfs or less) and therefore must be coordinated with water managers who temporarily reduce outflow from MMD. In 2006, for example, high flows damaged the barrier flashboards in January, and Buckley project staff was not able to replace them until July. Given the overlap between salmon migration and typical low flow periods (April-October), dewatering the river via flow reduction at MMD has historically resulted in stranding and mortality for juvenile fish, including listed salmonids. In addition, flashboard failure creates gaps in the barrier structure that can result in an undesirable attraction flow for fish. This problem is compounded since the apron condition is extremely hazardous due to exposed metal spikes that physically harm fish and the presence of eroded pockets that can trap fish. Fish leap toward the flow, but due to the long distance from the downstream end of the apron and the top of the flashboards, most do not make it and fall back onto the apron and can become physically injured, killed, exhausted, or, at minimum, delayed in entering the trap-and-haul facility entrance.

The effects of sediment and flows from MMD (discussed above) can also be of significant concern to the Corps operations at the fish trap and present another recurring maintenance issue at the barrier structure. The large volume of sediment and bedload movement resulting from the glacial hydrologic inputs and the periodic storage evacuation at MMD cause operational and maintenance challenges associated with sediment accumulation at the barrier and fish trap facility. With the flashboards in place, bedload accumulates upstream of the barrier structure, which occasionally results in obstructions to the water intake of the fish trap. This reduces the reliability of the fish trap and increases maintenance costs. In order to pass the bedload, project personnel must coordinate the temporary removal of flashboards to allow the river flow to sluice the rock and gravel over the foundation of the barrier. High sediment flows and bed aggradation occur throughout the White River and are also a focus of a General Investigation Flood Risk Management study currently underway in the Puyallup River Basin.

Recent high flows have resulted in damage that has further weakened the barrier flash board support structure. Photos from 2011 (Figure 9) show some of the downstream apron timbers are missing; internal rebar is exposed, bent and eroded; and some erosion of concrete components is seen (note circle in Figure 9). More importantly erosion of the structure is seen around the flashboard anchor points. Between 2011 and 2012 another 8,000 cfs event occurred. Further, site investigations from the summer of 2012 show an increase in significant erosion have occurred near the flashboard anchor points.

**Figure 9. Erosion at the foundation of the barrier structure (2011)**

#### 1.3.1.3 Other Related Infrastructure

***Muckleshoot Indian Tribe, White River Hatchery***

The Muckleshoot Indian Tribe's White River Fish Hatchery is located on the right bank of the White River adjacent to the barrier structure and on lands formerly owned by PSE (i.e. the opposite bank from the Corps trap-and-haul facility, Figure 4). The hatchery was originally constructed by PSE and began operation in 1989, propagating White River spring Chinook salmon since its inception. It is currently owned and operated by the MIT. A fishway entrance/outlet slot to the hatchery is located on the right bank below the barrier structure. The entrance slot is designed to receive spawning Chinook salmon for hatchery use. The entrance slot is generally less efficient at attracting salmon than the Corps fish trap, although wild and hatchery fish are caught on both sides of the river. Hatchery bred Chinook captured at the Corps fish trap are identified individually through clipped fins and radio tags, separated by tribal representatives with nets by hand and transported to the hatchery by truck. Water for the hatchery is supplied by wells and a river intake located approximately 2,000 feet upstream of the barrier. The hatchery intake was upgraded with a new inlet structure, a pump station, and a levee during the mid 1990s. Currently, the fishway entrance/outlet is prone to blockage by bedload and requires that a channel be periodically dredged out to maintain the flow path and attraction flow.

The hatchery produces roughly 260,000 fingerling and 90,000 yearling Chinook each year. Fish raised at the hatchery are released to the White River system from holding ponds located on site or from acclimation ponds above MMD. While not a responsibility of the Corps, the facilities owned by MIT also benefit from the co-located facilities at the Buckley site. Similar to the Buckley fish trap-and-haul facility, operations at the MIT White River Hatchery are dependent on the barrier structure for effective operation. Adverse effects from barrier structure maintenance activities directly impact the migration of hatchery fish through flow reduction. Further, a catastrophic failure of the barrier structure would likely reduce the numbers of returning fish to the hatchery due to the reduction in attraction flow at the entrance.

#### *White River Diversion Flume*

A diversion flume, which transitions into a canal, located on the left bank upstream of the Buckley barrier structure (Figure 10) conveys a portion of the river flow from the White River to Lake Tapps. The flume was originally constructed for the purposes of developing a reservoir for hydropower; however, the flume is currently owned and operated by CWA for the purpose of municipal and industrial water supply. Midway down the canal, fish screens and a bypass prevent fish in the river from entering Lake Tapps and redirect the fish back into the White River.

Concurrent with its barrier structure maintenance, CWA performs maintenance at the entrance to the diversion flume which primarily consists of sediment removal from the intake and it is assumed that this maintenance will continue in the future. CWA utilizes the White River flume intake water withdrawal (up to 500 to 600 cfs withdrawal Feb. 15-June 30, up to 50 to 100 cfs the remainder of the year) and currently has rights to withdraw flow, based on the prior rights acquired by PSE. CWA's ability to access its existing water rights at the site constrains plan formulation for existing and future the Corps operations at the site. While CWA operates the intake for the diversion flume, in a letter dated October 2012, CWA notified the Corps that they do not require the existing barrier structure in order to meet existing or future water supply requirements through diversion.

#### *Lake Tapps*

Lake Tapps (Figure 10) is a highly valued recreational resource to local communities such as Auburn, Sumner and Bonney Lake. The lake is the receiving water body for in-flow from the White River diversion flume. The lake is surrounded primarily by private residential lands which are supported in value by their proximity to the lake. Lake Tapps also serves as a source-water for future water supply for the CWA. Prior to conveying its ownership to CWA, PSE utilized its waterworks at the outlet of Lake Tapps for hydropower purposes, supplied by water diverted from the White River via the diversion flume.

From Lake Tapps, water flows from the northwest end of the lake via existing penstocks, through the old PSE powerhouse and its tailrace, and back into the White River at RM 3.6 near Sumner. The hydropower facilities are no longer in operation, however, impediments to flow within the White River diversion flume such as sediment and debris aggradation at the Buckley barrier structure directly affect in-flows to the lake and water supply for CWA.

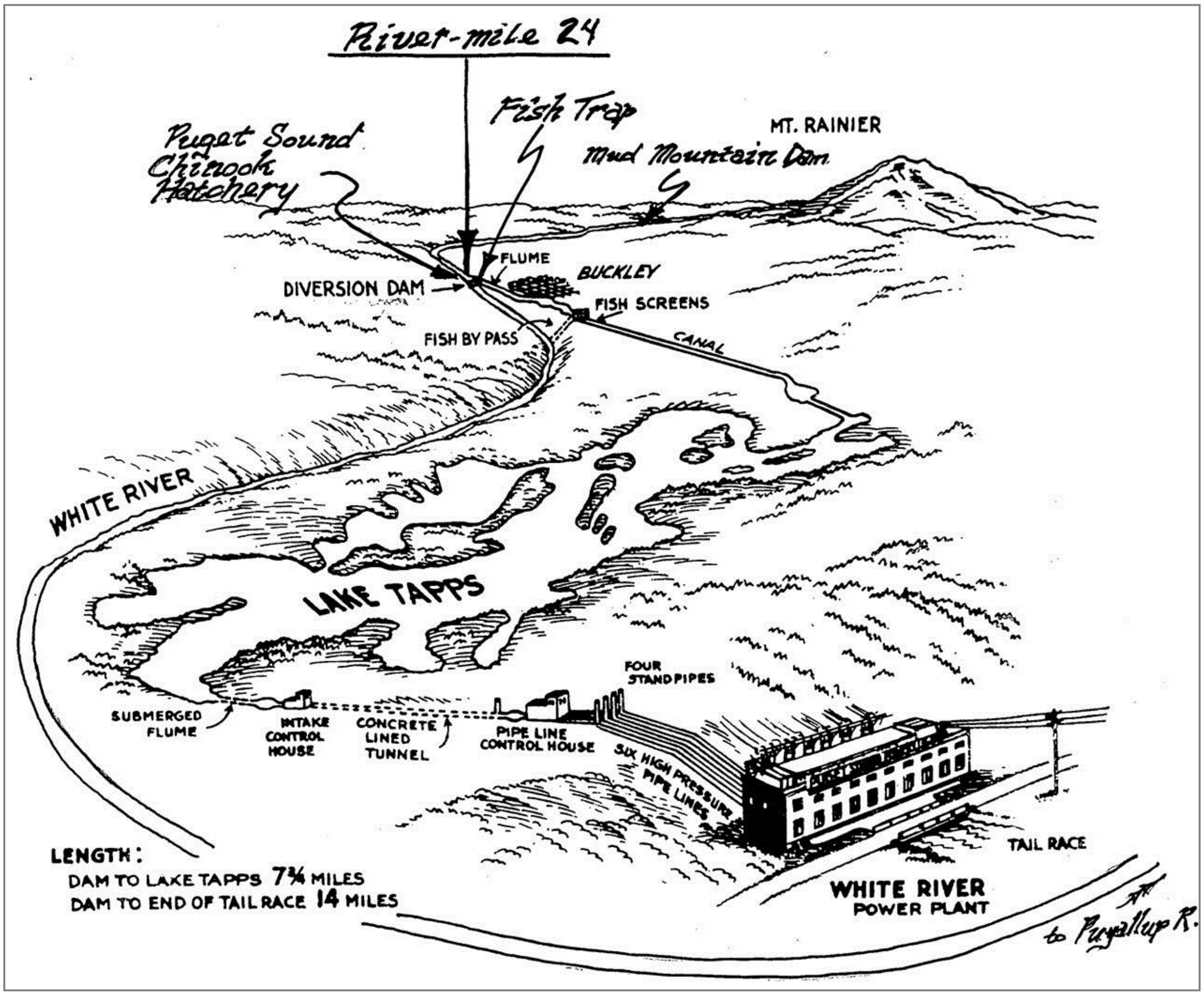


**Figure 10. Lake Tapps Hydrology and Hydropower (Puget Sound Energy)**

### 1.3.2 Project Purpose and Need

The purpose of the proposed action is to replace the existing fish trap and barrier structure, and upgrade the access roads to address issues with trap capacity, mortality to listed species, and safety. Both structures are showing signs of deterioration because of their advanced age and are not adequate for meeting the current mission of providing safe, effective, and timely upstream passage for migrating salmonids. In addition, the replacement is needed to comply with the NMFS BiOp RPA Action Item 3 .

### 1.3.3 Previous Planning Efforts

The Corps' investigation of the problems and opportunities regarding fish passage for the MMD fish passage facility initially began in 2002 with the intent of comprehensively addressing a host of issues related to upstream fish passage on the White River. This included both the problems related to the deterioration and maintenance burdens of the barrier structure (owned by PSE at the time) and occupational safety issues with transporting fish to the release site above MMD, as well as shortcomings encountered with capacity, efficiency, and effectiveness of passage of ESA-listed species at the current fish trap-and-haul facility.

Before the Corps investigation, plans for a new fish passage facility began with PSE design efforts in the early 1990s. The PSE planning and analysis included an integrated facility design combining the barrier and fish trap-and-haul under a single purpose for fish passage. Prior to this effort the two features were built separately and had been operated for distinct purposes; the PSE barrier was a diversion for water supply for hydropower but also functioned as a barrier to fish allowing salmon to find the MMD fish trap. PSE plans for such an integrated fish passage facility were ultimately provided to the Corps at the start of the federal planning process. The initial stages of the Corps' investigation coincided with the PSE abandonment of its FERC license and hydropower facilities at Lake Tapps. By September 2005, recognizing the importance of the barrier structure to ongoing operations, the Corps executed an agreement with PSE for maintenance of the barrier structure, thereby incurring a portion of the expense of its operation. In 2009, CWA obtained ownership of the entire White River Hydroelectric Project including the barrier structure from PSE as well as the associated water rights, thereby requiring the Corps to execute a new agreement with CWA for the ongoing maintenance of the barrier structure (the 2010 Cooperative Agreement).

Since transfer of the barrier structure from PSE to CWA in 2009, the barrier has been damaged by high flow events and has continued to deteriorate, with a resulting need for extensive emergency repairs. (Figure 11). The damage to the structure has resulted in continued harm to migrating adult salmon (Figure 12). In 2013 the Puyallup Tribe of Indians (PTI) and MIT reported that approximately 20 percent of the steelhead and Chinook salmon were injured or had died from jumping onto or against the barrier structure, including being impaled by sharp spikes on the apron. In summer 2014 CWA completed an emergency repair that included removing or flattening down the spikes. The BiOp RPA Action Item 2 requires a more extensive interim repair to the barrier with replacement of the entire wooden apron with steel and concrete, which the Corps plans to complete by summer 2015.

**Figure 11. Barrier structure repair, deterioration of apron**

**Figure 12. Injured Chinook salmon**

Concurrent with the fish passage investigation and the worsening conditions of the barrier, increasing numbers of pink salmon began to migrate to the Buckley trap-and-haul facilities, further straining the limited operational resources at this facility and reducing its effectiveness in transporting ESA-listed species. As originally designed, the Corps fish trap was planned to handle a few thousand salmon each year and that capacity was sufficient in most years to haul all fish collected at the trap. Starting in 2003, pink salmon, a species of salmon previously observed only rarely in the White River, began to arrive at the trap in increasing numbers, in odd-numbered years (Figure 13). In 2003, the Corps transported about 13,000 pink salmon. Numbers of pink salmon arriving at the trap has increased exponentially since then to 540,000 fish in 2009 and 622,000 in 2011. In the peak transport day of 2011, 20,000 pink salmon were collected and transported over a 24-hr period. Even with that level of effort, tribal and state agency biologists estimated that between 100,000 and 200,000 pink salmon were not collected in the trap during those years and those fish either died without spawning or spawned in areas with poor habitat downstream of the fish trap. This change in environmental conditions and limited capacity of the trap prompted further reconsideration of alternatives to meet the needs of the increasing numbers of fish arriving at the trap, particularly during odd-numbered years when pink salmon are present.

The Corps study was active intermittently from 2005 to 2014. In 2005 initial plans for a new fish passage facility were included in the first Biological Assessment (BA) submitted to the NMFS and USFWS. In response, the 2007 BiOps from NMFS and USFWS affirmed that the proposed fish passage facility would meet ESA requirements at that time for passing ESA-listed Chinook salmon, steelhead, and bull trout. In 2007 designs for a fish passage facility were developed to what was considered a 65% level of design (USACE 2008). Those plans had a design capacity for 30,000 salmon to be hauled in an entire year. The design included a barrier with two radial gates next to the left bank and a fixed spillway crest extending to the right bank where the MIT hatchery is located. In 2011 a physical model study of the design was completed for the Corps by AECOM (AECOM 2011) and by 2012 Tetra Tech had completed a 35% design plan for care and diversion of water for the Corps (Tetra Tech 2012).

In 2012 the Corps design team revisited the fishway design and began working with the tribes and state and federal agencies to develop a revised fish capacity requirement for the facility that could better accommodate the increased numbers of salmon that the Corps observed returning to the trap in 2009 and 2011. In 2013 project planning focused on replacing the barrier only, and the fish trap was eliminated as a study component due to funding and schedule concerns. The hinged crest weir concept included a series of six gates, four to pass normal flows and two to pass flood flows, with a barrier width of 280 ft. The hinged crest weir concept was included in the Corps 2013 BA that had been submitted in spring 2013 for which the response was the 2014 BiOp (See Appendix D). A new fish trap-and-haul facility was not included in the BA.

**Figure 13. Abundant pink salmon below barrier and trap, pink salmon being loaded into the hopper from the braille**

### 1.3.4 Current Plans

The following sections provide a brief overview of the key points of analysis undertaken during previous planning efforts and the current plans to meet RPA Action Item 3 requirements for replacement of the existing fishway and fish passage barrier.

#### 1.3.4.1 Facility Design Objectives

RPA Action Item 3 in the final NMFS BiOp had specific requirements for the fish trap and barrier performance. The requirements included criteria previously presented in the 2013 draft BiOp but also included additional criteria developed in 2014 during the Regional Design Team (see below for more detail on the Team) meetings.

The fishway, including the new fish barrier structure, upstream fishway, trap, sorting, haul, and release facilities must all be designed consistent with the guidelines in Anadromous Salmonid Passage Facility Design (NMFS 2011a). The primary purpose for the new fishway is to provide safe, timely, and effective fish passage over a wide range of conditions. The new fishway should also facilitate collection of broodstock for ESA-listed species for hatchery propagation at the MIT White River hatchery. The new facilities must meet the following passage performance criteria provided in RPA 3:

- 95 percent safe and timely attraction of adults to facility;
- 98 percent survival of adults through the facility to their release upstream of MMD;
- Design criteria to safely handle 1.25 million fish per year; and
- Transfer of up to 60,000 fish per day.

#### 1.3.4.2 Regional Design Team

The BiOp directed that the Corps must assemble an agency and Tribal design team (Regional Design Team) including members from the Corps, NMFS, USFWS, WDFW, MIT, PTI, and CWA to jointly develop the design of the upstream fish passage facilities. The team is working together collaboratively and coordinating on design decisions for the barrier structure, upstream fishway, and trap-and-haul facilities. The members of the design team had collaborated in developing biological criteria for facility design prior to receipt of the final NMFS BiOp.

To develop the biological criteria, a Regional Design Team was formed in summer 2014 (see section 2.2.1.2) and has continued with the same participants into the FY15 concept design team. Key points of the Regional Design Team discussions included 1) establishment of the maximum annual and daily number of salmon that must be transported; 2) fish attraction requirements for the trap and number and location of entrances; and 3) the sorting requirements for meeting the Corps ESA requirements, MIT hatchery requirements, and desired functions for fish manager sorting (USACE 2014c).

The team considered the recent increase in pink salmon runs both in the White River and adjacent rivers and determined that a probable maximum event (PME) of up to 1.25 million fish in a season with a peak rate of 60,000 fish per day for facility planning purposes. The current trap can pass up to 20,000 fish per day. However, the current trap causes pink salmon to stack up below the fish barrier which results in a significant migration delay for ESA-listed fish. A concept currently being explored is the possibility that when pink salmon abundance exceeds a certain volume then fish sorting would cease and all fish would be loaded directly into trucks. NMFS is aware that the Corps will utilize a threshold for sorting. Although that threshold number has not been fully defined, the Corps team will establish a reasonable value early in the design phase.

The team used the BiOp criteria that the facility must be designed to attract and collect 95% of the fish approaching the facility. Currently the concept design calls attraction flow from the fish trap entrance of 10% of the high design flow or 360 cfs (see Section 3.2.1), which is consistent with the BiOp attraction flow guidance of between 5% (180 cfs) and 10% (360 cfs) of the high design flow. In team discussions and final BiOp negotiations, it was considered desirable to have entrances on both the left and right bank. The right bank was selected as the location for the concept design fishway by the regional design team as outlined in Section 3.1.

The team developed biological criteria for sorting which included a conceptual lay-out for fish sorting for Corps requirements and a schematic for how fish managers could conduct finer scale sorting (Figure 1 in USACE 2014c). The Corps responsibilities were described as coarse sorting of fish to separate ESA listed from non-listed fish; identifying tagged fish; and providing fish to the MIT hatchery for broodstock, fishery management, and evaluation activities of the MIT hatchery for raising ESA-listed Chinook salmon. The Corps and NMFS indicated that the Corps would not be responsible for sorting fish beyond separating listed from non-listed fish and identifying PIT-tagged and coded-wire-tagged Chinook salmon and steelhead. However, the fishery co-managers indicated that higher level, fine scale, sorting is required. The NMFS 2014 BiOp states that “The facility will include the means for sampling marked fish and separating PS Chinook salmon for MIT hatchery broodstock use.” Construction of sorting/sampling facilities (to support research, monitoring and evaluation to ensure the facility meets BiOp criteria) would provide an incidental benefit to the MIT in support of their hatchery operations. Subsequent to the team meetings, in September and October 2014 the Corps and NMFS formed a hydraulics and hydrology (H&H)/Fish Biologist Working Group to develop concepts for a resized fish trap to handle the PME described in the BiOp including bank location and barrier type/configuration (Section 3.1).

A notable inclusion in the BiOp is that if the design team chooses a design with fishway entrances on one bank only, the attraction flows may need to be considerably higher and must be concurred with by NMFS. Currently, the concept design calls for 10% of the high design flow or 360 cfs with an attraction flow equal to 5% or 180 cfs and 10% or 360 cfs discussed in the BiOp.

Following receipt of the BiOp the regional team held a concept design workshop on October 30-31, 2014 to provide final direction to the Corps on recommended fishway location and remaining unresolved issues.

# 2 ALTERNATIVES

## 2.1 Alternate Fish Trap Facility Locations

A comprehensive assessment of full replacement of the fish trap-and-haul facilities was contemplated under the initial planning effort. The team investigated the locations suitability for fish passage below the MMD. Because of technical difficulties in implementing a new fish passage facility at these sites, and the limitations placed by RPA Action Item 3, these sites were not considered for detailed evaluation. These sites included the following.

### 2.1.1 Mud Mountain Dam (MMD)

Implementation of fish passage facilities directly at the dam is limited by the physical constraints of the site. The outlet of the dam discharges into a narrow canyon on the river which makes vertical access difficult and lateral access from the river banks impossible at high flows and turbulent conditions at the MMD site may result in very poor conditions for attracting fish under all but very low flow conditions. Due to the significant physical constraints at this site, this alternative was eliminated from detailed evaluation.

### 2.1.2 USGS Gaging Station Site

The gauging station (No. 12098500) site is located at river mile 28.8, upstream of the Buckley site, at the end of a narrow canyon, downstream of MMD. The gauging station site is relatively remote, and the access is through a heavily wooded section. The gauging station site is likely feasible from a technical standpoint, but construction would be more difficult in the narrow river channel. Access is limited to the right bank unless an extensive road is constructed down from an existing logging road to the left bank. One of the most significant concerns associated with this site is the construction of a third barrier on the White River. Impacts to wetlands are also significant at this location.

A facility at this location would require a barrier structure that is integrated with fish collection operations to provide storage water for fish trap operations and also serve as a barrier to fish migration upstream of the fish trap. Locating a trap-and-haul facility at this site would limit the barrier width to the relatively narrow mouth of the canyon and open up downstream reaches between the gauging station and Buckley site to fish spawning. A primitive access road currently extends to the right bank side of the site.

If the Corps closed the trap-and-haul facility at the Buckley site and terminated its existing agreement with CWA, reconstruction of the fish ladder or demolition of the existing barrier structure at the Buckley site would be required in order to facilitate passage to the new trap-and-haul location. Due to the significant technical constraints of constructing this site, this alternative was eliminated from detailed evaluation.

### 2.1.3 Other Locations Downstream of the Buckley Site

The Corps also considered the viability of other sites downstream of the existing barrier structure at Buckley for relocation of fish trap-and-haul operations. The team concluded that consideration of additional downstream locations was undesirable based on two factors. First, that relocating a barrier structure downstream would reduce the available aquatic habitat within the White River between MMD and any new barrier structure. Operation of any fish trap facility is dependent on a barrier structure which would block upstream migration in order to direct fish into the trap-and-haul facility. This barrier on the river would effectively block a larger portion of the river for fish migration which may eliminate important spawning areas. As an example, Boise Creek, located about 1 mile downstream of the existing barrier structure and is a very important tributary for salmonid spawning. Access would need to be maintained to any similar areas blocked due to the relocation of the barrier structure. Second, the complexity of the real estate ownership increases significantly downstream of Buckley as the river travels through the residential lands around Enumclaw and Lake Tapps before transitioning into the urban environments near the confluence with the Puyallup River at Sumner, WA. In addition, transportation (haul) costs would increase with any potential site downstream of the Buckley barrier. For these reasons, additional downstream locations were not further considered in the planning process.

## *2.2 Alternatives Development at the Buckley Site*

A series of meetings were conducted in June and July 2014 to develop biological and engineering design criteria for the fish passage facility and provide input to NMFS for finalizing details of RPA 3 for the BiOp. Meeting participants represented partner agencies and fulfilled the membership of a Regional Design Team as outlined in the draft BiOp (including the Corps, NMFS, USFWS, MIT, PTI, CWA, and WDFW), and also included private consultants representing MIT and CWA interests. Following the Regional Design Team meetings, the Corps and NMFS held a week-long H&H and biology workshop in September 2014 to develop conceptual alternatives for the primary facility features and important considerations for locating the fish trap as well as the barrier location and width. For this workshop, a federal team of regional fish passage and hydraulics experts were assembled from the Corps' Walla Walla, Portland, and Seattle Districts, and NMFS, to determine a workable solution to the upstream fish passage challenges (the H&H/Fish Biologist Working Group). Facility and feature development was based on best available information and professional judgment.

After the H&H/Fish Biologist Working Group workshop, and issuance of the BiOp, the Corps and partner agencies conducted a final workshop in late October 2014 to determine the project location (right or left bank) and key facility features.

Where available, parametric cost information from other fish passage projects was reviewed and scaled to fit proposed project features. In the absence of comparative cost or design information, Engineering Professional Judgment was used to select features. Additional data/information recommended for further design is discussed in Section 3.

Project partners were included throughout the concept design development providing either direct design input or review immediately after feature development. Additional refinement will be accomplished during the design phase.

The sections below describe the major features of the proposed project and the limited alternatives analysis that was used to select them. The Regional Design Team summarized the project conditions and challenges as unlike any other fish passage project they were aware of. The setting is a medium size river with a mean annual flow of about 1,550 cfs with a normally modest volume of fish to handle. However, every other year during a few months in the summer there is the potential for a very large pink salmon run that requires the facility to be designed to handle 60,000 fish a day, in contrast the original facility was designed for 4000 fish in a year. The other challenge is the high sediment load at the site. This presents additional design, construction, project risk and O&M considerations required to ensure the fish facility meets the objectives set forth for this project.

## 2.3 Fishway Location (Left bank vs. Right bank)

Fishway location, particularly with respect to entrance placement, is one of the most important fishway design considerations. Ideally, fishway entrances are placed at the upstream terminus of the waterway that is accessible to fish. This is the location that represents the upstream-most point fish can access relative to the barrier in question and it can be defined by the physical barrier itself or it may be defined by a hydraulic barrier (i.e. stream velocity, which may create whitewater) that prevents or inhibits fish from swimming to the actual barrier itself. The upstream terminus location can vary based on changing hydraulic conditions and/or fish species using the facility. Additionally, if there is a right or left bank migration preference this would factor into an entrance placement decision.

For the MMD fish passage facility, the right or left bank location issue was addressed by the H&H/Fish Biologist Working Group determined that, strictly from the standpoint of fish attraction and minimizing the risk of not meeting the 95 percent attraction criteria, an entrance on the left bank was preferable to a right bank location. However, this group also noted that an entrance on the right bank could also meet the 95 percent attraction criteria. The right bank was also expected to have enough available area to collect, load and transport 60,000 fish in one day. The group concluded that additional information was needed to determine if there was enough available area for processing fish on the left bank. Figure 14 shows the facility vicinity and the right bank location.

At a follow on workshop (October 2014) with the Regional Design Team and Corps staff from Structural, Geotechnical, Mechanical, Cost, Hazardous, Toxic, and Radioactive Waste (HTRW), and other represented disciplines, it was determined that there are less risk and fewer constraints in locating a facility on the right bank. A main consideration in choosing the right bank was the presence of contaminated area(s) on the left bank that would need to be disturbed to construct a new and larger left bank facility (further discussion in Section 2.5.4). This poses a major risk to the ultimate feasibility of a left bank location. Other considerations putting the left bank at a disadvantage are the RPA Action Item 3 December 2020 deadline for construction completion, a need to create temporary fish passage during construction, and higher operation and maintenance costs. The main disadvantage of a right bank facility is the higher risk of not meeting the 95 percent attraction criteria compared to the left bank. The factors that put the left bank at a disadvantage ultimately create a higher risk to the overall feasibility of a left bank facility when compared to the right bank. It was decided that the higher risk in fish attraction at the right bank can be mitigated during the detailed design phase.

***Fishway Flow Rate***

The BiOp and NMFS criteria states that the total ladder flow volume should generally be 5 to 10% of the high design flow of the river or 180 cfs to 360 cfs (NMFS 2011, Paragraph 4.2.2.3). For costing purposes, the regional design team assumed the fishway to be sized with a maximum flow rate of 360 cfs. This total would be from the flow in the ladder and the auxiliary water supply (AWS) system. The flow rate would be adjustable to provide adequate attraction under all conditions over the design flow range. The precise amount of attraction flow within the BiOp prescribed range of 180 cfs – 360 cfs will be further refined in the detailed design phase. The final decision will honor the two guiding principles of biological performance balanced with economic concerns.

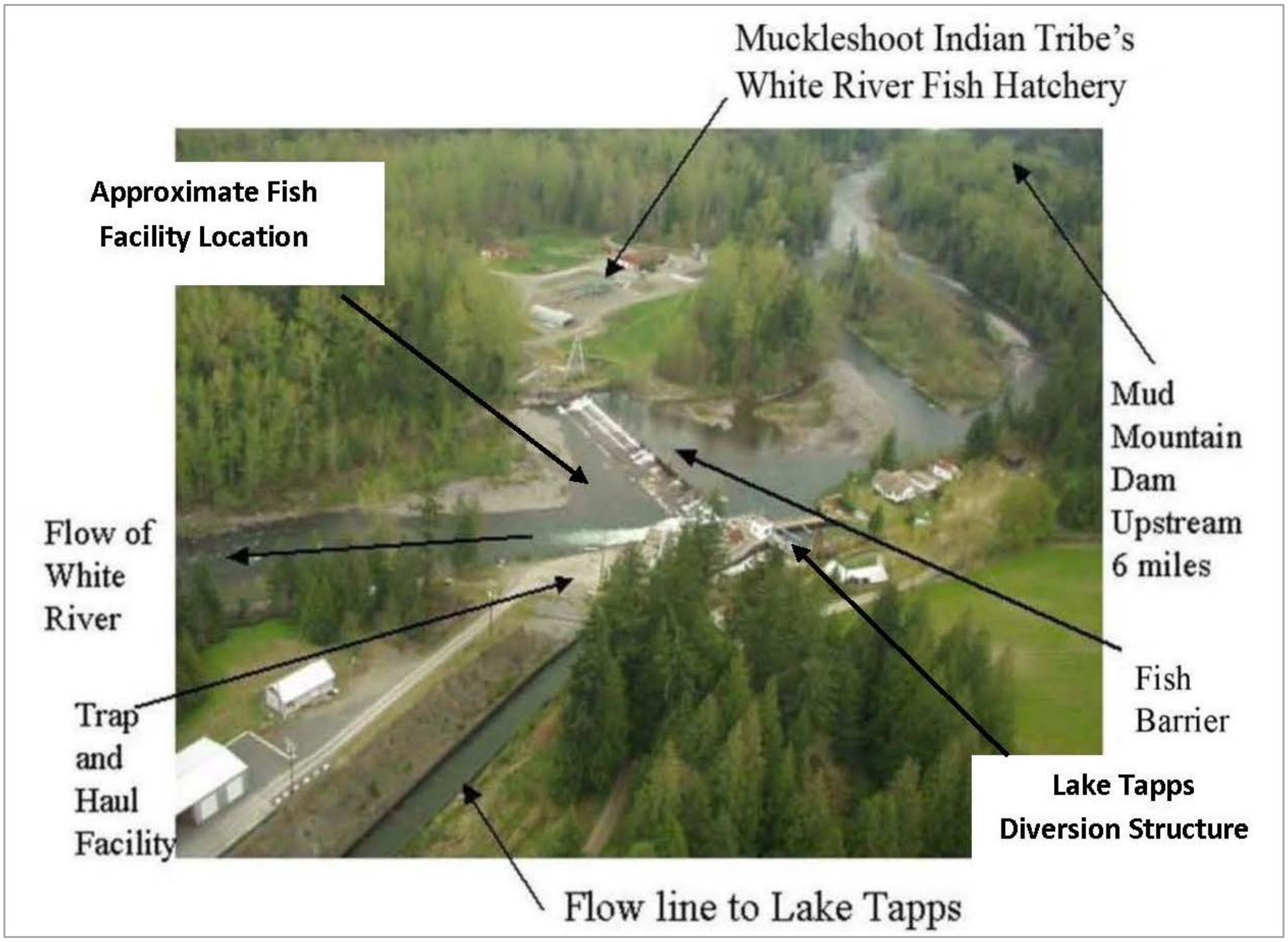


**Figure 14. Proposed Fish Facility/Barrier Location**

## *2.4 Design Features*

### 2.4.1 Fishway Features

The main features of the fish facility will include the entrance pool, the ladder, the water supply system, the pre-sort pool, and the truck loading/sorting/holding facilities. The H&H/Fish Biologist Working Group evaluated traditional fishway features but also considered some non-traditional alternatives to various facility components that may provide cost and fish throughput benefits.

#### 2.4.1.1 Fishway Entrance

The fishway entrance consists of the fish entrance pool and associated entrances and gates. Its function is to attract fish into the facility from the river. As such, its location, flow rate, and entrance geometry are of critical importance to meeting the 95 percent attraction criteria.

The pool is designed to function over the range of tailwater elevations occurring over the upper and lower design river flow values (high and low design flow). Based on a statistical analysis (per NMFS guidance) of daily average White River historical flow values, this flow range has been determined as 350 to 3,600 cfs. The 350 cfs represents the flow rate that could be expected to be exceeded 95 percent of the time throughout the year. The 3,600 cfs represents the flow rate that could be expected to be exceeded only 5 percent of the time throughout the year. The tailwater elevations corresponding to flow values of 350 and 3,600 cfs are elevations 658 and 662 feet, respectively. Figure 15 shows the flow-duration curve used in this analysis. Chapter 4 includes additional discussion/data regarding flow rates and river elevations.

The fishway will have an entrance for high and low flow conditions. The low flow entrance will include entrances(s) very near the barrier structure. The high flow entrance will include entrances(s) placed approximately 40 feet downstream to allow fish to access the facility under higher flows when conditions may not allow access to the low flow entrance near the barrier. The provision of two entrances is intended to accommodate the different swimming capabilities of the target fish species as well as different hydraulic conditions occurring over the design flow range. More detailed design analysis and/or hydraulic information could impact the number and placement of entrances.

#### 2.4.1.2 Fishway Ladder

The purpose of the fishway ladder is to allow fish entering the facility to overcome the elevation difference between the tailwater and the presort pool at the upper end of the ladder. The ladder would consist of six pools, each 24 feet wide, 10 feet long, and 6 feet deep. Pool size is based on the number of fish associated with PME of 60,000 fish per day. The weirs between pools are weir and orifice type known as an Ice Harbor type fishway. Per discussions with NMFS, the pool to pool design is 0.75 feet (with no need for variability). The flow rate required for this ladder configuration is approximately 65 cfs at the top with higher volumes at the bottom. Ladder flow is made up of flow from water introduced at the top as well as flow from the pre-sort pool(s). During higher river flow conditions the lower pools would be submerged requiring additional ladder flow to provide adequate attraction velocities in these pools.

#### 2.4.1.3 Pre-Sort Pools

The pre-sort pools (two are likely required to allow two hauling operations to occur simultaneously during peak runs) would be located at the upper end of the ladder and allow for short term fish holding and crowding to the transport/sorting/hopper system. The size of this portion of the facility is based on the 60,000 fish/day criteria.

The pre-sort pools would feature crowders to facilitate transfer to the sorting/loading facilities and V-Traps or other devices to keep fish in the pools. The details of this type of facility feature will be worked out in the detailed design phase.

#### 2.4.1.4 Water Supply

The bulk of the water supply for the facility is gravity fed from the forebay above the barrier structure. This system consists of a coarse trash rack, fine-screened intake, flow control, and stilling well(s) to dissipate excess energy. A system of diffusers to introduce water to the entrances, ladder pool(s) and pre-sort pools will be employed. Intake screens are sized/designed according to NMFS criteria taking into account the appropriate size juvenile fish present. The entrance and ladder diffusers are sized/designed according to NMFS criteria to ensure adequate conditions within the facility for continued fish attraction and safety. Trash racks/screens are fitted with a means of keeping them clear of debris. The intake and water supply design would be designed to not inhibit current MIT hatchery operations. This would be examined in later design efforts.

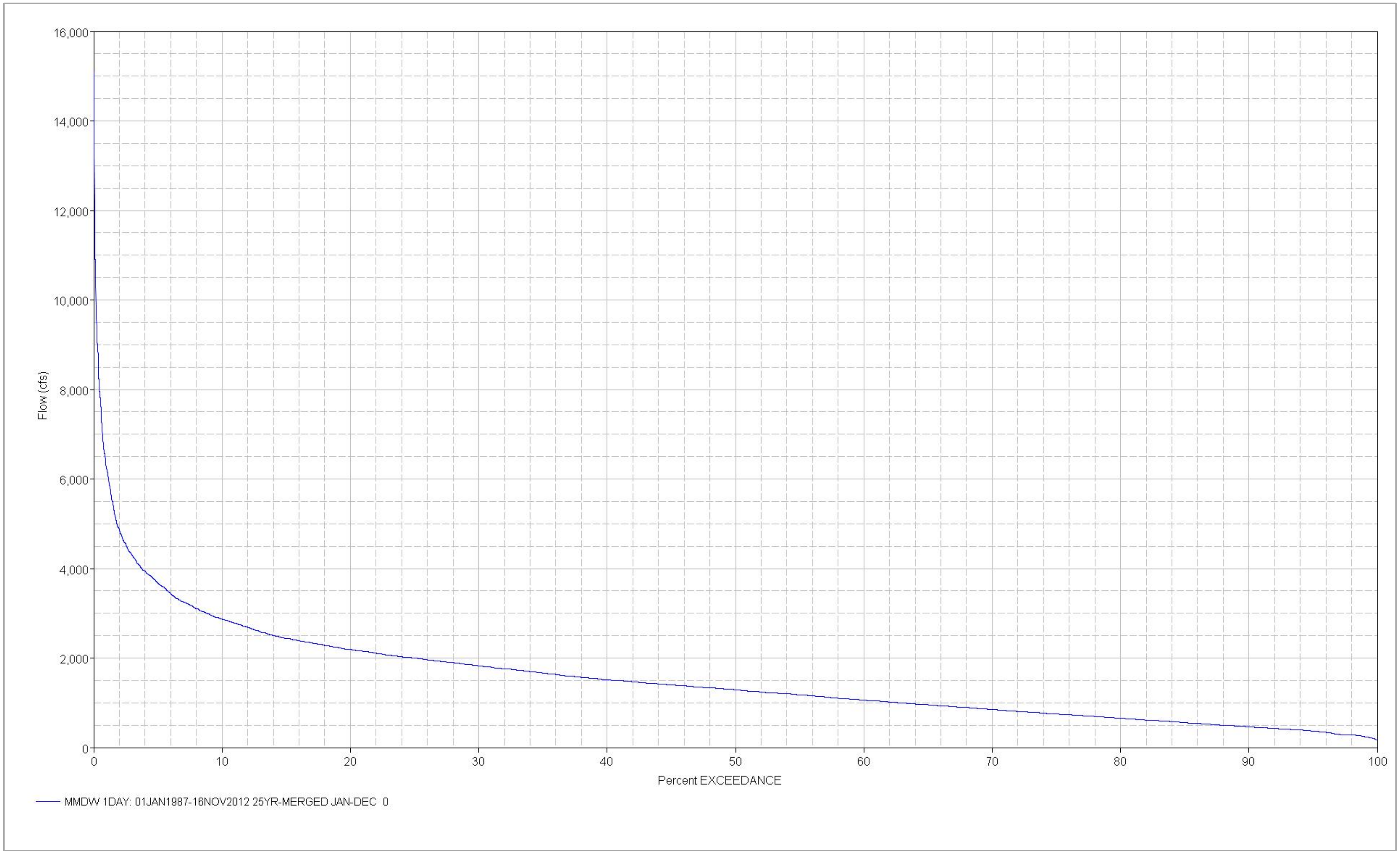


**Figure 15. White River near Buckley Flow-Duration Curve**

#### 2.4.1.5 Sorting, Holding, Loading, and Release Facilities

The last major component of the fish facility is the infrastructure that facilitates the sorting, holding, loading, and transportation of ESA listed and non-ESA protected fish and provides for hatchery broodstock collection for the MIT. The concept design is for fish to be lifted via hoppers to an overhead facility where they can be sorted, placed in holding pools, and loaded and transported. The H&H/Fish Biologist Working Group considered options for meeting the biological criteria discussed by the Regional Design Team in summer 2014. The features in this section include a brief discussion of alternative features that were considered for some functions (e.g., fish lifting equipment and truck loading).

***Sorting Area***

The primary objective in sorting fish is to pass ESA-listed species in a safe and timely manner and support MIT hatchery operation as a result of being located on the right bank. This will require coarse sorting by species and delivery of MIT hatchery fish to a required location. The NMFS BiOp has a requirement for the Corps to accurately separate out species and MIT hatchery fish, but also requires that the Tribes and fish agencies must have access to sample fish; the PTI currently conduct manual sampling at the existing trap. The NMFS BiOp also requires monitoring and adaptive management to ensure facility design and operation meets 95 percent attraction and 98 percent survival criteria. Details of the type of monitoring will be developed between NMFS and the Corps.

***Fish-lifting Equipment***

Since the fish ladder will only have 6-7 feet of vertical lift from the entrance pool to the pre-sort pool, a means to lift fish even higher for truck loading is required. Technologies such as hoppers, fish augers, and a vacuum pump system were evaluated by the H&H/Fish Biologist Working Group. Hoppers were chosen for this concept design due to their demonstrated ability to lift fish to the required height for this application (Figure 16 shows an example of a similar hopper, although the example does not show a secondary sorting area). Other technologies available at this time have not been proven on the scale required for this facility. Further evaluation of alternate lifting technologies may be warranted in the detailed design phase. A brief discussion of the hopper and fish auger alternatives follows.

***Hopper Loading, Delivery of Fish to Sorting Area, and Fish Auger***

The lifting of fish from the pre-sort pool to sorting and loading facilities is through the use of hoppers. Fish in the pre-sort pool(s) are crowded into a hopper and lifted to either a sorting area/pool or directly to a transport truck loading pool. A hopper has been the method of loading the fish truck at Buckley since project inception in 1948 (Figure 13 and Figure 17). The hopper full of fish is seated on the top of the truck and a hydraulic connection is established between the two. Once that is equalized the hopper door can be opened allowing the water to drain from the hopper into the truck. This design has been around a long time and has recently been employed at Corps facilities at Foster and Minto traps in the Willamette River basin. To pass 60,000 fish, larger fish-hauling trucks are needed; the current trucks each have 1200 gallon capacity and the proposed new trucks each have 4,500 gallon capacity (Figure 18).

In the concept developed by the H&H/Fish Biologist Working Group, each hopper lifts to a dedicated elevated secondary pre-sort pool with volume at least that of the hopper. A method for metering the fish out of the secondary pre-sort pool to sorting flumes, such as a Braille, needs to be developed during design. An important consideration during the detailed design phase is to determine the volume of fish at which sorting will cease and fish can be directly loaded into trucks. One method for direct loading might be via a braille or dewatering flume over the secondary pre-sort that directs fish to a loading flume. Fish would be metered out from the secondary pre-sort pool to sort flumes and directed to post-sort truck loading pools.

An alternative to hoppers is a fish auger, “pescalator”, a device recently developed that provides for volitional fish entry (rather than forced crowding) for vertical fish lift (Figure 19). Fish are captured by flights of the device at the base and then lifted both vertically and horizontally as the device rotates. Fish are spilled out of the top of the device and can be directed into a receiving tank, flume, or sort table. The device vendors (and some operators) claim that the fish do not get stressed by this means of conveyance. The constant metering of fish out of the top of the device is a great advantage when trying to integrate fish counting and sorting technologies and techniques. The disadvantages of this system are the throughput limit based on revolutions per minute, fish entry into the auger can be difficult (alternate entrance designs are available), design constraints (elevation gain, angles, associated structural supports), and uncertainty about performance. The technology was evaluated as an alternative due to the reported constant throughput, ability to integrate with sorting/counting, and reports of good fish safety. Data on fish conveyance rates for fish augers is a critical need if the fish auger alternative is investigated further. Though a handful of fish augers are being used (i.e., Nisqually River weir), there is virtually no literature (peer reviewed or grey) readily available on their performance or operation; therefore, and this alternative was not carried forward.

***Drive-Under-Loading***

Recently, adult-fish trapping facilities have been adopting drive under truck loading. In this design fish are held in post-sort holding pools which are elevated above truck loading areas. The bottom of each pool has a knife gate and mechanical system that is lowered in order to make the hydraulic connection with the truck. Then, much like the hopper, the pool and fish are drained into the truck. The speed, reliability, and superior holding for fish have made this the preferred truck loading technology for new adult-fish facilities.

The disadvantage is the fish and water must be elevated, or the loading bay for the truck must be excavated (or a combination of these elements). This can pose challenges both in constructability and water supply.

***Direct to Truck***

Elevated sorting facilities allow for fish to be sorted out of the sorting flume and directly loaded into the truck via a flume. Depending on the daily fish disposition this can greatly improve ease of operations and reduce fish stress. If the fish volume exceeds pragmatic efforts to sort, certain fish conveyance technologies such as fish augers and fish pumps could be used in direct to truck loading. Both of these options should be considered in the design.

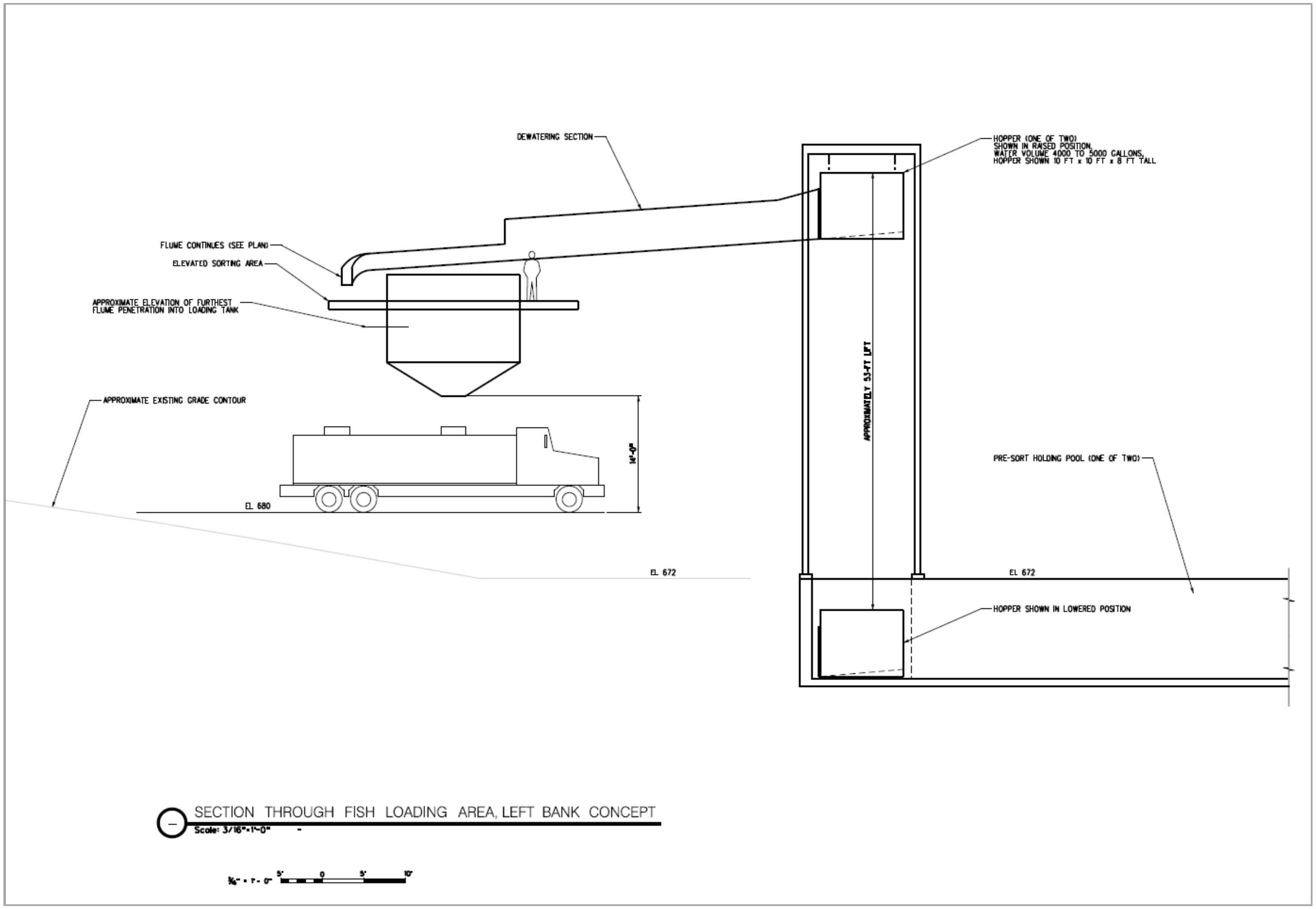


**Figure 16. Fish Lifting Schematic for Hopper (this example does not include a secondary sorting area as described in text)**


**Figure 17. Truck in position awaiting hopper being moved over truck for loading fish, and hopper being loaded into truck (top two photos); truck parked at fish release flume and salmon passed through chute to river (bottom two photos)**


**Figure 18. Example of current truck size (1,200 gallon) for fish hauling (top) at MMD and future size (4,500 gallon) for new fish passage facility (bottom, example size from a water truck)**

**Figure 19. Example of fish auger used to collect wild salmon on the Nisqually River. The auger includes an entrance that fish swim into (bottom photo)**

***Fish Release***

After upstream transport, fish must be released in a safe location with good water quality. The fish release site for MMD has been at the same river location since operation began in 1948 (Figure 2). The site lies within the uppermost portion of the inundation zone on Corps-owned lands. At exceptionally high flood pool the river is backwatered up to the release site. The location is sited on a stable portion of the river allowing a predictable release location with sufficient depth where fish can be safely released into the river. The route from the main road down to the release point is on a fairly steep and narrow one-lane road, which limits the number of truck trips during the peak pink salmon season. Other release locations have been investigated upstream of the existing site; however, the White River area is relatively undeveloped and the river channel is very active river channel so there are very few locations with road access to the river bank. Two other locations investigated were dropped from consideration after it was discovered that they were in areas that had unstable sections of the river. The concept design includes widening of the road and creating additional area for truck turnaround at the river for accommodating more than one truck.

The existing fish release area uses a single fish chute sized for 1200-gallon trucks, and a single graveled back-in area with a wooden crib wall. The site also includes a more primitive spare chute which has not been used. The new release site will include repairs to the exiting chute and a construction of a second chute for 4500-gallon trucks.

### 2.4.2 Fish barrier structure configuration

The existing barrier structure is approximately 352 feet wide and is comprised of a series of side-by-side flashboards that create the backwater for operation of the CWA  Lake Tapps Diversion and the water supply for the Corps fish facility on the left bank. The structure also serves as a physical barrier to upstream migrating adult fish, keeping them out of the river reach between the barrier and Mud Mountain Dam. While three steel-sheet flashboards on either side of the structure adjacent to the abutments can be pulled out when needed, the other (timber) flashboards stay in place until river flows are high enough to cause their failure. There is currently no way to purposefully manipulate flow over the width of the barrier to manage bedload. Bedload management is critical to proper operation of the fish trap. The existing barrier requires a minimum of one annual in-water work period to repair the barrier and remove sediment/bedload/debris build-up. Additional emergency in-water work periods are not uncommon. The concept design virtually eliminates the need for in-water work which is costly, environmentally destructive and unsafe.

In the past, PSE managed bedload sediment arriving at the point of diversion to minimize its deposition in front of the headgates and entry into the flowline by partially raising, or fully removing, one or more of the six steel-sheet flashboards located on the far left side of the barrier structure, immediately adjacent to the Lake Tapps Diversion intake. In doing so, PSE would allow a significant portion of the bedload sediment arriving at the barrier structure to stay in the White River and continue downstream. Following CWA's acquisition of the hydroelectric project including the diversion structure from PSE, CWA continued this method of managing sediment and debris.

Replacing failed timber flashboards on the existing barrier when they are displaced by high river flows requires in-river work, which can only be accomplished if the Corps manages White River flows at Mud Mountain Dam, reducing flows to very low levels to allow in-water work. This drawback has been considered in previous replacement barrier preliminary designs as well as the current concept design. Elimination of the need for in-river work and associated river-flow management in the future is a fundamental goal of the replacement barrier structure design criteria. Designs for replacement structures have been investigated in the early 1990s, the 2005-2008 timeframe, and 2013. All these replacement preliminary designs included a system of operable gates to manipulate flow spatially through the structure for effective management of sediment, cobble, large woody debris, and flow. The revised 2013 concept for barrier replacement recommended a series of six moveable hinged crest gates (USACE 2014a). Hinged crest gates are hinged at their base, so they can be “laid down” to lower the crest.

The H&H/Fish Biologist Working Group recommended narrowing the barrier to approximately 200 feet in width and providing a series of gates all along the width (as in the 2013 barrier design) to provide better sediment transport conditions through the site. Two hundred feet is the approximate width of the river channel upstream and downstream of the barrier site. Keeping the barrier width consistent with the channel width ensures material can move past the structure at approximately the same rate it does upstream and downstream (in the gate-open or “laid down” condition). Having a wider barrier causes conditions conducive to bedload accumulation in the vicinity of the barrier. A 200-foot wide barrier would also create a more compact tailwater area, making a right bank facility viable by allowing the entrance to be closer to the river thalweg, which is on the left side of the river and is where most fish are thought to approach the barrier.

The current concept design uses the H&H/Fish Biologist Working Group’s narrow-barrier recommendation and incorporates the previous hinged crest gate concept with four, 50-foot wide, hinged crest gates. Under normal conditions, the gates would be operated to maintain a forebay elevation of approximately 672 feet. This would provide at least 10 feet of water surface differential, which would meet NMFS physical barrier criteria and ensure enough head for gravity-fed water supply to the fish facility. During high flows, or if sediment management is required at the site, gate operation would create hydraulic conditions that would allow for the flushing or prevention of accumulation of sediment (sands, fine grained material), bedload (cobbles), and/or debris at the barrier, the Lake Tapps Diversion, and the fish facility. The barrier will also incorporate a concrete scour-protection apron downstream of the gates and riprap scour protection downstream of the apron.

The proposed conceptual barrier design is based on hinged crest gates with piers between gates and an access bridge across the top to facilitate maintenance and mechanical debris removal. The H&H/Fish Biologist Working Group recommended investigation of an inflatable weir system without piers as an alternative to the hinged-crest configuration. The hinged-crest weir was determined to be suitable for use in this river system but other barrier gate configurations (e.g. inflatable weirs, radial gates, etc.) may prove useful as more information becomes available (e.g., physical modeling).

### 2.4.3 Levee Improvements

The current levee on the right bank protects the MIT White River Fish Hatchery from flooding. The upper section of the levee was upgraded as part of the hatchery water supply pump station improvements. The lower section has required sandbagging to prevent flooding in the past. The intent of levee improvements would be to maintain the existing level of protection on the right bank and avoid induced flooding resulting from the proposed barrier. Water surface elevations during construction may be higher than those after construction of the proposed barrier. This scenario will require analysis to plan the care and diversion of water during construction.

### 2.4.4 Access Improvements at Fish Trap and Fish Release

#### 2.4.4.1 Fish Trap Access

The new fish trap-and-haul facility would be accessed through MIT property and would utilize the existing gravel access road. The existing road varies in width with portions as narrow as 19 feet and grades up to 9% and is bordered by a wetland with a crossing just beyond the downhill end of the retaining wall. Storm drainage features and improvements at the wetland crossing would be required. The proposed road section would consist of two 11-foot drive lanes, gravel shoulders, and a dedicated pedestrian walkway with a guardrail separating it from the roadway to address additional traffic generated by the project and tribal safety concerns. Noise, dust, and rapid road degradation under necessary trucking requires paving.

An existing ecology-block retaining wall separates the existing road from SE Mud Mountain Road. A short portion of this retaining wall may need to be realigned to accommodate the wider road section.

#### 2.4.4.2 Fish Release Access

The existing access road to the fish release site is approximately 2 miles upstream of SE Mud Mountain Dam Road and is located along Washington State Route 410. The existing gravel road ranges in width from 12 feet to a maximum of 18 feet in some locations and runs a total length of 6,900 feet. The existing roadway does not include safety measures such as vehicle turnouts or guardrails. The slope of the road steadily increases from a 2 percent slope to a maximum of approximately 9 percent after 3,200 lineal feet and to 9 percent again at 4,400 lineal feet. The uphill slope at the first 9 percent grade stretch of road is 1H:2V. At the second 9 percent grade stretch of road, the existing uphill slope is 1H:1V. The downhill slopes at both stretches are generally less steep. There is a 5 percent slope along two stretches, one is 200 feet long with a 60 degree turn and another is 300 feet long with a 70 degree curve and is approached by a 7 percent grade. The final 1,100 feet of road is relatively straight and flat with a slight slope (3 percent) near the far end leading up to the fish release area.

## *2.5 Design Considerations*

### 2.5.1 Care and Diversion of Water

The care and diversion of water would require three different phases and involve constructing temporary cofferdams to facilitate construction of project features. While different phasing approaches were looked at, only one met the requirements of the project. The selected phasing approach would have a left bank cofferdam to facilitate construction of the left three bays of the barrier structure (Phase 1), a right bank cofferdam to facilitate construction of the right side of the barrier and the training wall protecting the fish facility (Phase 2) and then the construction of the fish facility itself (Phase 3). This sequencing provides for the most efficient construction schedule. For the Phase 1 condition, flow would be restricted to a 150-foot wide section of the existing barrier invert. For Phase 2, river flow would be restricted to the first three bays of the new barrier. For Phase 3, the entire new barrier would be available to pass river flow. Due to the restriction of the river, it is anticipated that the lower 500 to 1,000 feet of the existing levee on the right bank may need to be raised.

The current conceptual schedule is not developed to the degree necessary to indentify all periods of in-water water. The normal in-water work window of July 15-August 31 is considered insufficient to conduct a year-round construction schedule in the river. Even the repair of the existing barrier has resulted in frequent periods of work during January-March. The phasing of the project will result in periods of work outside the normal window most likely during fall and winter. The periods of in-water work outside the normal window will be scheduled to the greatest extent possible during low abundance periods for salmon and trout that are collected at the trap. The need for work outside the window has been coordinated with agencies and was part of the ESA consultation with NMFS and USFWS. Input from these groups will continue during the detailed design phase.

Various cofferdam types (e.g. earthen berm, supersacks, standard sheet pile) were considered in this concept design. Several were rejected due to site constraints. A design with a fillable concrete box structure was developed by Tetra Tech in 2012. This cofferdam style was determined to be most appropriate for this project given the space restrictions and inability to drive sheet piles or soldier piles.

During construction, temporary features would be designed to accommodate a river flow of 8,000 cfs. Various design flows for the care and diversion of water were considered based on risk and consequences. Flows at the project site are regulated by Mud Mountain Dam. Due to the MMD deviation request and the project’s ability to temporarily store water, it is expected that an 8,000 cfs flow rate would not be exceeded up through a 20 year or 30 year return interval event. Preliminary hydraulic modeling indicates that with the proposed care and diversion of water features, forebay water surfaces at 8,000 cfs are about elevation 673 feet which appears to be a manageable level. However, it is possible that a large flood event could occur requiring releases from MMD in excess of 8,000 cfs. Higher flows could have impacts on construction and surrounding infrastructure. Measures to deal with flows above 8,000 cfs would need to be developed in the detailed design phase. For context, assuming that MMD can regulate flows at the site to no more than 8,000 cfs for flood events up to approximately a 20-year return interval, there would be a 5% chance that flows would exceed 8,000 cfs during any given year.

### 2.5.2 Sediment Load Considerations

The White River carries a large sediment load due to its source being the glacial slopes of Mt. Rainier. The sediment load is estimated at approximately 500,000 tons per year and consists of suspended sediment, which are silts and fine sands, as well as larger bedload estimated at approximately 20,000 tons per year that consists of coarse sands, gravels, cobbles and small boulders (Dunn, 1986). At the barrier structure and fishway site, bedload deposition can be problematic, impacting the ability to divert water into the CWA intake and the Corps fishway water supply intake. Bedload deposition can also impact the fishway entrances into both the Corps fishway and the MIT fishway. Dealing with adverse bedload sediment and floating debris deposition with the existing barrier structure most often requires in-river work coupled with temporary flow regulation/storage by the Corps at MMD to remove bedload and debris after they have accumulated. The proposed concept design is intended to provide a new, gated barrier structure configuration that deals with this issue by allowing for manipulation of flow over the entire structure width to allow real time management of bedload (i.e., prevention of accumulation) rather than post-accumulation management. The new design would incorporate features that allow operators to ensure acceptable conditions are maintained at the CWA intake, the new Corps fish facility water supply intake, and the new Corps fishway entrances.

Within the fish facility, deposition of suspended sediment is an issue. Diffuser wells, ladder pools, and holding areas may have conditions that allow for the settling of suspended sediment. The facility needs to be designed with features that allow for suspended-sediment management. Some small portion of the facility water supply (maybe 5 to 10 cfs) may need to be pumped to support truck loading, flumes, etc. A high sediment load environment is not conducive to long pump life. Pumps and other equipment required for the facility need to be designed for this type of environment.

### 2.5.3 Cascade Water Alliance and Muckleshoot Indian Tribe.

#### 2.5.3.1 Cascade Water Alliance

Originally constructed and placed into service in 1910, the White River diversion dam and intake was capable of diverting up to 2,000 cfs into an 8-mile-long flowline that conveyed the diverted waters into Lake Tapps Reservoir. Water was withdrawn from the Reservoir and run through a powerhouse located on the White River to generate electricity for the growing City of Seattle. Hydroelectric power generation ceased in 2004 at the decision of PSE.

The Lake Tapps Diversion (flowline) intake is located on the left bank of the river immediately upstream of the barrier structure. In 2009, CWA purchased essentially the entire retired WRHP from PSE (including associated water rights) for use in creating a future regional water supply for central Puget Sound. Until the new regional water supply is placed into service, CWA is operating the diversion, intake, flowline, fish screens, Lake Tapps Reservoir, and reservoir outlet works to the benefit of fish, while maintaining water surface elevations in Lake Tapps Reservoir at agreed to recreational water surface elevations, on an ongoing basis. The shoreline and area surrounding Lake Tapps Reservoir has a high density of valuable residential housing overlooking and accessing Lake Tapps which is one of the most utilized and visited recreational lakes in the State of Washington.

Sediment deposition within the upper end of the flowline is periodically removed to maintain the hydraulic capacity of the flowline. Sediment removal is typically performed concurrent with the resetting of the flashboard on the barrier structure. CWA utilizes the flowline intake to withdraw water at flow rates up to 1,000 cfs maximum for Lake refill each Spring. The water rights contain maximum diversion limits throughout the year. Typical allowed diversion flows outside the Spring Refill period are currently 100 – 150 cfs. CWA notified the Corps by letter in 2012 that they do not require the existing barrier structure in order to meet diversion requirements for existing or future water supply operations. The ability of CWA to continue to exercise their existing water rights at the permitted point of diversion is included in the planning for the new barrier structure. These water rights contain specific requirements for the barrier structure for both:

- Minimum flows that need to be maintained in the White River at all times, by season, immediately downstream of the barrier structure.
- Maximum ramping rates (in inches per hour , for both upramping and downramping) of flows in the river as affected by diversions from the river coupled with the operation of barrier structure gates that affect the water surface elevation in the White River immediately downstream of the barrier structure.

#### 2.5.3.2 Muckleshoot Indian Tribe

The Muckleshoot Indian Tribe (MIT) White River Fish Hatchery is located on lands formerly owned by PSE located on the right bank of the White River (the opposite bank from the existing Corps trap-and-haul facility, as shown in Figure 4), adjacent to the barrier structure. The Muckleshoot Indian Reservation is located 9 miles downstream, and tribal members have treaty fishing rights in the river reserved by the treaties of Point Elliott and Medicine Creek. The hatchery was originally constructed by PSE as part of a hydropower settlement with MIT and began operation in 1989, propagating White River spring Chinook salmon since its inception and steelhead beginning in 2007, both listed as Threatened under the ESA. It is currently owned and operated by the MIT for the purpose of rebuilding native fish runs in the White River, and ultimately to restore significant treaty fishing opportunity. The hatchery spring Chinook are part of the Puget Sound Chinook ESA listing. NMFS has determined that White River spring Chinook are essential for the recovery of the Puget Sound Chinook Evolutionary Significant Unit.

Currently, the Tribe obtains up to 50% of broodstock from the hatchery trap on the right bank of the barrier structure, with the remainder from the existing Corps fish trap. The Corps replacement fish trap on the right bank would replace the MIT fish trap facility and become the sole source of broodstock for White River Fish Hatchery programs. A fishway entrance/outlet slot to the hatchery trap is located at the right bank below the barrier structure. The entrance slot is designed to receive adult Chinook salmon and other salmonid species for hatchery use. The entrance slot is generally less efficient at attracting salmon than the USACE fish trap, although wild and hatchery fish are caught on both sides of the river. The hatchery water supply was upgraded with a new surface water intake structure, a pump station, and a levee during the mid 1990s. MIT has stated that the surface water intake becomes clogged at times by sediment released from Mud Mountain Dam following flow regulation or by natural events, interrupting flows in raceways and rearing ponds and requiring prompt use of temporary river pumps or limited well water supply to protect fish life until the intake can be cleared out. Currently, the hatchery fishway entrance/outlet is prone to blockage by bedload and requires that a channel be periodically dredged out to maintain the flow path from the fishway ladder to the river channel. Hatchery fish and wild fish broodstock collected at the Corps trap-and-haul facility requires manual netting by hatchery employees and transport across the river to the hatchery. Due to high numbers of pink salmon and a lack of sorting capability in the Corps trap, the Tribe's spring Chinook brood collection in 2011 was one-third short of the goal (700), reducing the number of juveniles produced by the hatchery and intended to restore spawning abundance in the White River. Although the Tribe's hatchery trap on the right river bank collects a portion of the broodstock, the Corps trap on the left bank currently collects more fish as the majority of the river flows along the left bank and additional attraction flow is provided in the trap, creating more attraction to the trap.

Similar to the Corps fish trap, operations at the MIT White River hatchery are dependent on the barrier structure for effective collection of returning salmon. In a letter to NMFS in July 2013, MIT identified impacts to Chinook collected at the hatchery and the fish trap. They stated that a proportion of fish transported upstream, spring Chinook in particular, likely die before spawning as a result of stress, delay, cranial lesions and other wounds acquired at the barrier structure and fish trap. We think the lesions are caused when fish collide with concrete or other structures at dams and in fish passage facilities. Head lesions and other wounds are commonly observed in fish in the Buckley fish trap especially among spring Chinook. MIT hatchery staff report that despite selecting the least injured fish for broodstock and inoculation with a general antibiotic, up to 20% of spring Chinook broodstock held in White River Hatchery raceways die before spawning as a result of fungal and bacterial infections, predominantly in head wounds existing at the time of trap collection.

The MIT’s hatchery-related interests and requirements associated with replacement of the barrier structure and fish passage facility center around minimizing and mitigating the effects of the Corps’ construction activities, project configuration, and long term operations and maintenance on hatchery operations, employees, and employee residences (two single-family homes). This includes broodstock collection; hatchery water supply reliability; flood protection and levee positioning to maintain hatchery vehicle access; the stability and safety of the hatchery access road; maintaining the safety and security of hatchery employees and children/family members living on site; mitigating traffic impacts on employee residences and hatchery operations; and development of a site access/easement agreement with the Corps for long term operations.

Project effects on the MIT river intake would need to be addressed in the detailed design phase.

### 2.5.4 Hazardous, Toxic, and Radioactive Waste Issues

The concerns of HTRW impacts on the left bank led to greater consideration for the right bank which is assumed to have no significant HTRW issues. The discussion below is from a Memorandum for Record prepared by NWS Environmental Engineering Section.

“The MMD FPF project must determine whether the left or right bank is preferable for construction and operation of the FPF. One of the weighting factors in this decision is the presence of known HTRW in areas needed for construction and operation of the new facility. ER1165-2-132 suggests avoidance of HTRW sites for construction of CW projects if practicable alternatives exist. A portion of the left bank of the site needed to create a truck turnaround area is within an existing restrictive covenant held by PSE From 1900 to the early 1960s, a larger portion of the left bank had a wood treatment facility in operation from ~1900 to the early 1960s which was used to provide treated timbers to construct and maintain the existing White River flume. Practices at the time allowed for release of PCP, dioxin/furans, arsenic, chromium, carcinogenic polycyclic aromatic hydrocarbons, and diesel and heavy oil-range hydrocarbons into soil. These compounds were concentrated in the immediate vicinity of the former wood treatment and storage areas, downslope from the treatment areas and in areas used to dry and store treated wood. Concentrations exceeded the Model Toxics Control Act (MTCA) cleanup levels; therefore, soil at the site was remediated in 2000-2001 by PSE under agreement with the WDOE. The remedy included soil excavation and removal to a maximum depth of 3.5 ft to remove significant source and isolation of contaminated soil left in place with placement of low permeability or impermeable caps. The land is currently owned by PSE and the restrictive covenant is specifically to minimize soil disturbing activities in the remedied area. Contaminated groundwater was also identified; however, continued monitoring indicates that groundwater is not reaching the White River. It was expected that chemical concentrations in groundwater would decrease over time as a result of the source removal and isolation of remaining contaminated soil with protective caps. Groundwater monitoring results indicate that arsenic and PCP concentrations still slightly exceed MTCA cleanup levels in some wells during some monitoring events, but this is consistent with known groundwater elevation information. In general, the monitoring indicates that contaminated groundwater is not reaching the White River.

The left bank area identified for the truck turnaround was not investigated for HTRW during previous activities but was included in the restrictive covenant in order to provide a 'buffer' from the remediated area so that future actions would not impede the soil cap. If the left bank were to be utilized for this project, soil and groundwater investigations to identify soil disposal and potential groundwater treatment and disposal are needed early in the pre-design phase. In addition, close proximity to the soil cap area necessitates careful construction management to assure that worker health and safety are properly managed. Engineering practices can be implemented to mitigate for known and potentially unknown left bank contamination but schedule impacts are unknown at this time. However, real estate considerations to obtain a portion of the area currently under PSE easement may also significantly impact project schedule.

Project partners including PSE, Muckleshoot Tribe, and Cascade did not identify any potential for HTRW on the right bank, however, a limited database/document review will occur to verify that activities suspected of causing a HTRW release do not exist on the right bank."

### 2.5.5 Real Estate Considerations

Sufficient real estate to construct a fish passage facility large enough to meet the BiOp criteria is a significant consideration. During the right bank and left bank discussions, it was determined that the real estate on the left bank did not provide sufficient area to expand the fish trap for the design event of 60,000 fish. The narrowing of the barrier structure created the opportunity to utilize reclaim flood plain on the right bank which provides more area for an expanded fish trap, holding facilities, truck loading and access.

## 2.6 Alternatives Considered at the Buckley Site but Eliminated from Detailed Evaluation and Selection of the Preferred Alternative.

As described above, several different options are available at the existing site to meet the needs for fish passage as outlined by RPA 3. The study team looked at facilities on the right bank, left bank and a combination of the left and right bank. Because of the RPA requirement to pass up to 95 percent of the returning salmonids, and the presence of Hazardous and Toxic waste sites on the left bank, the size requirement of a new facility on the left bank was determined to have too much risk and was eliminated from detailed evaluation. Likewise, the selection of the right bank as the preferred alternative influenced the width of the new fish passage barrier. A reduced barrier was proposed to increase the reliability of attraction flow to any right bank facility being proposed.

Based on the analysis of site conditions and project requirements, the right bank with a reduced barrier width was selected as the preferred alternative.

# 3 PROPOSED PLAN

## 3.1 Project Description

The proposed Mud Mountain Dam fish facility consists of a barrier structure located on the axis of the existing barrier and a trap-and-haul fish facility immediately downstream on the right bank. The purpose of the barrier is to prevent fish from migrating past the site, to provide a water supply source for the fish facility, and to facilitate the movement of bedload (large sediment) and debris through the site to ensure proper operation of the fish facility, the Lake Tapps Diversion, and the Muckleshoot Indian Tribe (MIT) fish hatchery. The fish facility allows fish migrating upstream to be collected and transported around Mud Mountain Dam. Table 1 below lists the general design criteria for the project and associated design parameters derived from those criteria. Facility design would be in accordance with criteria in NMFS guidance (NMFS 2011) to ensure conformance with biological criteria outlined in the NMFS 2014 BiOp.

Physical modeling will be pursued as part of the detailed design phase. Certain parameters listed in Table 1 and the other detailed parameter tables provided later in this document could change as additional information becomes available or existing analyses are refined. Many of these parameters used to characterize this concept design, such as tailwater elevations, are based on an available 1-dimensional hydraulic model of the site. The geometry of the site is highly variable through time due to the high sediment load in the White River. Due to the fixed-boundary assumption of the available hydraulic model and the age of the survey used to generate the model geometry, the model likely generates results that are not optimal for the purposes of designing a facility of this scale.

**Table 1. General Project Criteria/Parameters**

| Criteria | Value | Comments |
|---|---|---|
| Attraction | 95% | According to NMFS 2014 BiOp |
| Survival through the system | 98% | According to NMFS 2014 BiOp |
| Period of Operation (basis for design) | All Year | Based on discussions Summer 2014 |
| Fish Design Flow — Low | 350 cfs | 95% exceedance flow Rate-see flow-flow duration curve |
| Fish Design Flow — High | 3600 cfs | 5% exceedance flow Rate-see flow-flow duration curve |
| Design Tailwater Elevation — Low | 658 ft | Based on 1-D hydraulic model results with narrow barrier and an estimate of the post construction TW geometry. Uncertainty should be considered high. |
| Design Tailwater Elevation — High | 662 ft | See above comment |
| 100-Year Flow | 12,000 cfs | Based on MMD max release |
| 50-Year Flow | 12,000 cfs | Based on MMD max release |
| Fishway flow rate | 180-360 cfs | 5-10 % of high river design flow |
| Fish facility location | Right bank | |
| Yearly Fish Design Volume | 1.2 M | |
| Daily maximum fish number | 60,000 (total) | |
| Design fish weight | 4 lbs | |

### 3.1.1 Project Components

#### 3.1.1.1 Barrier Structure

The concept for a barrier structure with a narrower channel was an outcome of the September 2014 H&H/Fish Biology workshop. This group decided that a barrier with about 200 feet of flow area would better match the sediment transport capacity of the natural river upstream and downstream than either the existing structure or previous designs. In this concept design, the barrier would be fitted with four hinged crest gates. Additional gate configurations and types (inflatable bladder, radial gate, etc) would be examined in future detailed design phases for life cycle cost savings.

The new fish barrier structure would be located at the same location as the existing CWA fixed barrier structure. The existing CWA fixed barrier is 352 feet wide and comprised of 6-foot wide flashboards. The new barrier is 222.5 feet wide across the White River spanning between the existing Corps fish trap facility on the left bank, and the new trap-and-haul facility on the right bank, next to the MIT fish hatchery facility. The new barrier structure would consist of two concrete abutment walls, one on each end of the structure. The left abutment wall would be adjacent to a remaining portion of the decommissioned existing fish-trap facility. The right abutment wall would be next to the new water supply channel for the new trap-and-haul facility. There would be three intermediate piers to subdivide the structure into four 50-foot bays each equipped with a hinged crest gate.

The river flow through the new fish barrier would be controlled by the steel hinged crest gates, which would be operated by hydraulic cylinders at each end, and supported on the piers with a concrete apron slab underneath them. In the upright ("closed") position, these gates allow for the maintenance of a physical fish barrier and an upstream pool for fish facility water supply. One or more gates may be lowered ("opened") to allow for the manipulation of sediment through the site to ensure adequate conditions at the CWA Lake Tapps diversion and at the new fish facility. They also allow for the manipulation of flow laterally in the river for far-to-near field fish attraction purposes. The fully upright elevation of the gates is 671.5 feet.

Figure 20 shows the tailwater and forebay rating curves for the new barrier concept. Shown on this plot are two forebay curves. One is the maximum forebay operating elevation and the other is the "free-flow" rating curve. The free-flow rating curve is representative of the condition where all four of the barrier gates are completely open or in the down position.

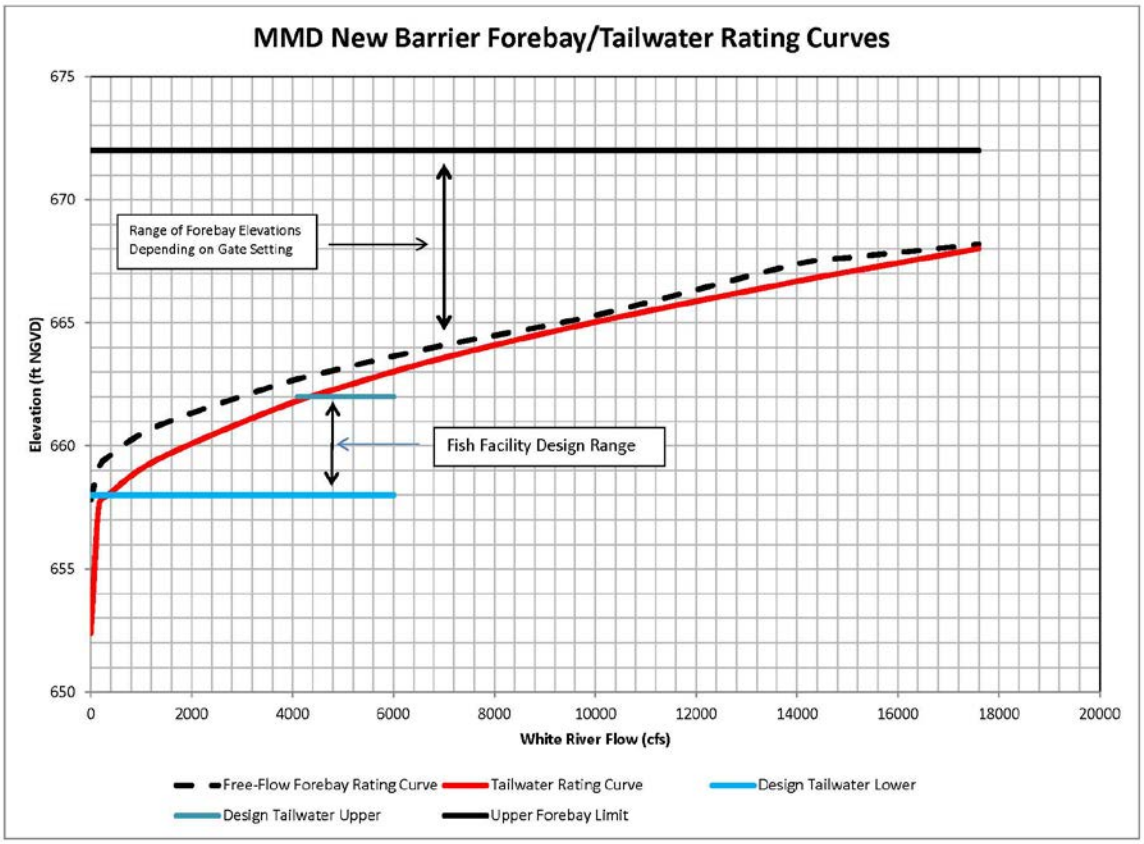


**Figure 20. Forebay/Tailwater Rating Curves**

Hydraulic modeling was conducted to evaluate changes in water surface profiles due to the project and construction activities. Figure 21 shows computed water surface profiles for a number of different scenarios. For simulations of the existing barrier, it was assumed that the flashboards would be in place for all flows up to 6,000 cfs. Beyond this flow value it was assumed the flashboards would be pushed out (i.e., the flashboards would fail) and flow would simply be over the structure invert. Based on these assumptions, water surface profiles shown in Figure 21 indicate the 'worst case' existing condition water surface profile occurs at 6,000 cfs. At flows greater than 6,000 cfs, the lack of flashboards (assumed) creates lower water surface elevations at the downstream end of the represented reach.

The concept to date calls for a maximum operating forebay elevation of 672 feet. This elevation would provide adequate water supply to the fish facility and provide a physical fish barrier in accordance with NMFS criteria up to river flows of approximately 4,000 cfs. During times when river flows are within the fishway design range and fish are present, it is anticipated that the barrier would be generally operated to maintain a forebay elevation of 672 feet. At high flood flows (10,000 cfs and greater), when sediment is actively moving, the barrier would likely be operated with all the gates fully open (laid down) to allow sediment to pass and to ensure there is enough hydraulic capacity so adverse conditions from high water surface elevations do not occur. At the intermediate flows how the barrier would be operated is more uncertain. Further analysis of sediment transport process at the site and more details of the barrier design are required to better define the operation.  Details of the barrier operation would be further developed during the detailed design phase.

It is unknown how sediment management activities at the site post construction would impact the sediment transport farther downstream. Changed or changing post-construction conditions farther downstream of the project site could impact the design tailwater range shown used for fish facility design. Project-induced geomorphic changes would be evaluated in the detailed design phase.

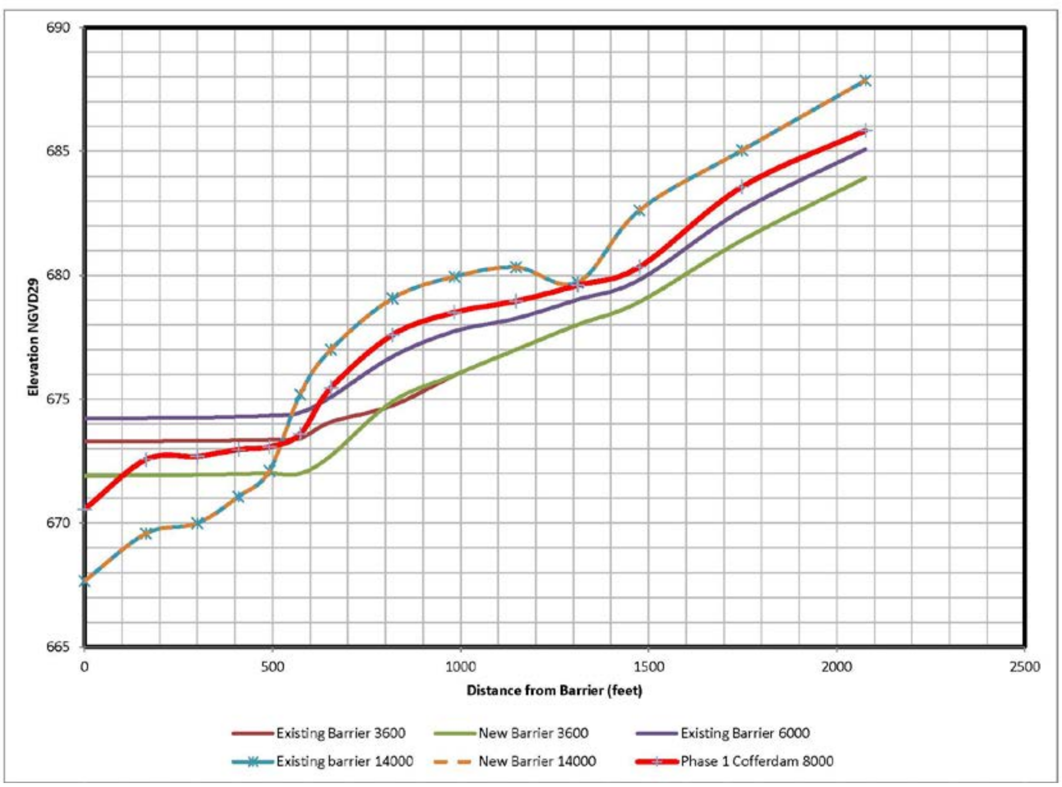


**Figure 21. Computed Water Surface Profiles for Several Scenarios**

#### 3.1.1.2 Upstream/Downstream Scour Protection

Scour protection downstream of the barrier is required to protect the structure from erosive forces resulting from flow over the barrier and to maintain adequate conditions in the fishway. The scour protection consists of a concrete apron immediately below the barrier and a riprap blanket farther downstream. The scour protection design for this effort is based on a flood flow of 15,000 cfs.

Based on an analysis using drop spillway design guidance (Chow 1959, section 5-15) to estimate hydraulic conditions below the barrier, 70 feet of scour protection is required downstream of the barrier structure gates to accommodate the very turbulent hydraulic conditions which would occur below the barrier at flood flows. This length would be comprised of approximately 14 feet of concrete apron and 56 feet of large riprap. The riprap downstream of the apron would be of a gradation including an average size of six-feet. Material would be placed at a thickness of 11 feet. The purpose of the shorter section of concrete apron was to minimize the impact of large bedload material on the concrete during high flows yet allow for the jet of water over the gates to land on the concrete apron during the high design fish flow (3,600 cfs) condition to provide safe passage for downstream migrating juveniles. It is preferable to have bedload material strike the riprap portion of the scour protection instead of the concrete apron and at the same time have a concrete apron that extends far enough downstream to ensure downstream migrating fish land in the tailwater over the concrete apron. Values presented here are conceptual and would be revisited during the detailed design phase. Just two flow conditions were analyzed for the purposes of this conceptual design.

#### 3.1.1.3 Abutment Walls

The left abutment wall as designed will tie into the existing left bank abutment of the existing Buckley Fish Trap. The left bank abutment wall will be supported on spread footings. The right abutment wall will be supported on spread footings and will act as a gate support, as well as a channel wall for the new trap-and-haul facility water supply channel.

#### 3.1.1.4 Levee Improvements

The new barrier will require realignment of the lower portion (500-1,000 ft) of the right bank levee to match up with the new right abutment position. The new levee prism will match the existing levee which consists of 2H:1V side slopes and with a 15 foot top width. The new levee will also include 3-foot thick 30-inch diameter riverside riprap with 1-foot thick spall filter layer. The overall average height would be two feet with the highest section (approximately 8 feet) at the fish barrier abutment access ramp. The construction and permanent easement requires approximately 3.3 acres. Clearing and grubbing would be required for the construction of the levee.

#### 3.1.1.5 Maintenance Features

To facilitate access and maintenance to the new barrier, a maintenance deck was incorporated into the structure design. The maintenance deck was designed for a 25 ton excavator, including uneven loading resulting from the removal of debris and bedload that can’t be passed through the gates. The barrier design also includes a system of stoplog slots, and stoplogs that can be installed with a mobile crane from the deck. The stoplogs would provide a method to unwater individual gates in the barrier, for emergency repairs or normal operation and maintenance. Unwatering of an individual gate can be completed without reducing the river flow to the minimum, which was required for unwatering the whole existing barrier. The maintenance deck along with the flexible operability of the hinged crest weirs, would eliminate the need for dewatering the whole barrier to facilitate maintenance of the structure or the gates. In addition, features yet to be determined would be required to deal with sediment within the fish facility.

#### 3.1.1.6 Trap-and-haul Facility Features

The trap-and-haul facility consists of water supply channel, water supply system, entrance structure, ladder and pre-sort pools, and the lifting/sorting/loading structure(s). The water supply channel is a narrow channel through the barrier with intake screens/trash racks and a downstream flow control gate to manage sediment/debris and ensure hydraulic conditions in the channel allow for proper facility function. The entrance structure contains the ingress points for fish from the river to the facility. Placement, number of entrances and flow rate of this component is critical to meeting the objectives of the facility. The ladder is a series of pools that allow fish to ascend to a point above the high design flow tailwater elevation where holding, sorting and hauling can occur. This feature needs to provide adequate hydraulic conditions and capacity over a range of conditions to ensure fish can safely and efficiently navigate ascend. The lifting, sorting, loading and transport features of the facility are required to facilitate the movement of fish from the Buckley site to the release point above MMD.

#### 3.1.1.7 Fish Trap Access Road Features

The improvements to the existing MIT road (1,400 LF) would include paved asphaltic concrete (AC) 22 feet wide with 2 foot shoulders. The existing retaining wall would be extended approximately 240 LF which would also move approximately 12 LF of the retaining wall 3 feet into the hillside. This may require relocation of the utility pole in this area. This section of road would also be shifted to the north providing clearer sight for a greater distance along the retaining wall. Along the existing retaining wall the road would be a one-way road with automatic signaling. The road from SE Mud Mountain Road to the residence(s) (1,200 LF) would include a 4-foot wide pedestrian path with a guard rail as a vehicle/pedestrian barrier. Approximately 440 LF of guard rail is included on the downhill side of the road. Approximately 480 LF (22 feet wide) of new AC road would be used to access the fish trap loading area. Approximately 500 LF (18 feet wide) of new gravel road would be used to as access between the MIT Fish Hatchery and the new fish trap loading area.

Due to the increased impervious surfaces created as part stormwater mitigation for both water quality and flow control will be required. The proposed improvements include a stormwater detention pond to be located in the vicinity of the trap and haul facility. Siting of the stormwater detention pond will made to avoid any wetlands in the area.

#### 3.1.1.8 Fish Release Road Proposed Improvement

The road access at Washington State Route 410 would include 60 LF of AC. The fish release area would include a 0.55 acre (23,960 square feet) fish release and turnaround area. The fish release area would include retaining walls as necessary to provide close access to the river. The fish release area includes one gabion wall.

Based on the existing terrain, there are four locations anticipated for vehicle turnouts. A vehicle turnout 10 feet wide by 200 feet long could be improved at station 3+00; turnouts 10 feet by 140 feet could be cut at approximately stations 36+00 and 57+00 and 63+00. The vehicle turnouts would provide trucks with waiting areas along the road to allow other vehicles to pass as needed. Two additional turnout areas are included.

Drainage ditches would be improved along the roadway to prevent ponding and allow drainage for the improved surface. Guardrails could be placed along 1,200 feet of roadway to provide safety measures where steep downhill slopes are approximately 10 feet or less from the edge of the improved roadway. A 160-foot long gabion wall up to 30 feet high is anticipated to widen a turn; 1620 CY of gabion material and 3520 CY of cut is anticipated. Two additional gabion walls are included to supplement turnouts.

Wetland delineations indicate that the siting of the 3+00 turnout will need to be adjusted to avoid wetland impacts

#### 3.1.1.9 Fish Release Features

At the existing fish release site a single chute is used to convey fish from trucks into the river. The conceptual plan is to repair the existing chute for use with the smaller trucks currently in use. A new second chute will be constructed for use with the new larger trucks that will be necessary to move larger numbers of fish. The fish release site will also be improved with larger turnaround and staging area as described above.

### 3.1.2 Trap-and-haul Facility

The trap-and-haul facility consists of water supply structure, the entrance structure, the ladder and pre-sort pools, and the lifting/sorting/loading structure. This section deals with the detailed criteria and computed parameters required to determine what the physical facility looks like and provide enough detail for a cost estimate.

A systemic and effective method of dealing with the sedimentation at the barrier will be designed and incorporated at the detailed design stage.

### 3.1.3 Fishway Entrance

The location and design of a fishway entrance is one of the most important aspects of a fish facility. For this concept, the entrance structure is designed with two sets of entrances to accommodate both high and low flow conditions as well as different swimming capabilities among the target fish species . The low flow entrance will be placed close to the barrier structure as during these conditions fish will be able to swim right up to the barrier. A high flow entrance will be placed approximately 50 feet downstream. During high flow conditions it is anticipated that hydraulic conditions in the tailrace may prevent fish from accessing the entrance(s) that is very close to the barrier and intended for low flow conditions. Each entrance will be controlled by a gate to allow for opening and closing the entrances and adjusting the tailwater-entrance water surface differential.

#### 3.1.3.1 Fishway Water Supply

The fish facility water supply will be gravity-fed from the barrier structure forebay for the bulk of the facility's requirements. The water supply system will be designed based on NMFS criteria. Major features include an intake channel on the right side of the barrier, a system of screens and cleaning equipment, the water supply energy dissipation pools for the entrance and ladder, and diffuser panels at the entrance structure and select ladder pools. All water intakes from the river for supplying the fish passage facility would be screened according to NMFS Fishway Design Manual (NMFS 2011a). There would also be a small pump station with a capacity of approximately 5 – 10 cfs supplying the sorting and loading portions of the facility. The elevations of these components are higher than what can be accommodated via gravity water supply.

Although the BiOp requires 180-360 cfs, in this concept design, the total flow rate is 360 cfs. At low tailwater conditions the water supply system would provide approximately 65 cfs to the ladder and 295 cfs to the entrance for a total of approximately 360 cfs. To ensure adequate velocities in the submerged portions of the ladder for fish attraction at high tailwater conditions, the water supply system would have the capability to reapportion the total flow, supplying more flow to the ladder and less to the entrance, but keeping the total the same. Flow would be introduced to the ladder and entrance via floor diffusers. These could pose sediment concerns and should be further evaluated during the detailed design phase. Wall diffusers may be a better option here.

#### 3.1.3.2 Fishway Ladder

The fishway ladder consists of six pools and two pre-sort pools at the top of the ladder. The ladder pools are 10 feet long, 24 feet wide, and 6 feet deep. The volume of the pools is based on a 1,000 fish per pool loading which was determined by assuming 200 fish per minute entering and 5 min residence time per pool. Each pool is configured with an Ice Harbor, weir and orifice-type baffle.

Each pre-sort pool is 145 feet long, 12 feet wide and 6 feet deep. The sizing of each pool is based on a maximum facility throughput of 3,000 fish per hour coupled with the NMFS short-term holding criteria of 0.38 cubic feet of pool volume per pound of fish and the design fish weight of 4.0 pounds. Each pre-sort pool would be fitted with a V-Trap (or similar fish containment device) from the upper ladder pool as well as a mechanical crowding system to crowd fish into the hopper/lifting system.

The ladder flow rate at low tailwater conditions is 65 cfs. Under this condition most of the ladder flow is introduced via a diffuser in the upper pool, or pool number six. The other pools would be fitted with diffusers to allow flow to be introduced under different tailwater conditions. At high tailwater, the total flow in the lower pool of the ladder needs to be about 240 cfs to maintain velocities of approximately 2 ft/sec in the lower portion of the ladder. Under this condition flow added to the entrance would be scaled back to a maximum of 120 cfs so as to maintain the same total flow rate. The ability to change how flow is introduced to the facility ensures acceptable velocities for fish attraction in the ladder under all conditions. Calculations and a profile schematic of the ladder, maximum and minimum water surface profiles and an estimate of required add in water to the ladder are shown in Appendix A.

It should be noted that the assumption of 200 fish per minute entering the facility was based on an original hourly estimate of 12,000 fish. Based on review comments, this maximum hourly value has been reduced to 8,000 fish and will be evaluated further in the detailed design phase to ensure we only pursue the minimum BiOp responsibilities. This change, along with changes in the hauling capacity used in the analysis, resulted in changes to the required presort pool volume. The reduction in the peak hourly fish number also could have an impact on the ladder design as well. Based on the approach for ladder pool volume determination earlier in this section, under an 8,000 fish peak hour assumption, the computed volume would be smaller. This could result in a lower ladder flow rate, depending on how the pool dimensions are adjusted and how the weir crest lengths are changed. This will be refined in the detailed design phase.

#### 3.1.3.3 Lifting/Sorting/Loading

The fish lifting and loading facility includes fish conveyance to the vertical lift, a diverter flume for routing fish to a sorting area or to direct truck loading, a post-sort holding pool, a truck loading system (hopper), and the truck fill facility. Once fish are loaded in the truck they are hauled to the fish release site above the dam. Water to water transport must be used, with facilities designed according to Section 6 of the NMFS Fish Passage Design Manual (NMFS 2011a).

#### 3.1.3.4 Sorting Area

The sorting facility will be integrated with the fish ladder and holding pool(s) and will include features (e.g., crowder, sampling table, loading provisions, and fish return chute) necessary to facilitate hatchery broodstock collection as the Corps' fish passage facility will displace the existing MIT hatchery fishway on the right bank. These facilities will include the means for sampling marked fish and separating Puget Sound Chinook and steelhead for MIT hatchery broodstock use. The sorting area will be used throughout the year while direct-to-truck loading (no sorting except broodstock collection for the hatchery) may occur (further discussion required with regional team) during the peak of the pink salmon run when a maximum transport rate is necessary to move fish as they arrive at the facility.

### 3.1.4 Fish-lifting equipment and Trucking

The concept design includes four hoppers to provide vertical lift for passing from the pre-sort pool to a secondary pre-sort pool prior to elevated sort facilities. The four hoppers were considered necessary to handle the maximum daily fish loading criteria. Loading to trucks will be water to water to ensure fish safety. Water supply to this portion of the facility will likely be via a pumped system.

To ensure all adult salmon are transported without long term holding (i.e., greater than 24 hours), a fleet of up to four 4500-gallon transport trucks will be required to make about 60 transport trips for a peak passage day of 60,000 salmon. The NMFS BiOp states that if sorting of ESA-listed fish and adequate holding facilities for pink salmon are included in the facility design, the number of transport trucks can be reduced. Subsequent iterations of the design of the transport and holding systems are to be developed as part of the Regional Design Team efforts.

### 3.1.5 Fish Release

NMFS criteria for the fish release site includes a maximum drop height of 6 feet and a minimum river depth of 3 feet at the release point; water quality conditions should be representative of the general water conditions in the river; and the site must provide direct and simple egress for fish for continued upstream migration. The release site would include a second chute designed to accommodate the larger trucks necessary for transporting up to 60,000 fish in one day.

## *3.2 Construction Considerations, Barrier Structure*

### 3.2.1 Construction Duration

Based on the current concept and cofferdam design (described below), construction of the new barrier structure and fish passage facility is anticipated to take approximately 3 years. As mandated in the BiOp, the fish passage facility must be operational by December 2020.

### 3.2.2 Temporary Measures to Maintain Existing Site Functions

Construction activities would require cofferdam construction as described above which would constrict the river. Construction phasing analysis indicates that a 150-foot wide flow opening is required during construction to pass expected river flows with acceptable hydraulic conditions. It is assumed that the design flow for construction activities is 8,000 cfs. Figure 21 shows a profile depicting the Phase 1 cofferdam condition which would facilitate construction of the first three gates on the barrier.

During construction, the right bank levee would remain in its existing alignment but may need to be raised along the lower 500-1,000 feet to facilitate the constricted construction condition. Hydraulic modeling performed to look at the cofferdam condition showed that with some shaping of the downstream island, river flow can be discharged over the existing barrier foundation and would provide a 10-foot forebay/tailwater differential for fish exclusion purposes throughout the design fish flow range.

It is possible that a large flood event could require releases from MMD in excess of 8,000 cfs. Higher flows could have impacts on construction and surrounding infrastructure. Measures to deal with flows above 8,000 cfs would need to be developed in the detailed design phase.

### 3.2.3 Dewatering Plan

A dewatering plan is required prior to commencement of construction of the fish passage facility. A care and diversion of water design was completed in 2012 (Tetra Tech 2012).

The Mud Mountain Fish Passage Facility (Tetratech 2012) 35% Care and Diversion of Water Feasibility Design Report (CDWFDR) provided technical documentation of the 35% design for the care and diversion of water (CDW). The current concept design draws from that previous Tetra Tech, Inc. report. The 65% Corps design (USACE 2007) was also used.

The primary project objectives for the dewatering plan (care and diversion of water) are to:

- Isolate the FPF construction site from the flow of the White River and establish a safe, dry working area that can be economically maintained for necessary construction activities.
- Maintain minimum required river flows and designated flows to the Lake Tapps Diversion Flume.
- Ensure that the care and diversion of water plan can be implemented while restricting in-water work to established annual in-water work windows as defined by resource agencies.
- Maintain fish exclusion barrier to meet and maintain the current fish passage levels throughout construction.
- Ensure that the MIT hatchery can continue to maintain current production levels throughout construction.
- Protect environmental quality by maintaining acceptable water quality during construction.
- Use Best Management Practices to minimize impacts to habitat including use of site restoration and compensatory mitigation (NMFS 2014, Appendix B).

The care and diversion recommendations in the report would need to be re-examined, evaluated, and validated with the final design of the fish passage facility. An updated 35% Care and Diversion Feasibility Design Report would need to be produced. Areas that have been identified where additional analysis may be needed in future design phases are listed below, and additional areas may be identified during design.

- Conduct additional field exploration and testing to fill gaps about the nature and distribution of soil and water conditions.
- Update and modify the proposed dewatering system discussed in the 35% Care and Diversion Feasibility Design Report as needed due to new design requirements. The report currently recommends a combination of cutoff walls and dewatering wells around the perimeter of the site.
- Update topographic and bathymetric survey. The upstream extent of the required levee improvement on the White River is not known with certainty due to the lack of a recent topographic survey along the right bank.
- Confirm the adequacy of the assumption of a nominal 1 foot of freeboard (i.e., freeboard relative to the energy grade line, in most cases) of the cofferdam, the high-flow diversion, and the low-flow diversion.
- Conduct physical and numerical modeling.
- Refine configuration of the temporary downstream channel for flow diversion.
- Optimize low-flow diversion alignment to further minimize the effects of super-elevation and make transitions more hydraulically efficient.
- Evaluate and validate the use of a cutoff wall constructed with secant piles is still valid for use with the right bank alignment with proposed permanent FPF.

- Finalize staging and storage locations, and identify specific mass haul volumes to each location.
- Confirm the adequacy of access roads to handle construction and temporary fish passage traffic.
- Review construction schedule relative to in-water work windows.

#### 3.2.3.1 In-water Work Windows

The accelerated schedule and complex nature of the planned construction period will require a review of the sequencing of work to coordinate with normal window work and to minimize the frequency and duration of in-water work outside the normal window. The conceptual project schedule is not developed to a level where an analysis of periods outside the work window is feasible. A major constraint in relying on the existing in-water work windows (July 15-August 31) is that the peak abundance period of pink salmon occurs in August of 2017 and 2019, two of the four potential work windows for the conceptual construction schedule. The BiOp includes directions for minimizing harm to ESA listed fish by coordinating with NMFS and WDFW to identify workable windows, and to employ the best management practices as modeled after the Portland District Corps' Standard Local Operating Procedures for Endangered Species (NMFS 2014, Appendix B). The Regional Design Team will be part of the detailed design process enabling direct input from the resource managers on a construction schedule that will best minimize harm to aquatic resources.

### 3.2.4 Temporary Construction Access Roads

There are three access roads to the site, two on the left bank (Corps and CWA) and one on the right bank (MIT). Another road on the left bank extends beyond the Corps access road. These are all gravel roads and will be repaired after construction. Temporary access routes around the site and into the riverbed will be removed and the area restored as necessary after construction.

The Corps access road crosses a wooden bridge with load and size limitations. For this reason the CWA access road to the project site would be used as a primary construction and haul access from the left bank. The MIT road is the only access from the right bank. It has not been determined whether the paved improvements would be done prior to the Fish Trap construction.

### 3.2.5 Temporary fish trap construction/operation

Under the current concept design, there will not be a need for construction of a separate temporary fish passage facility during construction. The existing left bank fish passage facility will remain in operation throughout construction. A temporary extension of the existing fish trap entrance may be required to facilitate cofferdam construction. The left bank fishway entrance will require an extension beyond the cofferdam to provide access for fish to enter the fishway. The temporary entrance will not be at the terminus of the barrier and fish may pass by the entrance as they swim up to the new terminus on the right bank. To ensure fish are guided to the temporary entrance additional features may be necessary such as a temporary weir (i.e., floating weir or rock sill).

### 3.2.6 Staging Areas

Available area for staging on the right bank is limited and will be within the construction footprint for the roads and levees. Necessary temporary construction and access easements from adjacent property owners will be obtained to complete the project. Some limitations may apply when using the MIT road on the right bank.

Staging areas on the left bank will be along the access roads, at and beyond the demolished CWA caretaker's home. CWA is in the process of upgrading their diversion flume which may increase or decrease the available staging area along the flume. The adjacent CWA property with the restrictive covenant is assumed not to be available for spoils or material storage or other staging activities. The restrictive covenant protects soil capped areas which contain various contaminants including arsenic, pentachlorophenol, dioxins and furans.

### 3.2.7 Demolition Plans

Demolition under this project will include removal of the existing barrier structure and demolition of the existing fish trap on the left bank as well as portions of the MIT hatchery fishway. The barrier will be entirely removed from the riverbed. Above-ground structures at the existing Corp facility and the MIT hatchery will be removed. The fishway entrances will be filled with earth or concrete. The fish ladders and other upstream portions of the fishways will be demolished and filled by breaking off the above-ground portions of concrete walls and filling channels with earth fill. Portions of the MIT fish trap could be kept to provide fish holding area for hatchery purposes.

## *3.3 Muckleshoot Indian Tribe Fish Hatchery Accommodations, Issues, and Concerns*

The MIT White River Hatchery is located on the right bank of the White River adjacent to the project site . Tribal hatchery- related requirements associated with the project focus on minimizing and mitigating the impacts of the Corps' construction activities, project configuration, and long term operations and maintenance on hatchery operations, employees, and employee residences. This includes broodstock collection; juvenile fish releases; hatchery water supply reliability; flood protection and levee location to maintain vehicle access to hatchery facilities; the stability and safety of the hatchery entrance road; maintaining the safety and security of hatchery employees and children/family members living on site; and mitigating traffic impacts on employee residences and hatchery operations.

### 3.3.1 Construction Impacts

The Corps would work with the Tribe to assess and fully mitigate impacts to hatchery operations, employees, and hatchery residents during construction, specifically addressing issues of (a) human safety; (b) hatchery complex security; (c) noise, dust, vibration, lighting, and any other environmental impacts; and (d) disturbance to hatchery operations. A traffic and construction operations plan and agreement would be developed to address project related vehicle, equipment, and personnel access through the hatchery compound to facilitate traffic safety, and the efficient collection of hatchery broodstock from the Corps fish trap. The ability to release juvenile fish from the hatchery must not be impacted. Security for the hatchery would be a prime concern of the Corps, and would be coordinated with the MIT. A detailed security plan to prevent unauthorized public access during construction would be in place.

MIT would require access to fish in the Corps trap for the purpose of collecting hatchery broodstock from the trap and for biological sampling purposes.

It is expected that the Corps would require use of the Tribe's hatchery entrance road adjacent to the hatchery during construction. The existing road surface is gravel and the adjacent slope near the connection with Mud Mountain Road is stabilized with concrete blocks. The road is not currently adequate for increased traffic volumes or frequent use by heavy trucks and construction equipment. The Corps would develop a plan to ensure that noise, traffic, vibration, dust and other impacts are minimal and safety of all parties is ensured during construction. MIT would participate in the identification of impacts and development of the plan to address those impacts.

Vehicle access to the hatchery and residences, and vehicle access for trap and haul operations may require separate roadways and would meet requirements for traffic safety, security, vibration, and noise control. The Tribe has requested that the two Tribal housing units, which are located along the access road, be relocated to other areas on the hatchery property to mitigate disturbance during construction and post construction operations.

### 3.3.2 New Facility Impacts (post-construction)

MIT will require access to fish in the Corps trap for the purpose of collecting hatchery broodstock from the trap and for biological sampling purposes. The Corps will insure that the Tribe and the resource agencies have access to fish in the Corps trap. The Corps is responsible for sorting by species and by metal tags and to provide the facilities needed to safely collect fish for broodstock.

The Corps will require a perpetual road and utility easement from the MIT for the purpose of hauling fish from the right bank of the river through tribal property. Mitigation measures and operational plans will be developed and fully coordinated with the MIT prior to a final determination being made.

The Corps would ensure that noise, traffic, vibration, dust and other impacts are minimal and safety of all parties is provided for both during and after construction. The Tribe would participate in the identification of impacts and development of plans to address those impacts. Vehicle access to the hatchery and residences, and vehicle access for trap and haul operations may require separate roadways and would need to meet requirements for traffic safety, security, vibration, and noise control. As previously noted, the Tribe has requested that the two Tribal housing units, which are located along the access road, be relocated to other areas on the hatchery property to mitigate disturbance during construction and post construction operations.

Provision of vehicle traffic safety and emergency vehicle access in the roadway design and in safety systems during and after construction will be planned with the Tribe (traffic management on a narrow road, warning lights and noise or other measures).

A traffic management plan will be developed for post-construction operations to ensure all resident, staff and others are aware of the hazards and provided with the greatest amount of safety possible. An estimate of project traffic and mitigation requirements will be prepared during the design phase. A security plan for hatchery residences and hatchery facilities to prevent unauthorized public access will be developed. Security for the hatchery will be a prime concern of the Corps, and will be coordinated with the MIT. A detailed security plan will be developed during the design phase.

## *3.4 Cascade Water Alliance Accommodations, Issues, and Concerns*

CWA's Lake Tapps Headworks, Diversion Facilities and Flowline Intake (collectively the "CWA Diversion Facilities" are located on the left bank of the White River adjacent to the project site. CWA Diversion Facility related requirements associated with the project focus on minimizing and mitigating the impacts of the Corps' construction activities, project configuration, and long term operations and maintenance on CWA activities. This includes: avoidance of adverse deposition of sediments/debris in front of the CWA Diversion Facilities (adequate management of sediment/debris through operation of new barrier structure gates); maintenance of minimum normal water surface elevation behind the new barrier structure to allow CWA to fully maximize diversions allowed in its Water Rights (up to 1000 cfs); provision for continuous minimum diversion (30 cfs) by CWA at all times (no matter what the actual White River flow is); managing water surface elevation behind the new barrier structure (up to the maximum design flood flow) to prevent overtopping of CWA's operations deck and headgates; agreement for operational coordination to ensure necessary sediment/debris management and compliance with Minimum Flows and Ramping Rates in CWA Water Rights; the stability and safety of the access roads and bridges; maintaining safety and security; and mitigating traffic impacts on operations.

### 3.4.1 Construction Impacts

The Corps would work with CWA to assess and fully mitigate impacts to Diversion Facility operations during construction, specifically addressing issues of (a) safety; (b) security; (c) noise, dust, vibration, lighting, and any other environmental impacts; (d) disturbance to operations (including providing for CWA's water diversions throughout construction); and (d) continuous compliance with Water Right conditions.  A traffic and construction operations plan and agreement would be developed to address project related vehicle, equipment and personnel access through CWA property to facilitate traffic safety and Corps fish trap operation, CWA operations and construction activities.

It is expected that the Corps would require use of CWA's access roads and bridges (crossing the Flowline) during construction. The roads and bridges are not currently adequate for increased traffic volumes or frequent use by heavy trucks and construction equipment.  No bridge upgrades are currently planned. Construction traffic would be limited to bridge capacity. The Corps would develop a plan to ensure that noise, traffic, vibration, dust and other impacts are minimal and safety of all parties is ensured during construction. CWA would participate in the identification of impacts and development of the plan to address those impacts.

### 3.4.2 New Facility Impacts

Once the new Barrier Structure and Fish Passage Facilities are operational, CWA will require an operations agreement with the Corps that includes coordination of activities so that Corps activities: minimize adverse deposition of sediments/debris in front of the CWA Diversion Facilities (adequate management of sediment/debris through operation of new barrier structure gates); maintain a minimum normal water surface elevation behind the new barrier structure sufficient to allow CWA to fully maximize diversions allowed in its Water Rights (up to 1000 cfs); provide for continuous minimum diversion (30 cfs) by CWA at all times (no matter what actual White River flow); manage water surface elevation behind the new barrier structure (up to the maximum design flood flow) to prevent overtopping of CWA's operations deck and headgates; provide for compliance with Minimum Flows and Ramping Rates in CWA Water Rights; and provide for any continued access to the left bank, including the stability and safety of the access roads and bridges; maintaining safety and security; and mitigating traffic impacts on operations.

### 3.4.3 Implementation and schedule considerations

The project schedule as shown was developed assuming Seattle District will receive funds no later than May 25, 2015, and with sufficient funding in FY 2016 and through 2020 to maintain the rapid project schedule. The short-term funding required is for scheduled design, real estate and development of a physical model, and is subject to reprogramming funds within the USACE. Remaining project implementation funds will be recommended for budgeting in Fiscal Year 2017 through 2020. Lack of adequate funding for continued design or construction could jeopardize the Corps' ability to meet the construction completion date outlined in the 2014 NMFS BiOp.

| Task | Start | Finish |
|---|---|---|
| Site Investigations | May 2015 | September 2015 |
| Roads and Levee Design | Sept 2015 | Mar 2016 |
| Roads and Levee Acquisition | Mar 2016 | July 2016 |
| Roads and Levee Construction | Oct 2016 | Mar 2017 |
| Barrier & Fishway Contracting | Jan 2015 | Aug 2015 |
| Barrier & Fishway Designs | Sept 2015 | Feb 2017 |
| Barrier & Fishway Constr. Acquisition | June 2016 | July 2017 |
| Barrier and Fishway Construction | July 2017 | Nov 2020 |

There are multiple factors to consider in the schedule and implementation of this project including:

- Meeting the schedule specified in the NMFS BiOp, and U.S. Department of Justice requirements, for 2020 construction completion

- Availability of information required for complete design, particularly topographic data, geotechnical exploration data, physical model study results
- "Fish windows" – Periods of time when in-river work is allowed so as to lessen the risk of disrupting migrant fish and avoiding more than one pink salmon season
- Site and design uncertainties
- Little time would be available to learn facility operations for the new facility – foreshortened commissioning period
- Availability of a large A-E firm willing to undertake a large complex project with short schedule and uncertain funding
- MIT mitigation
- Lack of adequate topographic and geotechnical information would put the burden on the design A-E contractor to collect data to support their design effort.

## 3.5 Operation and Maintenance

The Corps will be the responsible entity for operating and maintaining the fish trap-and-haul facility and fish barrier. CWA or the current owner of the intake would be responsible for all associated expenses and operation related to maintaining a diversion to Lake Tapps. An operating agreement between the Corps and CWA is anticipated to outline specific operational parameters to protect both parties' interests. Any such agreement would be developed in conjunction with real estate acquisition following project approval. Additionally, operating agreements will be required between the Corps and the MIT for operation and maintenance of the fish facility, access roads and levees. All Operations and Maintenance costs were developed by NWS Cost Engineering, in coordination with MMD Operations.

## 3.6 Annual Requirements

### 3.6.1 Fish Trap-and-Haul

The new facility will be larger and more complex when compared to the existing facility. For this reason, additional permanent staff will be required to operate and maintain the facility. Their tasks will include insuring the facility is properly cleaned of sediment, removing debris, minor, reoccurring maintenance, and ongoing fish handling and trucking. Other annual costs will be related to truck operating costs, which are expected to increase due to a change in truck size from 1,200 gallon to 4,500 gallon.

The fish facility would be operated year round outside of periods where winter high flows may exceed the height of the structure or when required maintenance is scheduled to occur. Fish runs can vary significantly by several hundred thousand to one-million fish year-to-year depending on the year and species of returning fish. In odd years abundant pink salmon (future runs could reach 1,250,000 fish) arrive at the trap and require non-stop processing of fish for up to two-months while in even years fish runs may be as low as 15,000 fish. The new trap-and-haul facility must be able to operate effectively during all sizes of fish runs with a maximum design event of 1,250,000 fish in a year and 60,000 fish in one day. There must be acceptable conditions to operate the trap-and-haul facility, including access for personnel to collect, sort, and transfer ESA-listed species and MIT hatchery fish in a safe, efficient manner which minimizes physical handling, crowding, delay, and the resulting stress to the fish.

In general, the presence of fish in the trap would trigger the need to process captured fish with staff checking the trap first thing in the morning and during the day as needed. The trap may also be monitored using cameras or other devices fed live to MMD to observe presence of fish. As fish enter the fishway and then the trap they would be transferred from the pre-sort or holding pool either to the sorting area or post-sort holding pool and then to the hopper, or MIT hatchery, or directly to a hopper. The operator would record the number of fish by species loaded into the truck. The fish would be loaded in trucks and then hauled to the release site above MMD. The number of truck trips depends on the abundance of fish at the trap. During winter periods when few fish are present fish hauling would occur at most once per day during weekdays (BiOp does not require transport over a weekend in January or February if less than 5 ESA-listed fish are present). During peak periods of ESA-listed and abundant non-listed fish, hauling may occur 7 days per week. The number of truck trips may increase from 1 per day in winter to up to 60 trips during the peak pink salmon run. The number of trucks operating would vary from 1 truck during winter to 1-2 trucks during peak periods in non-pink years (even number years) and up to 4 trucks during two months in abundant pink salmon years (odd-numbered years). The total number of operators needed to run the trap and trucks could vary from 1-2 staff during the winter with up to 19 staff during peak pink salmon periods in the summer (current trap includes use of temporary or seasonal hires with WDFW trained truck drivers hired under cooperative agreement).

Inspection of various features of the trap would occur regularly throughout the season with some items to be checked daily. The water supply to the trap includes trash racks and screens to exclude debris and juvenile salmon from entering the water supply channel and to reduce sediment and debris accumulation. NMFS criteria require daily inspections and maintenance for screening and bypass systems for water supply to ensure operations remain consistent. As part of the inspection, sediment and debris maintenance would occur on an "as needed basis" to remove sediment and debris from the flow intakes to prevent build-up or clogging of screens.

The features of the fish facility and barrier structure provide a range of options to adaptively manage the structures to meet BiOp criteria for attraction and survival, manage river flows and handle sediment and debris. The fish facility entrance includes different configurations of the gates, adjustable weir heights in the fish ladder, and regulation of water to the auxiliary water supply to maintain attraction flows as river flows change. The trap-and-haul operation includes 4 hopper and truck loading areas to adapt to the changing fish run sizes.

**Table 2. Design and Operating Criteria for the Fish Facility (Trap-and-Haul)**

| Criteria | Value | Comments (Source/Explanation) |
|---|---|---|
| Period of Operation | All Year | Current project operations and NMFS 2014 BiOp |
| Maintenance Period when Fishway Closed | 14-days maximum, during winter outside ESA fish runs | NMFS BiOp; January and February are low run periods and current maintenance occurs during those times |
| Outage for High Flows | Facility shut-down during high flows | NMFS BiOp, facility shut-down is allowed if greater than 50-yr flows occur. The fishway design should have sufficient river freeboard to minimize overtopping by 50-year flood flows. |
| Daily Operations and Fish Holding | Fish must be moved within 24 hours unless during low abundance period | NMFS BiOp, Exception is fall and winter periods that have low fish numbers so fish may be held over the weekend up to 60 hrs |
| Fish Counts and Coarse Sorting | Operators are to accurately count fish and separate out listed and non-listed fish by species and tagged MIT hatchery fish | Regional Design Team and NMFS BiOp; tagged fish would be automatically separated by detectors or observed by operator and then diverted to sorting pool. |
| Broodstock Collection | Provide MIT hatchery broodstock to meet hatchery objectives for now and future operations | Existing MIT hatchery fish trap broodstock collection facility will be displaced by this project. |
| Biological Sampling | Resource Managers and MIT Hatchery personnel may conduct sampling of fish | NMFS BiOp requirement for Corps is to accurately separate out species and MIT hatchery fish, but also requires that the Tribes and fish agencies must have access to sample fish; PTI currently conducts manual sampling at existing trap. |
| Monitoring of Fish Passage Performance | Fish passage performance must be monitored for the first 3 years of operation with additional monitoring if metrics are not met | NMFS BiOp requires monitoring and adaptive management to ensure facility design and operation meets 95% attraction and 98% survival criteria. Details of the type of monitoring will be developed between NMFS and Corps. |
| Maximum Passage Day | 60,000 fish (total) | Regional Design Team, NMFS BiOp; Pink salmon returns up to 1.25 million fish could arrive in a period of approximately 2 months. |

### 3.6.2 Barrier Structure

Currently the Corps reimburses CWA for operating costs of the existing barrier structure through a cooperative agreement. The Corps will own and operate the proposed barrier structure.

The proposed barrier structure will be able to flush debris downstream more effectively than the existing barrier, because the hinged crest gates would be able to be laid down flat to pass debris over the top of the gates when needed. Gate operation alone is not expected to move all of the debris. Some debris will still be expected to collect at various locations along the barrier. The current plan for debris handling with the proposed barrier is to provide a maintenance deck over the top of the barrier, and utilize debris handling machinery which would be operated from the maintenance deck. It is expected that an excavator would be purchased and will need to be located on-site at all times in order to deal with debris build up problems that cannot be planned for.

Monitoring of the hydraulic gate levels at the site will be required daily. Periodic adjustments to meet flow conditions will be needed to ensure proper function. MMD operations staff was consulted regarding whether existing staff could assume these duties. Because the frequency of gate adjustment would likely increase during the flood season when flows are most variable, this period will most likely coincide with upstream flood operations at MMD when operations staff are burdened by emergency operations. As a result, additional labor in the form of an operator would be needed to provide daily monitoring at the site. This individual would monitor gate heights, adjust as necessary and also perform duties related to debris and sediment management. Additional effort is likely to be needed from the Water Management section at the Seattle District Office. The new barrier will require monitoring by this staff in order properly manage flow to the Corps' new trap, CWA flume, and MIT hatchery.

Additional labor would be required in the form of a mechanic to monitor, repair and replace mechanical failures and damage that occurs in the course of operations.

# 4 AFFECTED ENVIRONMENT

## *4.1 Geology*

The proposed project is located approximately 45 miles from Mount Rainier. The existing barrier structure at the project site occupies a portion of the White River Valley just inside the western mountain front of the Cascade Range. This portion of the range is generally characterized by smoothly rounded mountain ridges with a thick mantle of colluvium and residuum.

Between 15,000 and 13,500 years ago, glacial ice moving south from Canada, the Vashon Glaciation, invaded the Puget Sound lowland. At its maximum extent the glacier occupied a position adjacent to the northwest flank of Mud Mountain, initially impounding a lake in the older, broader White River Valley into which silts and very fine sands were deposited. Glacial streams deposited a thick fill of sand, gravel, and boulders in the valley, shifting drainage against the south valley wall. The top of the outwash fill attained an elevation of about 1,350 feet and extended 4 to 5 miles upstream. The White River cut an "inner" valley into this fill of glacial outwash and lake beds. The portion of the stream against the south valley wall cut a steep-sided, 2-mile-long canyon partly into the underlying bedrock.

About 5,700 years ago, a major mudflow off Mount Rainier, the Osceola Mudflow, discharged down the partly cut valley, flooding over the top of the outwash surface and down the northwest flank of Mud Mountain, and leaving a mantle of boulder, sand, and clay over the entire Mud Mountain-Scatter Creek upland area. Final cutting of the "inner" valley then continued to its present stage, though interrupted by short periods of aggradation. At least one of these depositions appears to have been caused by a major landslide from the north side of the valley (which is the right side when looking downstream), 0.5 mile above the dam. Remnants of fill terraces of recent White River alluvium along the lower flanks of the “inner” valley substantiate these events (USACE 1976).

### 4.1.1 Sediment

The White River is a large, powerful stream fed in its headwaters at Emmons Glacier on Mount Rainier. The river’s name derives from its characteristically high spring and summer turbidity, which gives its waters a milky color and transports a great deal of sediment, especially at high flows. All sediment is currently passed over the existing barrier structure or carried into the CWA flume and into one of several settling basins operated by CWA.

The amount of sediment transported into the reservoir varies from only small quantities at river flows below 2,000 cfs to large quantities following flood events. The White River annual suspended sediment load at Buckley ranges from 100,000 tons per year to 1,000,000 tons per year with an average of 500,000 tons per year. The average annual bedload at Buckley is 20,000 tons per year with a minimum of 6,000 tons per year and a maximum of 56,000 tons per year. Sediment is trapped in the reservoir in the winter due to winter floods, high pools and low velocities in the pool. Much of the sediment passes through the dam in the spring however, on average, about 30,000 cubic yards of this sediment was permanently deposited in the reservoir per year between 1951 and 1993.

River sediment and composition at the project site are currently altered from the natural condition. The existing barrier structure retains fine material behind the structure, particularly on the right bank where currents are slowest. Material accumulated behind the barrier structure is transported only when the existing barrier structure is damaged or when portions of the structure are removed. Downstream sediment accumulations are most noticeable on the right bank and can impede adult access to the White River Hatchery.

## *4.2 Water Quality*

### 4.2.1 General

Chapter 173-201A Washington Administrative Code (WAC), Water Quality Standards for Surface Waters of the State of Washington, classifies the “White River from the mouth upstream to latitude 47.2348 longitude -122.2422 (approximately RM 4.5) as a Salmonid Spawning, Rearing and Migration Aquatic Life Use. The White River from latitude 47.2348 longitude -122.2422 (approximately river mile 4.5) to MMD (river mile 27.1) is classified as a Core Summer Salmonid Habitat Aquatic Life Use. From MMD upstream to the West Fork White River at latitude 47.3699 longitude -121.6197, the White River is classified as a Core Summer Salmonid Habitat Aquatic Life Use. Upstream of the confluence with the West Fork, the White River is classified as a Char Spawning and Rearing Aquatic Life Use. Water quality standards for the various use designations applicable to salmonids potentially affected by the proposed action on the White River are presented in Table 3. Although Washington State designated the char spawning and rearing use and associated temperature standard of 12 °C, there currently are no waters designated for this use in the White River watershed.

WDOE listed several segments of the lower White River, downstream of MMD, as water quality impaired for temperature and pH, and placed these segments on the 2012 Section 303(d) list of Category 5 impaired waters that require a total maximum daily load (TMDL) analysis. Temperature and pH impairments were identified at several locations between the mouth of the White River and river mile 9. Currently, a TMDL study for pH is ongoing for the lower White River. A TMDL study for temperature has not yet been approved by WDOE. Approved TMDLs for the lower White River include a bacteria TMDL, approved in 2011 (WDOE 2011), and a 5-day BOD and ammonia TMDL approved in 1993 and 1994 (WDOE 1994).

WDOE has not listed any segment of the upper White River upstream of MMD as Category 5 water-quality-impaired waters requiring a TMDL analysis. However, several drainages in the upper White River watershed were determined to be impaired for sediments and temperature resulting in an Upper White River Watershed Sediment and Temperature TMDL approved in 2006 (WDOE 2006). Other water quality issues in the White River watershed upstream of MMD include natural turbidity associated with the glacial nature of the system, increased peak flows, debris flows, and loss of riparian habitat associated with forest management in the basin (WDOE 1998), as well as the above mentioned increased sediment loading and temperature loading from several drainages in the basin (WDOE 2011). In the White River basin upstream of MMD, the USFS, Weyerhaeuser, and Washington Department of Natural Resources own or manage 109,000 acres, 68,000 acres, and 7,000 acres, respectively (WDOE 1998). This equates to approximately 83 percent of the basin under forest management.

**Table 3. Freshwater Designated Uses and Critical Applicable to Salmonids in Western Washington (WAC 173-201A-200)*. White River specific uses including core summer habitat, and salmonid spawning and rearing.****

| **Category** | **Temperature Highest 7-DAD Max** | **Dissolved Oxygen Lowest 1-day minimum** | **pH Units** | **Turbidity NTUs** |
|---|---|---|---|---|
| Char Spawning and Rearing* | 12°C (53.6°F) | 9.5 mg/L | pH shall be within the range of 6.5 to 8.5, with a human-caused variation within the above range of less than 0.2 units. | 5 NTU over background when the background is 50 NTU or less;<br>or<br>A 10 percent % in turbidity when the background turbidity is more than 50 NTU. |
| Core Summer Salmonid Habitat* and ** | 16°C (60.8°F) | 9.5 mg/L | Same as above. | Same as above. |
| Salmonid Spawning, Rearing, and Migration* | 17.5°C (63.5°F) | 8.0 mg/L | pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 units. | Same as above. |

| Category | Temperature Highest 7-DAD Max | Dissolved Oxygen Lowest 1-day minimum | pH Units | Turbidity NTUs |
|---|---|---|---|---|
| Salmonid Rearing and Migration Only | 17.5°C (63.5°F) | 6.5 mg/L | Same as above. | 10 NTU over background when the background is 50 NTU or less; or A 20 percent increase in turbidity when the background turbidity is more than 50 NTU. |
| * *http://apps.leg.wa.gov/WAC/default.aspx?cite=173-201A-200* | | | | |
| ** WDOE (2006) established a lower temperature criterion of 13 °C from September 15 to July 1 for the White River between the Lake Tapps tailrace and diversion structure (excluding the portions within the MIT Reservation) to provide additional protection for salmonid spawning and incubation. | | | | |

### 4.2.2 Water Temperature

In general, the temperature of the White River does not exceed 16° C in the project area. Because MMD holds a pool mainly during fall-winter flood events and is operated as run-of-river for most other times, it has little impact on the water temperature in the White River during the critical summer time period. However, water temperatures increase downstream in the lower White River and temperature is listed on the 2012 303(d) list as impaired from about the mouth to RM 9.0 (WDOE 2012). White River temperature monitoring was conducted by WDOE at RM 1.8, about 1.5 miles downstream of the Lake Tapps tailrace canal, in 2001, 2004, and 2006, and at RM 8 within MIT lands in 2002, 2003, and 2008 (Ebbert 2002, Zentner 2005, Bell-McKinnon 2006, Ward 2008). Prior to cessation of hydropower operations in 2004, the White River temperature ranged as high as about 21o C in July and August (WDOE 2005). In July and August of 2001, the water temperature ranged up to about 20o C at RM 1.8 and up to about 21o C at RM 8.0, and exceeded the state water quality criterion of 17.5° C 7-day average daily maximum (7-DADMax). After 2004, diversions from the White River into Lake Tapps Reservoir and releases from Lake Tapps Reservoir through the tailrace canal were significantly reduced (from 2000 cfs to less than 1000 cfs) under the Interim Agency Operating Agreement. Reducing diversions from the White River to Lake Tapps Reservoir provided additional water in the river for both the MIT Reservation Reach and the Lower White River. Although PTI personnel indicate this has allowed for lower summertime temperatures, there isn't any data that clearly supports this.. However, riparian development places this indicator "at risk."

Upstream of MMD, watershed activities such as forestry, roads, recreation and riparian vegetation disturbances can impact landscape characteristics and may cumulatively act to increase water temperatures. These watershed activities were noted by the Temperature TMDL as probable sources of temperature impairment in the upper White River watershed (WDOE 2003). For the mainstem White River above the dam, there are unvegetated banks in the inundation zone, so shading may be affected. However, the reach above and below the dam also contains steep walls and slopes that shade the river even on midsummer days. Consequently, water temperatures in the mainstem White River immediately above and below the dam are cool and generally do not exceed 16° C. The indicator above MMD is “properly functioning”.

Temperatures recorded from 1994 to 1998 at the USGS station near Buckley, downstream of MMD, are slightly higher than temperatures recorded at a station a short distance below the mouth of the Clearwater River, at the head end of MMD project lands. Given that the downstream location is approximately 10 river miles below the upstream location, that the river between these points is wide and not well shaded, and that the lower station is at a lower elevation, the mean temperature increase observed between the two stations (1.6°F for data from 1994 to 1998) is not surprising. The lower station has not recorded any temperatures in excess of the Class A water quality criterion of 64°F.

### 4.2.3 Turbidity and Suspended Sediments

Large amounts of glacial flour are conveyed from Mt. Rainier from glacial melting in warmer months, causing considerable accumulation of fines in the mainstem White River. This is likely to increase during the next few decades as climate change causes continued or accelerated retreat of glaciers. Any impoundment has at least temporarily caused sediment to accumulate in the reservoir that forms; this gradually erodes over time as flows drop and channel cutting combined with rain transports it out. Some scour and removal of accumulated sediment would occur in the winter, when glacial melting is not taking place, and water is clearer.

There is also some accumulation of coarser sediments behind the fish passage barrier at Buckley and below the barrier near the MIT fish trap entrance; they are washed through from time to time, particularly when the flashboards are blown out by debris in high flows.

Turbidity concentrations in the White River are elevated compared to other Puget Sound rivers due to the glacial origins of the river. Additionally, in the upper White River watershed, activities such as forestry, road building, recreation and riparian vegetation removal have resulted in increased sediment loading from the watershed to the White River (WDOE 2003). Turbidity concentrations in the White River are measured upstream and downstream of MMD. Data show that baseline turbidity concentrations are greatest in the White River during the summer months, likely because the river naturally carries glacial meltwater sediments. WDOE has not listed the White River above or below MMD as water quality impaired for sediments. Despite its natural origins, the high amount of fine sediment in the White River means that this indicator is “not properly functioning,” and it impacts the usability of the mainstem White for spawning and egg incubation.

The White River has a significant sand/gravel/cobble bedload and a large suspended sediment load (WDOE 1999). The suspended sediment from glacial meltwater during the spring, summer and fall reduces the light penetration in the water column and limits biological productivity and algal growth (Ebbert 2002). Further, the river also has an exceeding low buffering capacity which limits its ability to assimilate pollutants.

### 4.2.4 Chemistry

Several areas of the lower White River from the mouth to RM 9.0 are on the 2012 WDOE Section 303(d) Category 5 list for pH and require a TMDL (WDOE 2012). Past monitoring conducted by WDOE between 1996 and 2003 documented pH exceedances of the 8.5 maximum at many locations in the lower White River (Ebbert 2002, 2003; Stuart and Brett 2001). The primary cause of elevated pH levels in the lower White River was attributed to the increased growth of periphyton caused by excessive nutrient inputs. Increased algal growth can result in diurnal cycling of pH because during daylight hours algae consume carbon dioxide ($CO_2$) in the water resulting in an increase in pH levels. WDOE measured pH in the lower White River between August and October 2012 at several locations, including RM 28 (at the USGS gage house downstream of MMD) and RM 3.7 (just upstream of the Lake Tapps tailrace) (WDOE 2012b). Preliminary data analysis shows that pH levels at RM 28 (downstream of MMD) were good and ranged from 6.99 to 7.7, while pH levels measured downstream at RM 3.7 (upstream of Lake Tapps tailrace) were higher and ranged up to 8.71. Nutrient inputs to the lower White River from point sources such as waste water treatment plants and industrial discharges, and non-point sources such as agricultural runoff and stormwater runoff, likely result in the increased algal growth and higher pH levels measured in the Lower White River.

### 4.2.5 Land Use and Potential Pollution Sources

Land in the project vicinity can be characterized as either natural or rural. Public land use in the vicinity of the barrier structure is limited to residential activity and intermittent visitation by trail users. Land use on the right bank, is limited to the propagation of Chinook salmon at the hatchery. The hatchery grounds are comprised of several outbuildings concrete ponds, and cleared land. Bordering the upstream and downstream areas of the hatchery are natural areas owned by CWA and not developed and not actively logged. On the floodplain terrace upslope of the hatchery is a series of rural homesteads with associated pastures and landscaping. The road that services the homes and the hatchery is traveled primarily by residential vehicles as no notable industry exists in the surrounding area.

On the left bank of the project area CWA has several outbuildings and support facilities for the operation and maintenance of the diversion. The City of Buckley and several new suburban home tracts are located on the floodplain terrace of the left bank. The City of Buckley has allowed home development along much of the left bank floodplain terrace. Older homesteads, a National Guard Armory and school border the newer developments. The road that services the fish trap is controlled by PSE and so gets little public or industrial traffic. An existing PSE building located on the left bank has been identified as containing soil contamination as a byproduct of discontinued wood treatment activities and has been remediated.

In general, land use around the project area is limited to activities immediately relevant to the fish trap, hatchery and flume operations and few visitors walk up the shoreline to visit the barrier dam. Light human development on both banks could contribute to slight temporary increases in air pollution but there are no notable sources of significant air, noise or water pollution

## 4.3 Hydraulics and Hydrology

The White River originates from Emmons glacier on Mount Rainier and flows west for 57 miles before joining the Puyallup River near Sumner, Washington. Major tributaries include the Greenwater, Clearwater, and West Fork White rivers. The White River is fed by glacial and snowmelt, and exhibits a strongly bimodal hydrograph, with peak flows occurring in May and June as a result of snowmelt and in November, December and January as a result of seasonal rains.

White River minimum instream flows are addressed as follows: (1) in a 1910 Pierce County Superior Court decree requiring the Pacific Coast Power Company (predecessor to Puget Sound Power and Light [Puget Power]) to maintain instream flows of at least 30 cfs below the diversion weir (FERC 1992); (2) in a 1986 settlement agreement between Puget Power and the MIT that established a minimum instream flow for the Reservation Reach of 130 cfs and a 3,650 second-foot day (sfd) water budget for fish transport; (3) in a March 2005 letter from NMFS addressed to the Corps establishing minimum flows, referred to in this document as the "Interim Agency Flows" (NMFS 2005a, b, or c?); and (4) establishment of new minimum instream flows for CWA water diversion for Lake Tapps by WDOE (2010).

The instream flows for the White River are presently measured at the U.S. Geological Survey (USGS) gage No. 12099200 above Boise Creek at Buckley. Both streamflow and pool level have been monitored on a daily basis for many years. Both current and historic data on reservoir inflow and outflow, forebay elevation and storage are available at [http://www.nwd-wc.usace.army.mil/perl/dataquery.pl?k=mud+mountain+dam.](http://www.nwd-wc.usace.army.mil/perl/dataquery.pl?k=mud+mountain+dam)

Since the purpose of MMD is to provide flood risk management, pool levels have varied widely over time. Mud Mountain's normal winter operation is to maintain its pool near empty until flows reach a specified level and then begin storing water so that the flows at the Puyallup River near the Puyallup control point do not exceed 50,000 cfs. Most flood events are associated with a substantial increase in pool level that persists for periods ranging from a few days to a few weeks, to be followed by a return to a low pool. Over 90 percent of the time, pool elevations are held at between 900 and 990 feet, resulting in reservoir inundation that extends up to approximately 0.5 mile up valley from MMD.

On more than one occasion, pool levels have been above 1,080 feet for a period of weeks. The first such occasion was in 1974, when a pool was stored and held between elevation 1,100 and 1,150 feet from the beginning of May to the beginning of August to evaluate seepage through the right (north) rim of the reservoir. The second occasion was in 1996 when the record pool was stored in response to a large flood event. For this event, the pool was near 950 feet prior to the storm and filled to a maximum of 1,196 feet, using 89,000 acre-feet, or 80 percent of the total available flood control space. This storage reduced the Puyallup flows at Puyallup from an unregulated peak estimated at 76,000 cfs to a regulated flow of 48,000 cfs. The Mud Mountain pool is typically maintained empty, unless storage is required during a flood event, so pools above 1,080 feet occur infrequently (based on historical operations, the pool is below elevation 1,080 feet greater than 95 percent of the time).

Until recently the river channel below the Buckley area (RM 23.3) was affected by a series of concrete slabs as a grade control structure to protect Tacoma Water's Municipal Water Supply Pipeline 1. The structure and pipeline created sediment deposition and scour conditions up to 1-mile upstream and downstream of the site and created a barrier to fish passage under certain conditions. In 2005 a new pipeline crossing was completed with removal of the existing concrete slabs and burial of the water supply pipeline; this resulted in new channel equilibrium and removed of a fish passage barrier.

The lower White River from the fish passage barrier to the confluence with the Puyallup was surveyed for aquatic and riparian habitat conditions in 2004 (Pierce County 2012). The habitat conditions were characterized in seven river reaches as shown in Table 4.

**Table 4. Survey of stream reach conditions in lower White River mainstem (Pierce County 2012)**

| Reach Designation | Reach Description | Reach Length (feet) | Channel Type[a, c ,d] | Percent Gradient | Bankfull Width (feet) | Aquatic Habitat[a] | Riparian Corridor[b] |
|---|---|---|---|---|---|---|---|
| 0031-01 | Mouth to confluence with Dieringer Canal | 19,500 | Large contained | 0.75 | 80 | Poor | Fair |
| 0031-02 | From confluence with Dieringer Canal to Stewart Rd. Bridge | 6,900 | Large contained | 1 | 165 | Fair | Fair |
| 0031-03 | From Stewart Rd. Bridge to bluff at Auburn Game Farm Park | 18,600 | Flood plain | 1.25 | 200 | Fair | Fair |
| 0031-04 | From bluff at Auburn Game Farm Park to pipeline crossing on MIT reservation | 12,000 | Flood plain | 1.75 | 200 | Fair | Fair |
| 0031-05 | From pipeline crossing on MIT reservation to RM 14.7 | 18,000 | Flood plain | 1.5 | 500 | Good | Fair |
| 0031-06 | From RM 14.7 to RM 19.0 | 22,800 | Flood plain | 1.75 | 300 | Fair | Fair |
| 0031-07 | From RM 19.0 to Buckley fish passage barrier | 27,600 | Flood plain | 2 | 200 | Fair | Good |

[a] ***Aquatic habitat*** condition is based on a numeric average derived from the Tri-County aquatic habitat ratings averaged using poor = 1, fair = 2, and good = 3. Average poor ratings were less than 1.67 and average good ratings were greater than 2.33

[b] ***Riparian corridor*** condition is based on a numeric average derived from the Tri-County riparian corridor ratings averaged using poor = 1, fair = 2, and good = 3. Average poor ratings were less than 1.67 and average good ratings were greater than 2.33

[c] ***Floodplain***: Low-gradient depositional channels. Substrates are typically small gravel to cobble, and the bedform is typically regularly spaced pool-riffles. LWD is important for forming pools and providing cover. These channels migrate freely across alluvial floodplains and off-channel habitats are normally abundant;

[d] ***Large contained***: Low to moderate gradient channels that are moderately to deeply incised. Stream power is moderate to high with coarse substrates. LWD is easily transported and generally located along channel margins. These channels rarely have extensive off-channel habitats

The lower five miles of the river (RM 0-5, Reaches 1-2) is constrained in a steeply incised channel; banks are steep and the reach is mostly run (deep with no pools). There is some rearing habitat for juvenile Chinook, steelhead and coho and limited spawning areas for Chinook, pink and chum salmon. The next six miles (RM 5-11, Reaches 3-4) has moderate pool and riffle habitat, more spawning area, and a few side channels with some woody debris accumulation. The next three miles (RM 11-14, Reach 5) has the best spawning and rearing habitat for salmonids available below the fish passage barrier. The main channel is braided as is typical of a glacial river, with numerous side channels. Numerous pools occur at junctures of channels and bends in the river, with a moderate number of log jams, with a well-forested floodplain. Some riffles in this reach of the river may be too shallow for adult salmon (Chinook) spawner passage during periods of low water. The next four miles (RM 14.7-19) has fair spawning gravel and some deep pools where braids in the river join or where the river bends and comes into contact with the valley walls. Fish use is similar to that of Reaches 5 and 7, but there is substantially less side channel habitat present than in Reach 5. The last five miles (RM 19-24, Reach 7) to the Buckley fish passage barrier is slightly higher gradient than the previous reach, with very little side channel habitat. Most of the stream channel consists of runs, with little LWD or pools present.

Current MMD operations are to pass inflows when the risk of downstream flooding is low. During this operation, there is no impoundment of a reservoir; the inlet gates on the two regulation tunnels are left sufficiently open to not impede water flow and project outflow is the same as inflow to MMD.

During flood events, the project has been operated to provide flood risk management to the downstream basin. This involves operating the gates to reduce outflow as needed to mitigate downstream flooding. During these operations, water is stored in the reservoir as needed to mitigate downstream flooding, with the primary objective of keeping the lower Puyallup River within channel capacity (currently about 50,000 cfs) and the secondary objective of mitigating flooding along the lower White River. As the downstream threat of flooding begins to subside, stored water is released to empty the reservoir in preparation for future flood events. Figure 22 shows the MMD discharge capacity of the dam (i.e., gates on both tunnels fully opened) based on pool level upstream of the dam.

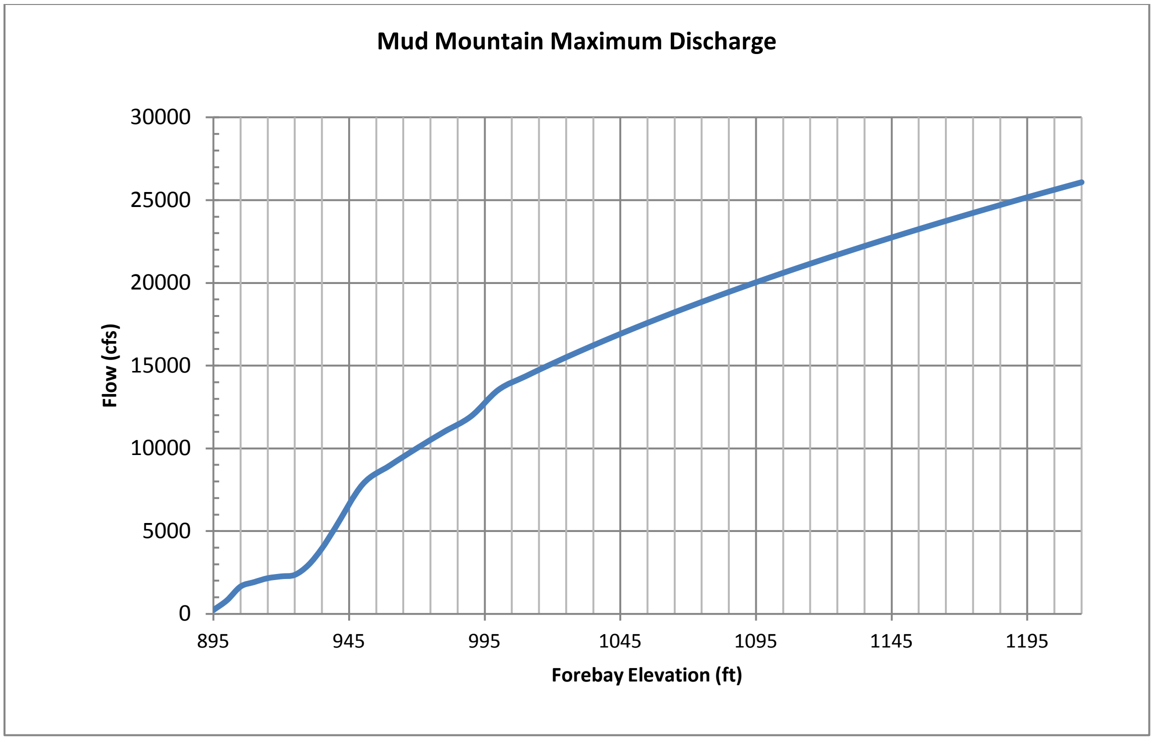


**Figure 22. MMD discharge capacity based on forebay pool level, with all gates fully open.**

This indicator is functioning at three levels. Upstream of the inundation zone, the indicator is "properly functioning" with no alterations to the flow regime occurring. Within the inundation zone, this indicator is "at risk" since natural unaltered flows would cause higher river stages within the narrow canyon, though stages are higher with dam operation. Below MMD, the indicator is "not properly functioning" due to changes in peak flows associated with MMD. Since the tunnels restrict outflows, alterations to peak flow are an unavoidable consequence of presence of MMD, even without regulation. That has implications for channel morphology, floodplain function, wood transport, and bedload and sediment dynamics. However, base flow alteration is minimal, as discussed in this section. Flood risk management operations, and impoundments for other purposes do alter flows relative to inflow, reducing them as water is stored, and increasing them as the pool is drained. Particularly, impoundment at MMD for diversion barrier repairs results in flows of 350 cfs at the diversion; this is below minimums.

## *4.4 Vegetation*

Vegetation in the White River basin can be generally divided into three categories: coniferous dominated upland vegetation characterized by high elevation upper watershed forests; deciduous dominated upland vegetation characterized by lowland forests of mixed age; and mixed riparian vegetation characterized by both coniferous and deciduous stands of mixed size and age colonizing the floodplain. Within the project area, the dominant vegetation is mixed riparian.

The riparian forests of the project area include conifer forests growing on terraces above the active floodplain, and hardwood or mixed stands growing on the active floodplain. Riparian species such as willow (*Salix sp*.), red alder (*Alnus rubr*a) and cottonwood (*Populus trichocarpa*) and other plant species quickly become established on new surfaces created by erosion or deposition of sediment during flood events. Remnants of logged old growth coniferous forests are evident in the surrounding terrain. Understory is principally blackberry and other species often found in disturbed upland areas.

Large woody debris (LWD) levels within the inundation zone and downstream of MMD is underrepresented in areas where LWD is likely to provide substantial habitat benefits. Some woody debris passes through MMD or becomes mobilized into the channel within the project area but at volumes much less than would be predicted prior to human development. In the absence of flood events or other natural disasters, the natural succession of PNW forests is one from deciduous to coniferous species. In floodplains such as the project area, floods, channel changes and sediment movement often keep this succession from occurring.

## 4.5 Wetlands

A wetland delineation of the project area found wetland conditions absent along the immediate project area on both banks upstream of the current barrier structure. However, wetland conditions did begin to appear along the interior (landward) alignment of the levee upstream of the hatchery complex. Downstream of the existing barrier no wetlands were identified in the riparian complex present (Tetra Tech, 2012). Corps biologists did identify wetlands adjacent to the right bank access road in one spot and several swales between the river and the existing access road.

## 4.6 Aquatic Resources

The amount of spawning habitat for salmon and trout available above MMD is estimated at 578 miles. This number includes 203 stream miles of the White River and the four rivers that feed into it; the Clearwater, Greenwater, Huckleberry and the West Fork of the White. The number also includes the tributary miles that feed into these streams; estimated at 375 miles (WDFW, 1974). Facilitating fish passage from downstream reaches to the watershed upstream of the MMD is critical from an ecological perspective because organisms within all trophic levels benefit from salmon returning to the watershed.

### 4.6.1 Anadromous Fish

The White River produces Chinook, pink, chum, and coho salmon in addition to winter steelhead and bull trout. Sockeye salmon adults are also observed annually but there is some question whether they are naturally sustaining natal run. A summary of salmon and steelhead usage in the White River subbasin is presented in Table 5.

**Table 5. Profiles of White River Basin Salmon and Steelhead stocks**

| Stock | Major Subbasin(s) | Stock Status | Stock Origin |
|---|---|---|---|
| White River Spring Chinook | White River<br>Clearwater River<br>W Fork White River<br>Greenwater River<br>Huckleberry Creek | Critical | Native |
| White (Puyallup) River Summer/Fall Chinook | White River<br>Clearwater River<br>Greenwater River<br>Huckleberry Creek | Unknown | Unknown |
| White River Coho | White River<br>Clearwater River<br>Greenwater River<br>West Fork White River | Healthy | Mixed |
| White River Pink | White River<br>South Prairie Creek | Healthy | Native |
| White (Puyallup) Winter Steelhead | White River<br>Clearwater River<br>Greenwater River | Depressed | Native |
| Source: Washington Department Fish and Wildlife 2002 | | | |

**Chinook Salmon**. Two genetically and behaviorally distinct runs of Chinook salmon use the White River system. A spring run, which spawns above MMD, and a summer/fall run, which spawns mainly below the White River Fish Passage Barrier (RM 24.3) but also spawns above MMD, are present. The two runs overlap in run timing Spring Chinook arrival beginning in June and can extend into late summer, while summer/fall Chinook may begin arriving in late July and continue to arrive into October. Spring Chinook broodstock may be collected for the MIT hatchery into October. There have also been occasional observations of adult spring Chinook in the Carbon River through the 1980's. It is not known if these adult Chinook are strays from the White River or remnants of a Puyallup River spring Chinook stock.

The 2002 WDFW stock status report for the White River spring Chinook states there is no evidence that the population has re-established itself naturally or achieved self-sustainability. Stock status remains Critical in 2002 due to chronically low escapement values and questions about the origin of Chinook returning to the White River and the sustainability of the increased escapements (WDFW Salmonscape website, accessed June 19 2013). The earliest return records for White River spring Chinook come from the Buckley fish trap in 1941 (Kerwin, 1999). Adult returns from 1942 to 1950 averaged 2,953 fish. After 1950 Chinook declines continued until 1986 when only 8 fish returned. In the decade after (1986 to 1996), naturally spawning fish began steadily increasing, averaging 353 adults. Returns since 1996 show returns are higher still (Figure 23).

White River wild and hatchery-raised spring Chinook salmon are listed as threatened under the ESA (NMFS 1999); fall Chinook in the White are part of the same listed Chinook ESU. In 1992 and 2002, the WDFW (WDFW and WWTIT 1994; WDFW 2002) considered the White River spring-run Chinook salmon status to be critical, based on chronically low escapement levels. That accounts for record lows of only 6-26 fish transported per year at Buckley from 1982 to 1986, but also includes counts trending mostly upward from the early 1990s. Observed counts of wild Chinook salmon (adults and jacks) at the barrier structure include historic highs of 5,431 fish and 4,603 fish during the second and third year of trap operation (1942, 1943), and recent highs of 4,565 and 4,634 (2005, 2006) of wild and a large proportion of hatchery fish. The counts for the past 5 years have ranged from a low of 1811 fish in 2014 to 5500 in 2013, with additional fish collected for the White River hatchery (e.g., 811 in 2012). The counts are difficult to interpret for fish trends, as the counts represent a variety of hatchery rearing types that have been developed over the recent past, and include counts of small Chinook (jacks). The fish count spreadsheets were updated in 2014 to reflect this spectrum of types or sources of Chinook salmon. The counts of Chinook in odd-years are not considered very accurate as the large numbers of pink salmon make it difficult to identify individual Chinook.

Various estimates of potential natural spawning Chinook salmon runs in the White River include 1) an Ecosystem Diagnosis and Treatment (EDT) analysis estimate of 3,225 Chinook, assuming that the White River diversion is discontinued; and 2) a historic capacity estimate of possibly 15,000 Chinook in the lower White and 6, 700 in the upper White River (SSPS 2007). For planning purposes for sizing and operating the new fish trap, the NMFS and Corps identified a future fish transport number of up to 5500 adult Chinook salmon.

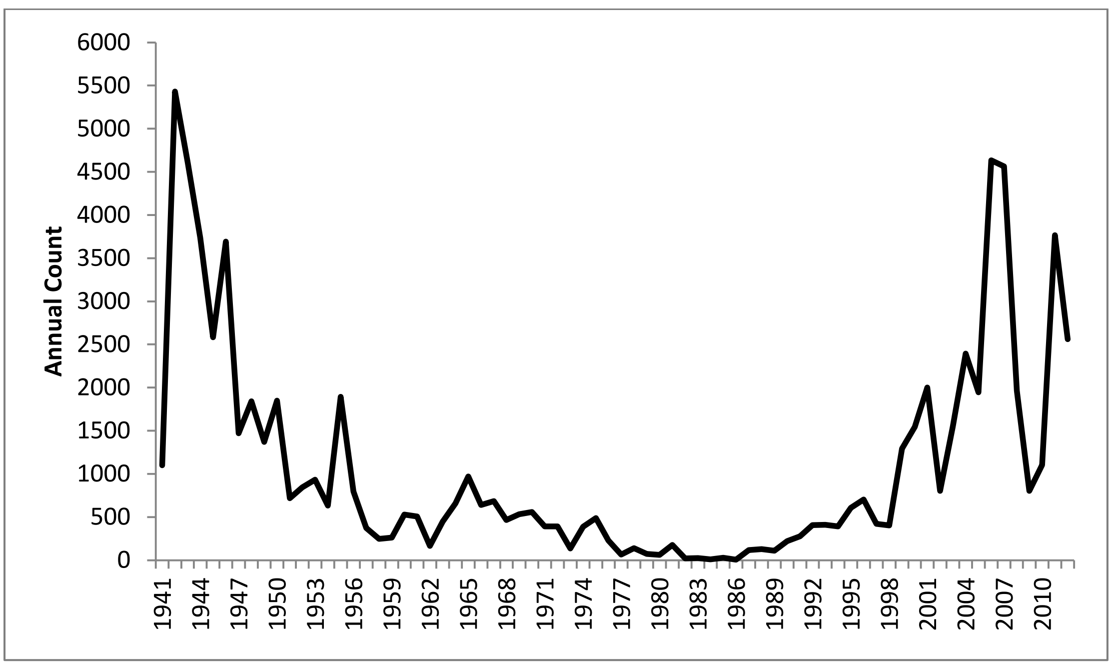


**Figure 23. Chinook returns (including hatchery and summer/fall) transported above MMD. Count includes both adult and sub-adult (jacks) returns for the period of 1941-2012 (from USACE fish counts and Marks et al 2011).**

Critical habitat has been designated (NMFS 2005b) for Chinook salmon to include the lower White River from its mouth to the barrier dam, and then upriver from MMD to the upper White, including the West Fork White River, Huckleberry Creek, and Greenwater River. A Primary Constituent Element (PCE) of Chinook designated critical habitat is "(3) Freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival."

**Coho Salmon**. Adult coho salmon enter the White River from July through mid-January (Williams et al. 1975). Puget Sound coho salmon are not listed under the ESA but are harvested by tribal and recreational fisheries. Migration is generally timed with the onset of the fall freshets, with peak entry occurring in November for Washington (Myers et al. 1998). As a general rule, the earlier fish begin their migration the farther upstream they spawn within the basin (Weitkamp et al. 1995). In British Columbia it was found that the majority of returning coho salmon were 3-year-olds, having spent approximately 18 months in both freshwater and in the ocean (Weitkamp et al. 1995). An estimated 59.5 miles of habitat within the White River basin are used by coho salmon during one or more life history stages (StreamNet 2001.) In the White River basin, most spawning takes place in the White, West Fork White, Clearwater and Greenwater Rivers. The White River coho salmon run had been the largest salmon run at the barrier structure until 2005 when pink salmon returns first exceeded coho counts. Fish counts at the barrier structure include historic lows of 300-400 fish in the late 1970's to mid-1980's. The run has been on an increasing trend since the mid-1990's. Over the past five years counts have ranged from 4,556, 9,801, and 9490 (2009, 2010, 2014) to record highs of 23,770 and 23,516 (2011, 2012) (Figure 24).

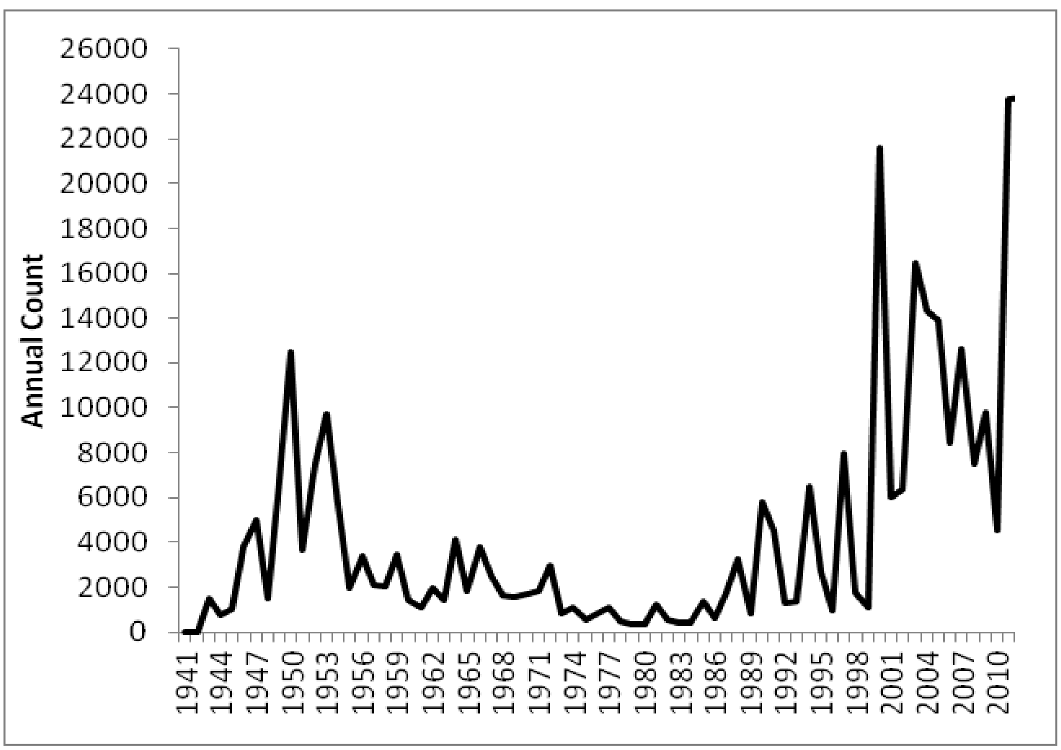


**Figure 24. Coho salmon returns transported above MMD for the period 1941-2012 (data source PTI and USACE fish counts).**

The White River coho salmon stock was assessed as healthy in 1992. The stock was rated healthy in 2002, because escapement values were at or considerably above the values observed prior to 1992 and the number of spawners is fairly robust. The stock origin is mixed, meaning the stock is composed of hybridized native and nonnative stock, or a native stock that has undergone substantial genetic alteration. The production type is composite, sustained by both native and artificial production. The fitness of the native stock may have been affected by introductions of nonnative stocks, but no specific changes have been documented (WDFW and WWTIT 1994, WDFW Salmonscape website, accessed June 19 2013).

**Pink Salmon**. Pink salmon are the most abundant salmon species in Puget Sound. Overall they are probably the most ecologically beneficial of any salmon providing marine nutrients and food resources to entire watersheds (such as the nutrient-poor White River) at levels that would never occur without these runs. Negative impacts also occur as juvenile pink salmon compete with other types of salmon for food in the nearshore of Puget Sound. Pink salmon have a two-year life cycle, returning as adults in odd numbered years in very large numbers to MMD fish trap. Puyallup River pink salmon have been considered native and healthy (WDFW and WWTT, 1994, WDFW 2002). Adult pink migration and spawning coincides with Chinook, with pinks entering the river as early as mid-July, and spawning from late August through mid-November. Like chum, pinks are mass spawners; frequently utilizing the habitat found in the placid flows of primary side channels and secondary ephemeral side channels established along the major mainstem rivers. Peak spawning occurs from late September to early October, with fry emerging from late fall through winter.

Since the construction of the MMD fish trap facility in the late 1930's, pink salmon were only observed at very low numbers in the White River at Buckley one or two years until 2001 when numbers began to increase steadily. This is corroborated by Salmon and Steelhead Stock Inventory (SASSI) distribution maps, which do not list the White River as a primary spawning area (WDFW WWTT, 1994). In 2003 the first substantial numbers of pink salmon returned to the facility, which coincided with the removal of TPU pipeline, which acted as a low-head sill in the in the river. It is thought that the removal of the pipeline allowed pink salmon to migrate freely up to MMD trap. That season over 13,000 pink salmon were trapped and hauled upriver. Since then, the number of pink salmon transported from the trap has steadily increased to 33,000 in 2005, 127,000 in 2007, 540,000 in 2009, 622,000 in 2011, and 465,000 in 2013. These numbers do not include a large proportion of pink salmon that are not transported and either spawned immediately below the trap or died prematurely. Only gross estimates, in the range of 100,000-400,000, are available on the non-transported fish. The returning pink salmon are mixed with smaller numbers of migrating bull trout, Chinook salmon and steelhead. The pattern of increasing pink salmon in odd-numbered years in the White River has greatly increased the required operations and maintenance of the fish trap facility, and directly impacts listed species mixed with the returning pinks. The large numbers of fish result in crowding and delay of all fish including ESA listed salmon.

Figure 25 helps put the phenomenal growth of the White and Puyallup River pink salmon run in context, as it shows the total count of Puget Sound pink salmon from these 11 different Puget Sound rivers, with the Puyallup River shown on a separate axis as a percentage of the total annual count. Historically the Puyallup river counts were always 6 percent or less of the total until 2005 when they reached 40 percent of total. In 2011 the White River represented 78 percent of the estimated 729,257 pink salmon in the entire Puyallup River system (WDFW 2012) and 22 percent of the entire Puget Sound pink salmon population. The number of pink salmon trapped at MMD likely underestimates the total number of pink salmon that arrive at the trap. The resource agencies provided information that the return of pink salmon to the Puyallup River in 2009 was 1.2 million, of which the White River may have exceeded 900,000 (75 percent of Puyallup basin) with 540,000 trapped and hauled at MMD. Of the remainder of the run, 200,000 were counted in a small nearby stream, Boise Creek, and an estimated 200,000 fish remained in the river downstream of the Buckley facility (i.e. were not transported) and spawned or died in the river (WDFW et al. 2012).

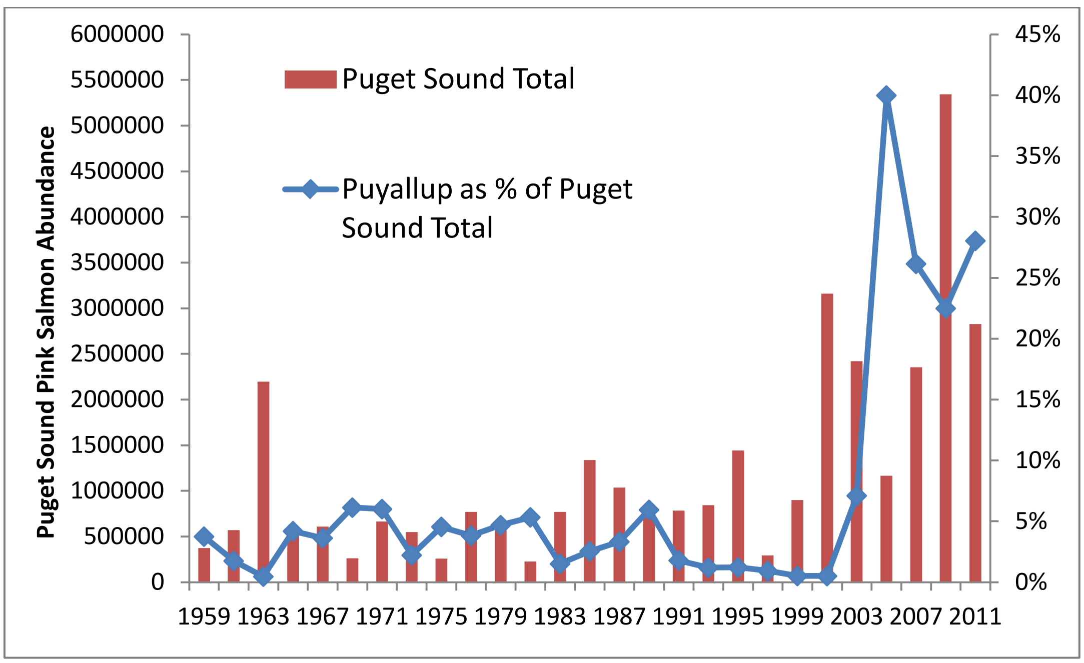


**Figure 25. Pink Salmon Returns for Puget Sound and Percentage returning to Puyallup River, 1959 to 2011.**

**Steelhead**. The White River contains a population of winter run steelhead that are primarily wild in nature though hatchery steelhead have been introduced routinely since 1989 and before. The earliest hatchery transplants were received in 1939. Since that date, hatchery outplants to the White River have been reduced but hatchery origin adults still return to the Buckley Trap. Recent efforts have been instituted to reduce the number of hatchery steelhead from spawning in the upper watershed. Although summer-run fish are captured at the Buckley fish trap every year, it is suspected that summer steelhead in the White River are fish straying from the Green River or Skagit River systems. However, because both winter and summer steelhead are known to use the

White River system, it is presumed that there are steelhead in the system throughout the year (Marks et al. 2008). Fish trap records show a peak in steelhead counts in the late 1980's and a long-term decline since then with a short rise in the last few years. The WDFW status of the stock is rated Depressed in 2002 based on the long-term negative trend and chronically low trap counts since 1992. Fish counts at the barrier structure include historic highs exceeding 1,900 fish (1942, 1946, 1986) and historic lows of 136 and 152 fish (2004, 2005). Steelhead have been collected at the Corps trap since 1941 and have ranged from a low of 50 to over 2,000 fish collected in a single year (Figure 26). In the past five-year period (2010-2014) counts of steelhead have increased to approximately 550 fish per year from the previous five-year period (2005-2009) of 178 fish per year.

Steelhead reside in the White River system through June and start upstream migration in March, with peak spawning occurring in late April to early May. Steelhead usually spawn in upper tributaries, although they commonly use the mainstem of the upper White River (Marks et al. 2008), as well as the area below the barrier structure. In the White River system, fry emerge within four to eight weeks following spawning. Juvenile steelhead rear in fresh water for one to four years, with the majority outmigrating as two-year-old fish to nearshore waters in the spring (Marks et al. 2008; Wydoski and Whitney 2003). The WDFW has conducted genetic work that has indicated most hatchery returns to the trap are strays from the Minter Creek hatchery on the nearby Puyallup River. As a result, returning hatchery steelhead are either transported to the hatchery or released back into the river by State and tribal officials in hopes they will return to the hatchery on their own. White River steelhead were listed as threatened on May 7, 2007 (FR Vol. 72, No. 91).

The MIT hatchery includes an emergency steelhead rearing and release program. According to R. Johnson (MIT, pers. comm., 2013), "The White River steelhead enhancement program began as the "Naturally Spawning Winter Steelhead Pilot Project" with the first adults collected at the Buckley (USACE) trap in 1996. In 2006 the WDFW, PTI and MIT began the White River pilot steelhead supplementation project with the primary goal to restore the steelhead run to a self-sustaining population (Marks et al. 2011). Today, the PTI Fisheries staff collects 10 to 12 pairs of wild, unmarked steelhead adults at the Buckley trap in March and April with production of 25,000-40,000 juveniles at Diru Creek hatchery.

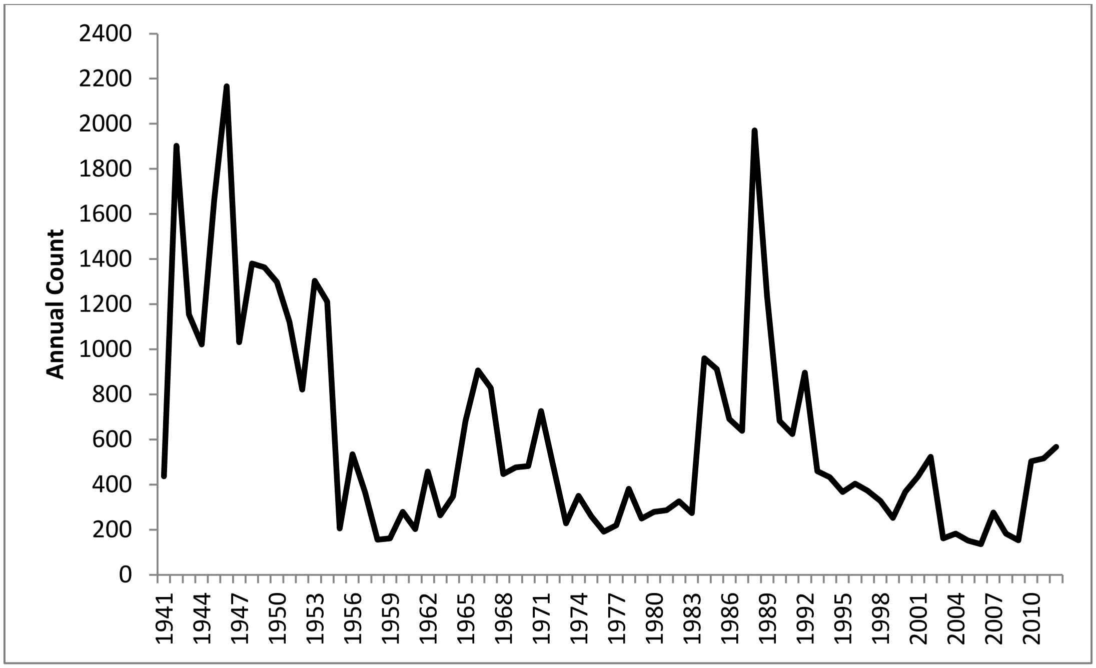


**Figure 26. Steelhead returns transported above MMD for the period 1941-2012. Returns include all wild steelhead (data from USACE fish counts and Marks et al. 2011).**

**Chum Salmon**. Three fall chum stocks, Puyallup/Carbon, Fennel Creek and Hylebos were listed in Salmon and Steelhead Stock Inventory (SASSI) (WDFW and WWTIT 1994, WDFW 2002) but only the Puyallup/Carbon stock is considered native. Both the Fennel Creek and Hylebos chum stocks are of unknown origin. The Fennel Creek and Puyallup/Carbon stocks are considered healthy. Chum salmon are numerous and widespread throughout the lower and mid-river system. Chum have been observed spawning as high as Boise Creek on the White River (RM 23.5). Adult chum salmon enter the Puyallup River as early as the second week in October. In most of the rivers and tributaries, active spawning occurs from the middle of November through the end of January, with peak spawning occurring in mid December. MMD fish trap records show chum to be extremely rare to the trap, with an average of 21 fish per year from 2002-2012 (USACE data), though historically they may have spawned in the lower mile of Boise Creek (Williams et al. 1975). The Tacoma Public Utility pipeline crossing located downstream may have prevented some chum from reaching the project area. This blockage was removed in 2003.

**Sockeye Salmon.** Small numbers of sockeye salmon (<50 adults) occur annually in the White River. The majority of sockeye salmon are observed in the lower river downstream of the diversion structure or in Boise Creek, a tributary to the lower White River (Marks et al 2011). Generally, less than 25 adult sockeye are hauled annually upstream from MMD.

### 4.6.2 Resident Fish

**Bull Trout**. Bull trout (*Salvelinus confluentus*) and Dolly Varden (*S. malma*) are two closely related species found in the Puget Sound region. These two species are similar enough in form and distribution that they are collectively referred to as “native char” by the USFWS and the WDFW. Migratory native char that are found in the White River and that are trapped at MMD have been identified exclusively as bull trout (Baker et al. 2003). Bull trout migrate upstream through the White River reaching the MMD Fish trap throughout the year, but the primary migration period is from June through August when 80 percent of the fish are caught at MMD. Bull trout captured at MMD average 18 inches in size but range from 11-25 inches (Marks et al. 2011). Ten streams in the upper White River watershed above MMD have documented bull trout spawning, including Silver Springs, Silver Creek, No Name Creek, Fryingpan Creek, Wright Creek, Antler Creek, Discovery Creek, Sunrise Creek, Shaw Creek, and Klickitat Creek (Marks et al. 2011). Specific spawning locations are documented by the PTI during their annual spawning survey. Juvenile, sub-adult and adult bull trout may use the lower White River year-round for rearing and foraging.

Bull trout exhibit four life history strategies including resident, fluvial, adfluvial, and anadromous (USFWS 1999a). Within the Puyallup basin, habitat exists for resident, fluvial, and anadromous life history stages (WDFW 1998). Resident forms spend their entire life cycle in their natal stream. Fluvial fish migrate between larger, mainstem rivers and smaller tributaries in which they spawn. Adfluvial fish migrate between lakes and smaller tributaries in which they spawn. Puget Sound anadromous bull trout have a short period of marine residence, exiting rivers in the late winter and early spring, spending 2-4 months in Puget Sound or river estuaries and then returning to freshwater between mid-May and mid-July to either spawn or rear (Goetz et al. 2004). Anadromous bull trout have been documented as residing and using the White River. The Corps has been monitoring bull trout migratory behavior in the lower White and Puyallup rivers and south Central Puget Sound since 2005 using acoustic transmitters and receivers. During that time seven of eleven bull trout migrating back downstream through Mud Mountain have been detected entering tidal waters of the Puyallup River with two migrating beyond Commencement Bay into nearshore areas of central Puget Sound just north of the bay (USACE unpublished data).

White River bull trout are listed as threatened under the ESA (USFWS 1999a). Bull trout were not counted as a separate fish type at the barrier structure until 1990; until that time they were lumped under the category of trout. Fish counts at the barrier structure have been trending upward since the late 1990's after a fish screen was placed in the water diversion then owned by PSE, and now owned by CWA. Between 1990 and 2012, the number of bull trout transported at the Corps trap averaged 43 fish with a low of 14 fish in 2008 to a high of 173 fish in 2012 (Figure 28). In the last two years counts have continued to increase with 270 fish in 2013 and a high of 406 fish in 2014. These highest counts are coincidental with the increase in pink salmon in the White River (Figure 27). It has been noted that the large food source provided by pink salmon carcasses, eggs and fry may have dramatically improved the growth and survival of bull trout in many Puget Sound rivers (e.g., Zimmerman and Kinsel 2011).

Bull trout designated critical habitat (USFWS 2010) includes the White River from its mouth to the upper basin, including the West Fork White River, the Greenwater River, Huckleberry Creek, Pinochle Creek, an unnamed creek, and Wrong Creek. PCEs include "*(2) Migration habitats with minimal physical, biological, or water quality impediments between spawning, rearing,* *overwintering, and freshwater and marine foraging habitats, including but not limited to permanent, partial, intermittent, or seasonal barriers.*"

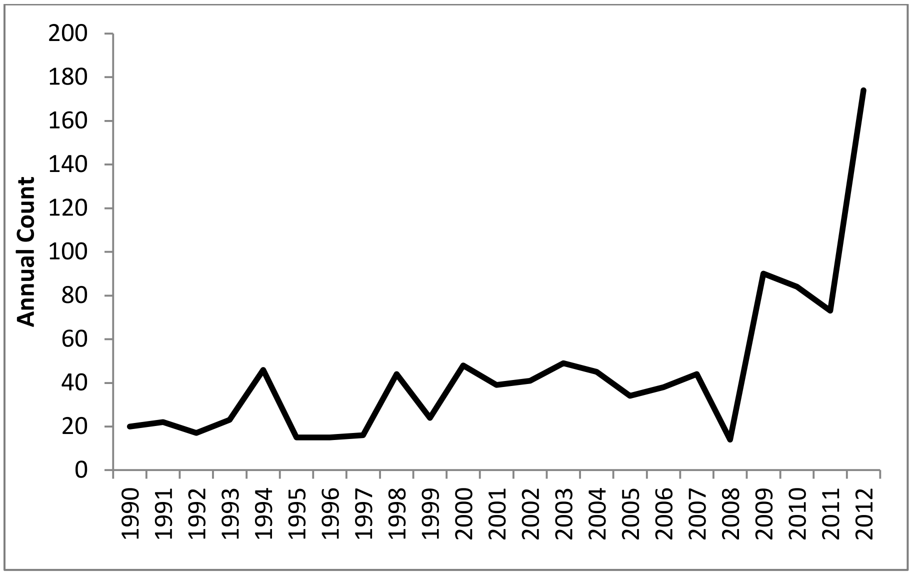


**Figure 27. Bull trout returns transported above MMD. Count includes all recorded char captures for 1990-2012 USACE and PTI fish counts); years 2009 and 2011 may be undercounted due to presence of pink salmon.**

**Other Resident Fishes**. Fish stranding events occur whenever the White River flows are reduced to levels (typically below minimum instream flows) where fish cannot find refuge in water depths sufficient to provide habitat during the lowered river period. During these periods resource managers conduct fish recovery efforts to put stranded fish back into suitable habitat areas before they die. These events provide documentation of other resident (non-migratory) fish species that are not normally studied or harvested in the river. Fish recoveries in the river in the early 1990's identified a range of species, including sculpin, longnose dace, peamouth, suckers, three-spine stickleback, redside shiner, whitefish, lamprey and others. Most of these species could be expected in and around the fish trap and barrier project area. In recent years additional drawdown events have occurred for periods when the barrier needed repairs. In 2012, fish agency staff again collected stranded fish in river areas below the barrier structure. Most fish were juvenile salmonids, but other fish captured include lamprey (20 or more fish, species unknown), dace, and stickleback (USACE 2013a).

Population estimates are not available for resident fish although whitefish and resident trout are trapped annually at the Buckley fish trap (Figure 28). Cutthroat and rainbow trout have been captured at the Buckley trap but only occasionally. Records of their returns are not routinely kept but since 2005 efforts have been made to identify them. Cutthroat and rainbow trout are common in White River and stream habitats such as riffles, plunge pools and off channel ponds. Mountain whitefish are also captured annually with recent counts increasing substantially from an average of 30 fish per year before 2010 to 96 fish per year since 2010.

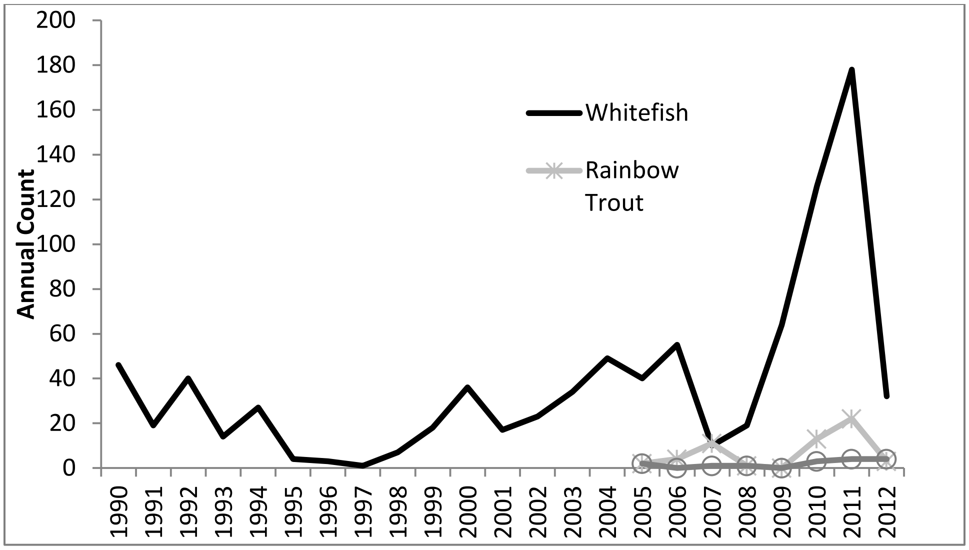


**Figure 28. Whitefish, cutthroat and rainbow trout return to Buckley Fish Trap 1990-2012 (data source USACE and PTI).**

## *4.7 Terrestrial Resources*

In the late 1700's and 1800's much of Pierce and King County was covered with climax coniferous forests. Most of the wildlife in the area inhabited the forested edges along the waterways, shorelines, and openings resulting from wind or fire disturbances.

During the mid-1800's settlers moved into the area and began farming and logging. These activities created additional openings in the forest, allowing understory plants to thrive. The interspersion of forest with croplands, grasslands, water, and native herbaceous vegetation allowed wildlife populations to prosper. However, increased human numbers, accompanied by industrial and urban development, has subsequently eliminated or altered many areas of food, water, or cover that are necessary to sustain optimum wildlife populations.

The Puyallup River Basin holds a diverse assemblage of wildlife from the alpine zone of Mt. Rainier to the estuarine zone of Commencement Bay. Several species move throughout the basin occupying many habitats, but exhibit different life history traits allowing them to use habitats differently. Land use within the Puyallup River Basin bears little resemblance to its historic condition. This consequently has had many impacts on wildlife resulting in several populations being considered depressed (USACE, 2002). In the lower portions of the basin, including the project area, extensive alterations to land forms, river courses, and stream channels have occurred as a result of urban, industrial, and agricultural development. In 1906, when the White River was diverted into the Puyallup River, the resulting flows almost doubled in the lower reach of the river. This diversion resulted in the lower 25 miles of the Puyallup River needing extensive flood control in the way of levees, dikes, channelization, and stream straightening. Some of the immediate impacts to wildlife were the loss of connectivity via riparian corridors, human encroachment into habitats, and the fragmentation of large blocks of contiguous habitat. Specific to the project area, and taken from Washington's gap analysis (WDFW, 2001), the habitats surrounding the project area derived historically from a western hemlock dominated zone that is now a dispersed landscape of young, mixed hardwood/conifer forests within the confines of agricultural and industrial development.

The shift from historical habitat conditions has had varying impacts to wildlife species found within the project area. Limited information specific to the project area is available; however, by taking a somewhat broader basin-wide approach, patterns emerge that are indicative to the current status of wildlife and can be considered somewhat representative for the project area in lieu of definitive surveys. As stated earlier, several wildlife populations are considered depressed. Some of these species include those that the public sees most often such as black-tailed deer, elk, and black bear. WDFW has determined that the elk herds of the greater White River basin (Mt Rainier herd) have declined slightly over previous years. The Mt Rainier herds range encompasses the project area. Furthermore, WDFW indicates that contributions to this type of decline can be attributed to habitat loss through urbanization, timber harvest, agriculture and domestic livestock, road management, and hydroelectric development (WDFW, 1996). In another instance, increased residential development poses the greatest threat to black bear habitat and consequently, black bear populations. Increasing development is likely to reduce suitable habitat and lead to an increase in bear/human encounters and conflicts. In reviewing the literature, rural development and land use modification such as found in the project area, was a common theme in all of the above species habitat conditions and trends. It was found that when rural development expanded into areas that were previously remote, wildlife species suffered through the loss of available habitat that inherently exerts stress on the species' viability and their population numbers.

## *4.8 Cultural Resources*

Cultural resources are locations on the physical landscape of past human activity, occupation, or use and typically include archaeological sites such as lithic scatters, villages, procurement areas, resource extractions sites, rock shelters, rock art, shell middens; and historic era sites such as trash scatters, homesteads, railroads, ranches, logging camps, and any structures or buildings that are over 50 years old. Cultural resources include traditional cultural properties, which are aspects of the landscape that are a part of traditional lifeways and practices and are considered important to a community.

The MMD barrier structure lies within the White River Hydroelectric Project (WRHP) Historic District. In 1911, the original White River Diversion Structure and headworks complex was constructed as part of the WRHP. The WRHP was derived from a 1912 merger that created the Puget Sound Traction, Power & Light Company, which was the largest investor-owned utility in the state. The company operated an integrated hydroelectric system that included western Washington's three largest hydroelectric projects: Snoqualmie Falls, Electron, and the WRHP. The current White River barrier structure and headworks complex includes: the barrier structure(1911); the flume control (1911); the headgate house and Stoney gates (1911); a tool shed (1918, 1937); a gravel chute (1911); the operator's cottage (1911); the former resident engineer's quarters/garage (1910); the operator's garage (1911); a bam/wagon shed (ca. 1900); the relief operator's cottage (ca. 1930); the head works machine shop and tram control house (1911, 1918); an oil shed (1918); another shed (1911); a cable/tram and hoist (1918); and the fish trap and haul facility (1948). The WRHP district was documented in 1994 by Puget Sound Energy pursuant to Historic American Engineering Record (HAER) standards as PSE no longer uses the White River barrier structure and headworks.

The WRHP historic district is eligible for listing in the National Register of Historic Places (NRHP) under criterion A and C for associations with Industry and Politics, fish migration, and Architecture and Engineering. The barrier structure and fish trap and haul facility on the left bank are components of the WRHP.

Beginning in 2004 the Corps began Section 106 consultation of the National Historic Preservation Act (NHPA) with the State Historic Preservation Office (SHPO), the Muckleshoot Indian Tribe and the Puyallup Tribe.

In 2004 a Corps archaeologist conducted a pedestrian survey of the project area. Additional fieldwork occurred in 2007. No archaeological sites or buried cultural material was identified during the 2004 and 2007 field effort. In addition, the Corps prepared additional narrative and photographic documentation on the individual components of the WRHP district that were not fully documented in the 1994 PSE HAER documentation and that would be affected by the proposed project at that time. The results of the archaeological survey and the additional narrative and photographic documentation are documented in the 2007 cultural resources report. No cultural material or archaeological sites were identified during the pedestrian survey or subsurface testing. In our consultation at that time, the Corps determined that the removal of the barrier structure and the associated structures would have an adverse effect on properties eligible for listing in the NRHP. At the time the Corps was preparing a draft Memorandum of Agreement (MOA) to mitigate the adverse effect to the WRHP historic district.

A review of the Washington Information System for Architectural and Archaeological Records Data (WISSARD) revealed that no archaeological sites are located within the area of potential effect (APE). In February 2015 additional archaeological fieldwork was conducted as the project footprint was revised to include the footprint of the proposed fish trap on the right (north) bank and the proposed improvements to the fish release access road. Eleven subsurface shovel probes were placed in the footprint of the proposed fish trap and eight subsurface probes were places along the proposed turnouts for the access road. No cultural material or archaeological sites were identified during the 2015 field work. The proposed MMD Fish Passage project will still have an adverse effect to the WRHP historic district. A Memorandum of Agreement (MOA) was developed in coordination with the SHPO and CWA on mitigation of the adverse effect to the WRHP. The MOA was signed by the Corps, CWA and the SHPO (Appendix F).

## 4.9 Federally Listed Endangered and Threatened Species

There are several species present in the project area that have some degree of federal protection under the Endangered Species Act (ESA) of 1973. A separate biological assessment designed to describe and assess effects to these species was recently completed (USACE 2013a). The document was evaluated by USFWS and NMFS as part of the Section 7 consultation process. A Biological Opinion (BiOp) was completed by each agency (NMFS 2014; USFWS 2015) with a list of measures (USFWS) or alternative actions (NMFS) considered necessary to ensure the fish trap and barrier fulfill ESA requirements for protecting the listed species. A summary of ESA impacts and determinations are provided in this section.

### 4.9.1 Chinook Salmon

Puget Sound Chinook salmon were listed as threatened under the ESA as of 1999 (NMFS 1999), and reconfirmed in 2005 (NMFS 2005a). In its original listing of PS Chinook, NMFS (1999) also included the White River spring-run Chinook salmon hatchery stock and their progeny, since the hatchery stock is currently considered to be essential for recovery (NMFS 1999). The MIT White River Hatchery opened in 1989 in an effort to protect, preserve and restore the spring Chinook run. The MIT hatchery has an annual production goal of 1000 fish and has received annual returns of hundreds to over 1,000 fish per year (M. McDaniel, MIT Fisheries Division, pers. comm. 2014).

Chinook have been collected at the Corps trap since 1941 (Figure 6) with recent counts of Chinook (wild and hatchery fish) ranging from a low of 1800 fish in 2014 to a high of 5500 in 2013. Spring Chinook arrive at the Corps and MIT fish traps beginning in June and are collected into October with July and August being the peak months. Spring Chinook generally enter the river in April and commence spawning in both the lower and upper White River around September. Fall Chinook salmon generally begin to enter the river later (August-September) and generally spawn below the barrier beginning in October. Chinook fry begin to emerge from gravels in January through March in the White River and migrate through the White River in March-August. The majority (80 percent) of juvenile Chinook migrate downstream as fry/fingerling, based on adult scale analyses (B. Smith, PTI, *pers. comm.*).

### 4.9.2 Bull Trout

Coastal/Puget Sound bull trout were listed as threatened on November 1, 1999 (USFWS 1999a). Critical habitat was originally designated for bull trout in 2005 (USFWS 2005), and revised in 2010 (USFWS 2010). This revision extended the geographic area of designated critical habitat to encompass most of the White River and larger tributary area, and added a PCE having to do with nonnative species. Five local populations of bull trout are found in the White-Puyallup Basin; Upper White River, West Fork White River, Greenwater River, Upper Puyallup River, and Carbon River (USFWS 2004). These tributaries support spawning and rearing populations of bull trout.

Between 1990 and 2012 the number of upstream migrating bull trout transported at the Corps trap averaged 43 fish with a low of 14 fish in 2008 to a high of 173 fish in 2012 (Figure 28). In the last two years counts have continued to increase with 270 fish in 2013 and a high of 405 fish in 2014. Bull trout counts in abundant pink salmon years may be under estimated as bull trout cannot be separated out sufficiently to identify and count individual fish. Since 2002, the Puyallup Tribe has marked and measured individual bull trout with PIT tags. Between 2002 and 2011, 14 percent of the fish handled at the trap were fish recaptured from the previous year. Sub-adult (immature migrants) and adult bull trout migrate upstream throughout the year with peak counts at the fish trap occurring between May and July. Juvenile bull trout migrate out of tributary streams downstream to lower river areas at 1-3 years of age, predominately between April-July (Zimmerman and Kinsel 2011). Bull trout sub-adults and adults are known to reside in the White River year-round including areas above and below MMD and above and below the barrier.

### 4.9.3 Puget Sound Steelhead

On 11 March 2007, the NMFS listed the Puget Sound Steelhead as threatened under the Endangered Species Act (Federal Register 72 FR 26722); critical habitat has been proposed for this Distinct Population Segment (DPS) as of January 2013 (NMFS 2013). The DPS includes all naturally spawned anadromous *O. mykiss* (steelhead) populations, from streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington, bounded to the west by the Elwha River (inclusive) and to the north by the Nooksack River and Dakota Creek (inclusive), as well as the Green River natural and Hamma Hamma winter-run steelhead hatchery stocks.

Three winter steelhead stocks – the mainstem Puyallup River, White River, and Carbon River stocks – have been identified in the Puyallup River system. These wild native stocks are treated separately due to geographical spawning isolation. Although summer-run fish are captured at the Buckley fish trap every year, it is suspected that summer steelhead in the White River are fish straying from the Green River or Skagit River systems. However, because both winter and summer steelhead are known to use the White River system, it is presumed that there are steelhead in the system throughout the year.

Steelhead have been collected at the Corps trap since 1941 and have ranged from a low of 50 to over 2000 fish collected in a year (Figure 28), In the past five years (2010-2014) counts have increased to approximately 550 fish per year from the previous 5 year period (2005-2009) of 178 fish per year.

### 4.9.4 Eulachon

Eulachon were listed as threatened in 2010 (NMFS 2010). Critical habitat was designated in 2011 (NMFS 2011c); it does not include the action area. Eulachon have recently been documented in the lower Puyallup. This species may be regarded as unusual for this river system. However, since they have appeared there in more than one year, and since large numbers have been entering the Columbia River late in the 2013 spawning season, despite their threatened status, it is possible that population-level events may be underway.

### 4.9.5 Bald Eagle

Bald eagles are no longer listed under ESA, but are protected under the Bald and Golden Eagle Protection Act.

Bald eagles typically nest in stands of mature trees near large water bodies. Nests are often constructed in the largest tree in a stand with an open view of the surrounding environment. Nest trees are usually near water and have large horizontal limbs. Snags and dead-topped live trees may be important in providing perch and roost sites within territories. Because of their large size, eagles require ready access to an abundant supply of medium-sized to large fish during breeding (Johnsgard 1990). Freedom from human disturbance is probably another important component of suitable nesting habitat. Bald eagles winter along rivers, lakes, and reservoirs that support adequate fish or waterbird prey and have mature trees or large snags available for perch sites. Bald eagles often roost communally during the winter, typically in a stand of mature trees with an open branching structure and well-developed canopies. Winter roost areas are usually isolated from human disturbance (Johnsgard 1990).

A bald eagle nest is known to exist within one-quarter mile of the project area and within line-of-sight to the proposed project. In the summer and fall, mature eagles are frequent visitors to the project area as it lies within a habitat corridor used by eagles. It is common to find birds perched in the large deciduous trees on both sides of the river downstream of the fish passage barrier. Mature eagles have been known to feed on salmon within the project area but are not seen to congregate in response to the presence of the fish trap or CWA diversion structure possibly because the principal foraging habitat exists in the upper watershed where most salmon spawning occurs. Daily disturbances are common for this nesting pair including heavy construction during the nesting period with little to no effect. Screening vegetation does occur between the nest and nearby facilities though it is visible in late fall and winter.

### 4.9.6 Marbled Murrelet

The marbled murrelet is currently listed as threatened by the USFWS. The North American subspecies of marbled murrelet occurs from the Aleutian Islands south along the coasts of Alaska, Washington, Oregon, and California. Its distribution is closely correlated with the presence of late successional coastal forests (Carter and Erickson 1988, Nelson 1989, Paton and Ralph 1988, Sealy and Carter 1984). When at sea, marbled murrelets are mostly found between 300 and 2000 meters from shore (Strachan et al. 1995). In Washington, the marbled murrelet is found in all near-shore marine environments, with the concentrations found in the northern Puget Sound area.

No known marbled murrelet use has been identified in the project area (WDFW, 2015). The nearest critical habitat for marbled murrelet occurs approximately 13.5 miles to the southeast of the project area adjacent to Mount Rainier National Park.

### 4.9.7 Northern Spotted Owl

The northern spotted owl is currently listed as threatened by the USFWS. The northern spotted owl is one of three subspecies of spotted owl occurring in western North America. The northern subspecies occurs from southwest British Columbia south through the Coastal Mountains and east and west slopes of the Cascade Range in Washington and Oregon, through the Coast Ranges of northern California south to Marin County (Gutierrez et al. 1995). In Washington State, spotted owls occur in the remaining patches of suitable habitat on the eastern and western slopes of the Cascade Range and on the Olympic Peninsula.

No known spotted owl use has been identified in the project area (WDFW, 2015). The nearest critical habitat for spotted owl occurs approximately 13.5 miles to the southeast of the project area adjacent to Mount Rainier National Park.

### 4.9.8 Grizzly Bear

The grizzly bear is currently listed as threatened by the USFWS. Historically, the grizzly bear occurred from the mid-plains west to the coast of California and south into Texas and Mexico. Currently, grizzly bears remain in only five areas in the conterminous United States: the Greater Yellowstone Ecosystem, the Northern Continental Divide, the Cabinet-Yaak area, the Selkirk Mountains, and the Northern Cascade Mountains. Two additional areas, the San Juan Mountains in Colorado, and the Selway-Bitterroot Mountains in Idaho, may also support grizzly bears (USFWS 1993).

No known grizzly bear use has been identified in the project area (WDFW, 2015)

### 4.9.9 Gray Wolf

The gray wolf was downlisted to threatened in 2003 for all parts of the Western Distinct Population Segment (50 CFR Part 17). Gray wolves are found in all habitats of the northern hemisphere except tropical forest and arid deserts. In North America, gray wolves historically occurred throughout Canada and the United States, except the southeastern quarter, and into Mexico. Currently, naturally occurring viable populations of the gray wolf in the United States have been documented from Minnesota, Wisconsin, Michigan, and northwestern Montana.

No known gray wolf use has been identified in the project area (WDFW, 2015)

### 4.9.10 Canada Lynx

The Canada lynx is currently listed as threatened by the USFWS. The lynx in Washington is mainly found in the north central and northeast mountains. The total number in the state has been estimated at 96 to 225 but population data are incomplete and the estimates depend upon habitat assumptions (USFS, 2000). The historic range of the Canada lynx in western Washington extends south from Canada to near Mount Adams, primarily on the east side of the Cascade Mountains.

No known lynx use has been identified in the project area (WDFW, 2015)

### 4.9.11 Southern Resident Killer Whale

The Southern Resident killer whale (SRKW) Distinct Population Segment was listed as an endangered species in November 2005 (NMFS 2005c). Over the last 28 years there has been an average 0.4 percent increase per year for the population (NMFS 2011b). There were 78 whales in 1982. In 2010, a total of 86 whales were counted. There is representation in all three pods, J (26 whales), K (19 whales), and L (41 whales). There are currently 3 reproductive males in J, 3 in K, and 10 in L pod. The current population is 38.3 percent juveniles, 32.5 percent reproductive females, 10.5 percent post-reproductive females, and 18.6 percent adult males (NMFS 2011b).

SRKW may be sensitive to effects on Puget Sound Chinook, negative or positive. Actions taken to benefit Chinook salmon (in particular with respect to changes in tunnel operations to benefit smolts, and replacement of the trap and barrier) should therefore also have indirect benefits to SRKW although there are many other factors that have more direct effects on the SRKW population, including: habitat loss, decline in availability of prey items, pollution (PCBs, dioxins, furans), and noise disturbance from vessel traffic and whale watching.

**Table 6. Summary of ESA Species and Effects Determinations**

| Common Name | Scientific Name | Status Under ESA | Critical Habitat | Effect to Species | Effect to Critical Habitat |
|---|---|---|---|---|---|
| Puget Sound Chinook salmon | Oncorhynchus tshawytscha | Threatened | Designated, including in action area | Jeopardize Continued Existence | Would destroy or adversely modify |
| Coastal/Puget Sound bull trout | Salvelinus confluentus | Threatened | Designated, including in action area | Likely to Adversely Affect | Likely to Adversely Affect |
| Puget Sound steelhead | Oncorhynchus mykiss | Threatened | Proposed, including in action area | Jeopardize Continued Existence | Would destroy or adversely modify |
| Southern Resident killer whale | Orcinus orca | Endangered | Designated—in action area but not in project area | Jeopardize Continued Existence | Would destroy or adversely modify |
| Eulachon | Thaleichthys pacificus | Threatened | Designated—not in project or action area | May affect, not likely to adversely affect | No effect |
| Marbled murrelet | Brachyramphus marmoratus | Threatened | Designated—not in project or action area | No effect | No effect |
| Spotted owl | Strix occidentalis caurina | Threatened | Designated—not in project or action area | No effect | No effect |
| Grizzly bear | Ursus arctos horribilis | Threatened | Not designated | No effect | n/a |
| Gray wolf | Canis lupus | Endangered | Designated—not in project or action area | No effect | No effect |
| Canada lynx | Lynx canadensis | Threatened | Designated—not in project or action area | No effect | No effect |

## *4.10 Climate and Air Quality*

Climate in the project and action areas is typical of the maritime climates that characterize most of western Washington. Records for the station at Buckley indicate an average annual precipitation of 48.54 inches with July minimum and November maximum, and an average annual air temperature of 50.7ºF (USACE, 2004). Precipitation in the form of snow is uncommon at the project site.

The Puget Sound Clean Air Agency's jurisdiction is currently in attainment for carbon monoxide, ozone and PM10, and has maintenance plans in place for these pollutants. The Environmental Protection Agency (EPA) has announced the development and release of a more stringent nitrogen dioxide federal standard as well as the monitoring rules associated with these standards. EPA has recently promulgated standards for lead and sulfur dioxide. Monitoring is ongoing to investigate compliance with the new standards for lead and sulfur dioxide. Three years of data will be required for final EPA determination.

Ozone levels remain a concern in the region. Over the last decade, ozone concentrations have not decreased as significantly as other pollutants. EPA strengthened its 8-hour ozone standard in March 2008. The 2011 ozone levels shown in this report are in attainment of the standard, but pollution levels are still close to the standard. The Enumclaw Mud Mountain monitor typically has the highest regional ozone concentrations during high ozone episodes.

The Earth's atmosphere is changing, the climate system is warming, and the changes are likely due in part to human activities that produce greenhouse gases (GHGs). GHGs include water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), ozone (O3), and some hydrocarbons and chlorofluorocarbons. These compounds create a greenhouse effect when they accumulate in the Earth's atmosphere. They act as a layer of insulation, retaining within Earth's atmosphere some of the thermal radiation that originated from the sun.
The Washington Department of Ecology (WDOE) (http://www.ecy.wa.gov/climatechange/effects.htm) has identified several projected effects of climate change on the region covering the Cascade Mountains which includes warmer average temperatures, reduced snowpack and a higher frequency of extreme weather. Most of the annual precipitation historically falls during the winter season (November-April); it is anticipated that as the climate changes, increasing amounts of precipitation will fall as rain rather than snow at increasingly higher elevations. These factors affect the critical variables of the timing of peak river flows and the water availability in the dry summer season. Flows in the White River within the study area are controlled by the upstream releases at MMD and constrained by flood risk management triggers downstream. While the hydrology of the river is expected to be affected by climate change, given the constraints of the flood risk management operations, design criteria formulated to the current conditions and operating plan for MMD are assumed to be adequate to provide for long-term stability of the structure and fish trap operations at the site.

## *4.11 Noise and Traffic*

The project area is located outside any major urban centers and rural communities. Residential and industrial noise from transient sources is rare and limited to truck traffic on Highway 410 and intermittent residential noise from a few nearby homes. Onsite noises are commercial in nature from the operation of the White River Hatchery, the fish trap and the diversion flume. Daily operations from these commercial operations include heavy vehicle noise and human disturbance. Sporadic occurrences of heavy equipment also occurs in relation to hatchery, fish trap and diversion flume maintenance.

## 4.12 Hazardous and Toxic Wastes

Project partners including PSE, MIT, and CWA did not identify any potential for HTRW on the right bank, however, a limited database/document review will occur to verify that activities suspected of causing a HTRW release do not exist on the right bank. The existing barrier dam will need to be evaluated during the design phase.

On the left bank, the property south of the project, WA WSU Buckley Dairy 2, aka WSU Dairy and Storage Facility, is listed on the EPA confirmed and suspected contaminated sites list for having pesticide contamination confirmed in the soil and suspected in the groundwater (USACE 2005). The WDOE status of this site shows remedial action in progress. It is listed as an inactive hazardous waste generator and active state cleanup site under WDOE. It is listed on both the underground storage tank (UST) and leaking underground storage tank lists; there were two USTs, one containing leaded gasoline. Both tanks have been removed and soil was reported cleaned up in June of 1996.

On the left bank, the property west of the project, owned by CWA and known as PSE Buckley, Buckley Head Works, and Puget Sound Energy North River Avenue, is listed on the WDOE Facility/Site Locator, EPA Facility Registry System, and the No Further Action Report. They are on the WDOE UST list for a former UST containing unleaded gasoline and have been listed as both an inactive and active hazardous waste generator. Past activities on this site have included production of preserved wood, which resulted in localized soil contamination. A site characterization report was completed and states that the contaminated soil had minimal impact on the groundwater, and arsenic was the only contaminant found in the groundwater exceeding MTCA cleanup levels. According to the report, the shallow groundwater in the area flows to the northwest, away from the barrier structure project site. This property is outside the proposed project but may be utilized for temporary storage of equipment and materials. Any use of this area will be coordinated and approved by the WDOE.

A larger portion of the left bank had a wood treatment facility in operation from ~1900 to the early 1960s which was used to provide treated timbers to construct and maintain the existing White River flume. Practices at the time allowed for release of PCP, dioxin/furans, arsenic, chromium, carcinogenic PAHs, and diesel and heavy oil-range hydrocarbons into soil. These compounds were concentrated in the immediate vicinity of the former wood treatment and storage areas, downslope from the treatment areas, and in areas used to dry and store treated wood. Concentrations exceeded the Model Toxics Control Act (MTCA) cleanup levels; therefore, soil at the site was remediated in 2000-2001 by PSE under agreement with the WA State Department of Ecology. The remedy included soil excavation and removal to a maximum depth of 3.5 ft to remove significant source and isolation of contaminated soil left in place with placement of low permeability or impermeable caps. The land is currently owned by PSE and the restrictive covenant is specifically to minimize soil disturbing activities in the remedied area. Contaminated groundwater was also identified, however, continued monitoring indicates that groundwater is not reaching the White River. It was expected that chemical concentrations in groundwater would decrease over time as a result of the source removal and isolation of remaining contaminated soil with protective caps. Groundwater monitoring results indicate that arsenic and PCP concentrations still slightly exceed MTCA cleanup levels in some wells during some monitoring events, but this is consistent with known groundwater elevation information. In general, the monitoring indicates that contaminated groundwater is not reaching the White River.

# 5 ENVIRONMENTAL EFFECTS OF THE PROPOSED PROJECT

## *5.1 Climate and Geology*

Construction activities associated with the proposed project will result in both native soils and fill material being disturbed and compacted by heavy machinery. Soil disturbances are required to clear the site in preparation for construction. This disturbance is likely to occur over much of the construction site and be evident on both banks. Installation of staging areas and temporary construction facilities will require the placement of non-native rock to ensure proper management of construction equipment, movement of vehicles and materials and protection of construction features. The construction of the new barrier will narrow the existing channel to a width commensurate with the existing width of the White River upstream and downstream of the existing barrier outside of the influence of the barrier. The construction of the new fish trap will convert approximately 5 acres of gravel bar and floodplain.

Temporary excavations will be required inside the cofferdams to allow for construction of the barrier structure. The foundation excavation plan in the river channel will remove up to 5 feet of native soil to accommodate the concrete base of the barrier structure on the downstream side where an extension of the turndown slab will be constructed along the flood gates. Also where scour protection is needed. Nearly all of the excavation in the river channel and along the left and right banks will be in the fluvial deposits of loose gravel with sands, cobbles and boulders. The design plans show temporary slopes suitably sufficient to avoid soil slope failures.

Construction of cofferdams needed to protect the proposed project during construction will require placement of armor rock and structural fill. Non-native rock and fill used for the cofferdams will be removed when construction is complete. When completed, all disturbed lands will be restored and non-native rock removed or reused elsewhere. Geology and soils will not be appreciably altered.

Flood scour protection is likely required below the barrier extending approximately 70 ft downstream from the gates. The depth of scour protection could be from 4-11 ft below existing sub-grade. Of the nearly 115 years since the original construction of the diversion weir there is only one known occurrence of placing riprap for scour protection which occurred in the 1930s during the period where peak flows as mentioned above in the soil conditions section. These flows were much higher than our current design flow of 12,000 cfs because MMD had not yet been constructed.

Additional investigation of the existing subgrade conditions downstream of the barrier is necessary to confirm need for additional scour protection, distance and depth given the conditions of existing riprap and large rocks. The last placement of riprap in the 1930's scour protection around the diversion weir has proven to be sufficient, unless otherwise demonstrated through a geotechnical investigation.

### 5.1.1 Sediments

Riverbed material will be removed from the riverbed in preparation of the proposed project. Riverbed modification may be required to construct a foundation for the project or cofferdams. Riverbed modifications may be required to ensure proper engineering and site stability criteria. Materials removed from the riverbed will be stockpiled upland for later use as appropriate for site remediation or disposed offsite.

Temporary dewatering will be required to control ground water seepage into the excavations. Cofferdams are proposed to isolate the site. . Construction techniques designed to manage fine material releases from construction activities will be in place, as will methods to control erosion and non-point pollution. Still, in-water work may result in short-term fine material releases as a result of riverbed disturbances.

In-water placement of armor rock and associated fill for cofferdam construction will present an opportunity for non-native materials to enter the stream corridor. Use of armor rock is required to protect the proposed project. High flows represent a significant threat to the project under construction and if not protected will cause delays in completion and extend the period of construction. River flows working on the cofferdam may dislodge armor rock that may not be recovered after construction. The rock will be sized to minimize this loss and maximize safety of personnel and equipment. When the cofferdams are no longer needed, armor rock and any non-native fill materials will be removed from the riverbed to the extent practicable but some rock may be unrecoverable. Lost material is expected to disperse downstream and become isolated components of the rivers' coarse substrate and not represent a reduction in ecological function.

Long-term sediment conditions at the project site will remain unchanged or slightly improved due to more natural passage of both fine and coarse sediment through the project area.

## *5.2 Water Quality*

### 5.2.1 General

Water quality and flow in the White River will not be appreciably altered by construction or operation of the proposed project. The project area represents a small area in comparison to the remainder of the watershed reducing any potential for significant water quality or flow stability degradations. The stream will continue to transport fine sediment throughout its length, through the bypass reach and into the Puyallup River system. The installation and operation of hydraulic gates at the fish passage structure will allow for more passive passage of coarse and fine sediments. Natural water quality characteristics of the White River, particularly the frequent high turbidity and total dissolved solids (TDS), will further moderate the potential for adverse short-term impacts construction. White River flow requirements established and implemented under other initiatives will likely control many of the water quality parameters of concern. Best management practices that could be employed include, isolating work sites through the use of cofferdams and silt fences, and monitoring of water quality parameters with work stoppages when water quality parameters are exceeded.

### 5.2.2 Temperature

Summer water temperatures of the White River are considered elevated over background but do not generally exceed 18°C at the project area. The proposed project will continue to maintain an operating pool similar to the existing 671.5-ft subject to variation from seasonal high and low flows. The potential for a temporary increase in the operating pool is incrementally small and only notable under high flows. Consequently, it represents a discountable potential for increased temperatures attributable to the fish passage structure and is unlikely that project operations would have any measurable adverse impact on this indicator. Most sources for increased temperatures on the White River are believed to be associated with reduced riparian vegetation, human development and reduced water flow. Water flow is controlled by primarily through diversion at the existing flume in support of water quality, recreation or other future needs.

Some portion of canopy cover around the project area may be lost during project construction. Replanting will occur, with some plantings being offsite due to levee vegetation restrictions. This loss is not expected to result in any temperature increases even during warm temperature and low flow conditions within the project reach. The loss will be minimized within the riparian corridor and does not represent a significant reduction in riparian function on any temporal scale.

### 5.2.3 Turbidity and Suspended Sediments

Potential point and non-point sources of turbidity or suspended sediments will not be appreciably affected by this project. Background turbidity levels in the White River typically exceed 50 NTUs, which may be due a number of factors including MMD operations, differences in channel morphology, flow variation, glacial melt, or erodibility of sediments in the lower watersheds. The existing barrier structure has not been implicated in additional increases to background turbidity although localized turbidity levels are elevated during the short repair periods (3-5 days) to the existing barrier.

There will however, be some construction impacts on water quality at several stages during the construction process. Temporary dewatering will be required to control ground water seepage into the excavations. Cofferdams are proposed to isolate the site. Pulses of short-term turbidity are possible following release of stored sediments behind the existing barrier structure or as part of cofferdam installation or new barrier construction. In extreme cases, releases of this sort can lower dissolved oxygen concentrations for short durations particularly in areas of slow poorly mixed waters. In the case of the White River, the nature of the material releases is not expected to represent a measurable degradation of dissolved oxygen or other important water quality parameters. Short-term releases of clean materials should not result in higher temperatures, increased biological oxygen demand or releases of contaminants such that dissolved oxygen will be notably degraded. This is particularly true in the turbulent White River, which remains well mixed and oxygenated despite high turbidity levels.

Floods during the winter and spring following construction may continue to mobilize sediments in the project area, and contribute turbidity to the river. Compared to turbidity normally seen during flood events on the White River, this increase is not likely measurable. Sedimentation impacts during construction will be controlled through best management and conservation practices. They should be temporary and of short duration. Salmon spawning has been observed in the mainstem below the project area in reaches with high levels of turbidity and suspended sediments although daily turbidity may vary from 1.78 NTU to 1500 NTU. It is presumed that spawning downstream of the proposed project by salmonids is minimally affected by suspended sediments given the variability of natural White River turbidity conditions.

Construction techniques designed to manage fine material releases from construction activities will be in place, as will methods to control erosion and non-point pollution. Still, in-water work may result in short-term fine material releases as a result of riverbed disturbances.

Because of the naturally high turbidity levels found in the White River within the construction windows, it may be difficult to isolate project related turbidity from natural sources. It is recommended that project related impacts be measured in term of percent turbidity over background as measured above and below the project. Water quality objectives will be monitored in the project area and downstream during construction to confirm that water quality impacts are minimal. A monitoring plan will be developed during the design phase keyed to WDOE 401 Water Quality Certification conditions and USFWS and NOAA BiOp requirements.

Operation of the fish trap will require periodic flushing of the intake works of accumulated sediment. These events are of extremely short duration and occur under present conditions. The removal of sediment from the trap does not appear to cause harm or adverse behavioral reactions from salmon holding in the trap or below in the White River. Overall, the construction of the new barrier with hydraulic gates will allow for expedited passage of sediment, and will reduce the need for periodic sediment maintenance events which result in pulses of high turbidity.

### 5.2.4 Chemistry

Existing chemical characteristics of concern on the White River will not be influenced by the construction or operation of the proposed project. Elevated pH levels in the White River are related to increased periphyton production associated with degraded flow conditions. Construction and operation of the proposed project will not alter the volume of water through the White River or affect flow related impacts to water quality.

Fecal coliform is considered a non-point pollution concern caused by urban growth, and agriculture neither of which will be influenced by the proposed project. There are no known contaminated materials in the project construction area. No contaminated materials will be imported as part of construction.

The proposed project will require placement of concrete as part of the new fish passage barrier. Where possible, these placements will be precast and cured on land. Where land based casting is infeasible, concrete will be placed in the riverbed under containment. The largest concern over uncured concrete entering the freshwater system is that of pH. If uncured concrete is poured in sufficient volumes into an aquatic system, it can cause a lowering of pH and a subsequent increase in the uptake availability to some heavy metals. This elevation of pH is most notable in slower water systems where the contact time of a water body can lead to fish and aquatic benthos impacts. Elevated pH from curing concrete is also related to surface area of concrete relative to the waterbody making large unconfined pours most likely to cause concern. It is unlikely that the proposed project will cause notable changes in pH to the degree that water quality standards would be violated or physiological harm would occur to aquatic organisms. The addition of admixtures to reduce curing time and loss of fines will be considered if unconfined placement of concrete is required. These admixtures will reduce any changes of perceptible water quality changes from the concrete placement. No unconfined in-water concrete placements are anticipated.

## 5.3 Land Use and Potential Pollution Sources

The proposed project will not alter existing land use or pollution sources except for the temporary water quality issues discussed in previous paragraphs. Known sources of existing hazardous or toxic waste sources in the project area will be remediated if disturbance is necessary or avoided if possible. Coordination with WDOE will occur prior to the use of any discovered areas with potential contamination.

## 5.4 Hydraulics and Hydrology

The hydraulic impacts of the proposed project were compared against those of the existing condition. The intent of the hydraulic evaluation was to ascertain any changed conditions in water surface profiles, flow velocities and volumes. This section describes the impacts to river function through changes in hydrologic characteristics as well as potential changes in habitat function.

**Change in Peak/Base Flows.** The purpose of the fish passage structure is to provide a barrier and water for proper fish trap operations. The new barrier will allow opportunities to route flows through different sections of the barrier to flush sediments or shape flows to improve fish attraction to the trap. Alterations to peak or base flows are not a consequence of fish passage structure operations. However, base and peak flows are altered through operation of Mud Mountain Dam and the Lake Tapps' diversion flume. Historically, the diversion flume has relied on the barrier structure to hold back sufficient water for proper operation. The water diversion into the flume from the White River by non-federal entities is outside the scope and responsibility of this construction project. Operation of the diversion flume and associated control gates remains the responsibility of the entity diverting water.

**Streambank Condition.** The project area streambanks have been hydromodified and floodplain connectivity lost, so that streambank condition contains less bankside stability and vegetation than would be expected naturally. An increase in the height and length of the levee protecting adjacent hatchery facilities may be required during construction under the proposed project, and maintained due to design flows. The existing levee is setback from the river for the protection of existing vegetation and bank conditions. The construction and permanent easement for access to the barrier and fish trap will require. Part of the existing floodplain will be filled due to construction of the new fish trap and floodwall for that facility. In addition, there will be approximately three acres of clearing for construction of the levee. All disturbed areas will be replanted with appropriate native species within the levee vegetation guidelines established by the Corps of Engineers.

**Floodplain Connectivity.** Floodplain connectivity within the project area is degraded due to the existing levee systems and controlled water releases from MMD and CWA withdrawals. The proposed project would ensure existing facilities would be protected from severe flood damage. The incremental increase in flood protection will be small compared to the existing level of protection afforded the White River hatchery (right bank) and fish trap (left bank). The proposed project would not significantly alter conditions.

At the proposed project site, the river receives seasonal pulses of sediment from the upper watershed either from natural sources or as the MMD reservoir is emptied after a period of high runoff. The proposed project would not alter existing practices with regard to sediment releases or transport.

**Pool Size and Frequency**. There is limited data available on pool frequency and size within the project area. However, since these areas experience LWD depletion, altered sediment transport and deposition, and an altered flow regime, it is likely that pool frequency and size have declined relative to conditions before construction of MMD and localized filling of pool habitat may have occurred through construction of the existing barrier dam. Ongoing bank stabilization activities in the project area may have also contributed to the loss of pool formation.

The proposed project could create a slightly different inundation pool behind the barrier structure under high flows. The use of gates allows sediment and flow management opportunities that should improve sediment and LWD transport conditions at the barrier. On-going operations at MMD will maintain current LWD, sediment and flow management to the site.

**Refugia.** Many off-channel and floodplain areas around the project area have become disconnected as a result of river management and development in the lower basin has become more prevalent. The proposed project will greatly reduce the frequency of barrier structure maintenance operations requiring flow fluctuations to perform which should reduce the potential for impacts but overall, the proposed project will not affect this habitat function.

Within the project area, controlled flow variations created by MMD and CWA flume operations currently present a risk of dewatering off channel refugia. The potential for impact is increased by the condition of the barrier dam, which requires flow modifications for routine maintenance. The proposed project will reduce the need for flow variations as part of routine maintenance, which will reduce but not eliminate potential for off-channel dewatering. Flow variations from operations of flood control and water diversions will remain. Sustainability and creation of off-channel habitats is controlled by flows exceeding the 2-5 year flood event; which would not be affected by the proposed project.

## 5.5 Vegetation

Riparian impacts will occur within the project reach and possibly through a number of mechanisms. The installation of staging areas could impact upland and riparian stands. Raising the right bank levee structure protecting the MIT Hatchery could result in the permanent loss of trees on this alignment. The construction and permanent easement for access to the barrier and fish trap will require approximately 3 acres of clearing for construction of the levee. Replacement trees would be planted at the site where possible and elsewhere in the project area as mitigation. Riparian impacts downstream of the project area are anticipated to be approximately 5 acres. New vegetation will be planted along all disturbed areas following construction. This new vegetation may take several years to replace the shading and detrital functions provided by existing vegetation within the construction area. Impacts to riparian and upland vegetation will be avoided wherever possible.

The proposed project will provide for LWD passage particularly at high flows most likely to mobilize LWD of beneficial size. No active LWD maintenance is anticipated at the site except in cases where LWD may compromise operations. Long-term mobilization of LWD is predicated on instream flows influenced by MMD and diversion operations.

## 5.6 Wetlands

The proposed project may have minor indirect impacts to wetlands in the project area. A reconnaissance survey of the project area found wetland soil conditions mostly absent from the project site. Downstream of the barrier on the right bank is a forested wetland complex with small depressions and pockets of hydric soil. These areas are outside the boundaries of primary barrier construction however; downstream access roads may require improvements that could result in minor wetland disturbance along the road edge. A wetland delineation by Corps of Engineers staff identified approximately 0.105 acres of wetland impact. The wetlands were rated as category 2 wetlands using the WDOE Wetland Rating System (2014). These areas will be identified and flagged for avoidance wherever possible however, because the wetland features run perpendicular to the road alignment, some impact will occur. Adequate crossing structures or culverts at the wetland locations will be required to maintain flows in the wetlands. Mitigation of the wetland loss will be through utilization of the Boise Creek In-Lieu-Fee Program. Road related impacts to the forested wetlands located along the hatchery road will be limited to minor dust and debris loading from construction related truck traffic.

It is not anticipated that wetlands would be affected by any water level changes as a result of the new barrier dam. Water levels will not be altered under normal water conditions. The levee alignment is aligned with existing fills and levee prisms which do not contain wetlands. The Right Bank Fish Trap Facility will be located on an existing gravel bar and will result in the filling of approximately 5 acres of Other Waters of the U.S.. Riparian plantings in the project area and the Mud Mountain Dam  Project boundaries will compensate for the loss of riparian vegetation at the construction site.

A wetland delineation was also conducted by Corps staff on the Fish Release site road. The upper most proposed turnout was initially located in a forested wetland, but designers have moved that turnout to the opposite side of the road to a non-wetland area. Refer to Figure 29.

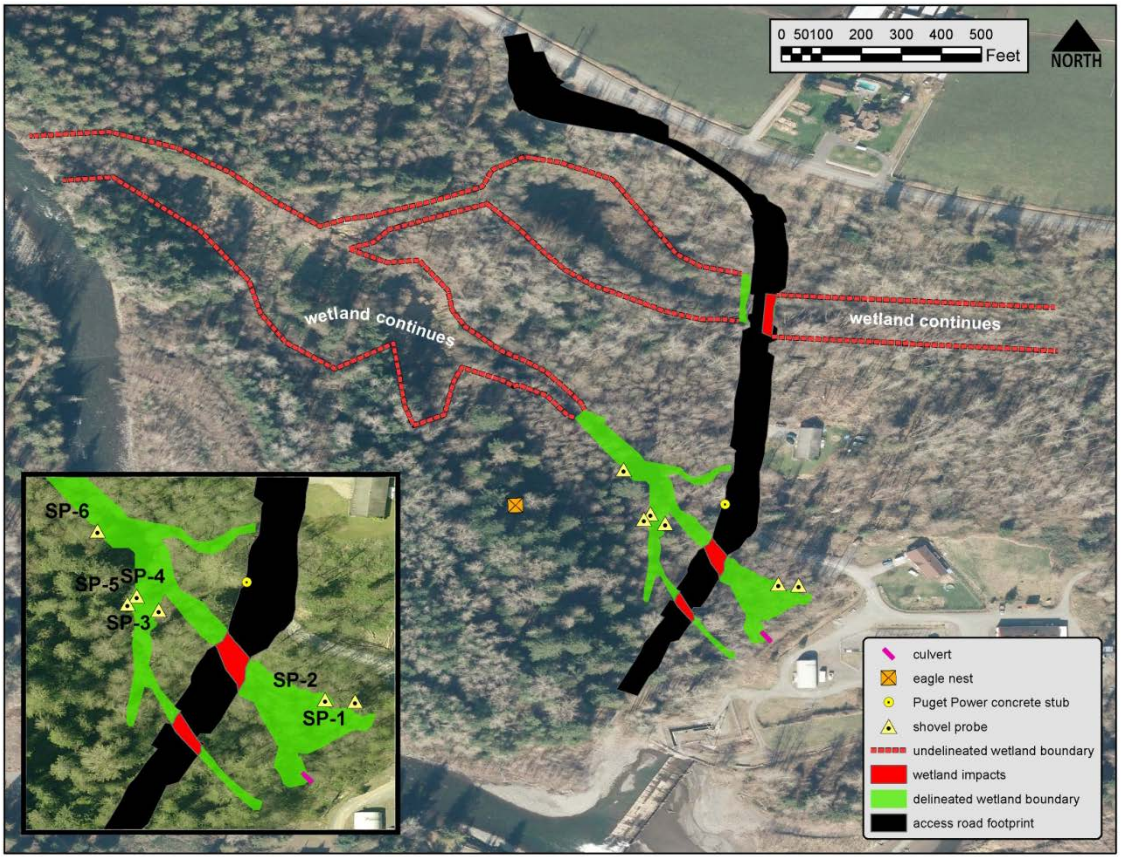


**Figure 29. Wetlands Located in the Project Area**

## 5.7 Aquatic Resources

### 5.7.1 Anadromous and Resident Fish Resources

Environmental baseline and project effects have been evaluated by evaluating pre and post construction conditions against aquatic functional assessments prescribed by NMFS (1996) and USFWS (1999b). A summary of this evaluation is shown in Table 7.

#### 5.7.1.1 Short-Term Construction Impacts

Summary- To minimize impacts to upstream migrating fish the current project sequencing is to work from the left bank to the right bank, with a project start after the primary migration period. Starting from the left bank allows for both the CWA water diversion flume and the Corps Fish Trap facility to be fully functional earlier in the construction cycle. On the right bank the river channel will be narrowed so additional fill will be required to level the land on the hatchery side. A temporary fish entrance extension on the left bank will be provided that reaches beyond the cofferdam to allow fish passage to the trap during construction. The right bank fish hatchery entrance will be demolished during the construction phase and hatchery fish will be collected from the left bank trap. The new right bank fish trap will replace the existing fish trap entrance. The left bank extension will be designed in cooperation with the agency fish passage engineers.

Preparation of the site for construction holds the potential for short-term impacts to fish particularly through an increase in delivery of fine sediment and for potential trapping of resident or rearing fish. The sediment releases will be minimized by onsite sediment control measures as prescribed by existing shoreline guidelines and state regulations however some material may still enter the river. This impact is made possible through a number of activities but particularly by clearing uplands for temporary storage and access roads as well as by operating equipment around or in the riverbed. Construction of cofferdams to facilitate construction and the placement of large non-native materials may also represent a short-term sediment impact. These materials will be removed at the time of cofferdam removal but 100 percent removal of all rock may not be possible. The presence of the White River hatchery in close proximity to vehicle access, construction, and staging equipment also presents a potential for short-term impact if not properly considered. Because construction will occur year-round there is the potential to affect all life-stages of aquatic resources using the river(Figure 30).

**Table 7. Summary of potential Effects for fish resources in the Action Area**

| Activity | Potential Effect Mechanism | Duration of Effect |
|---|---|---|
| Construction and Operation of Barrier and Fish Trap | • Short-term impacts from Fish Barrier and Fish Trap construction including increased turbidity, restriction of passage.<br>• Hatchery Impacts from construction near hatchery, replacement of existing hatchery trap requiring use of MMD fish trap<br>• Reduced potential for stranding due to barrier operation.<br>• Improved collection and survival of all fish arriving at the trap, including possible fish runs twice as large as current runs. | Short-term/Episodic<br>Short-term/Episodic<br>Longer-term/Persistent<br>Longer-term/Persistent |
| Flow management | • Potential deposition and scour of spawning habitat adjacent to the proposed project.<br>• Increased ability to provide minimum instream flows and reliability of maintaining flows. | Long-term/Episodic<br>Long-term/Persistent |
| Operation and maintenance of equipment in and near aquatic habitats | • Leaks or spills of chemicals including fuels, lubricants, adhesives, and other chemicals used in maintenance or repair of barrier and associated facilities. | Short-term/Episodic |

*Mechanisms for Impact*- Increased fine sediment delivery resulting in elevated TDS within a river or lake can cause respiratory difficulties for adult and juvenile salmonids at extremely high volumes or for sustained periods. TDS is distinct from turbidity in that TDS represents actual particulate matter within the waterbody rather than a change in transparency or color. If sustained, elevated fine sediment delivery can also cause siltation within the bed of a river where salmon redds are located and dependent upon adequate upwelling of flow through gravels.

Rock placement and subsequent removal will be a potential source of residual armor rock and fine sediment to remain in the river. These materials if sufficient in number could create degraded stream bank conditions and affect spawning success.

When the initial construction begins and deconstruction of the cofferdam occurs, the left bank trap may be out of operation for 1-2 weeks as the cofferdam is built and the temporary fish trap extension is completed and then when it is removed. During the period the trap is inoperable, returning adults will not be able to access the trap and must then rely upon the right bank fish trap for collection. The right bank trap will provide an opportunity to temporarily provide collection during this early outage of the left bank trap. After the initial cofferdam construction, the ongoing outages required for installation of new mechanical structures or water and sediment control structures will be limited to periods of 1-2 weeks. Access will be maintained to the MMD fish trap during most of the construction periods. However, the right bank fishway will be demolished during the construction period so the right bank trap will be unavailable as a temporary trap after that point. The ongoing periods of construction are timed to avoid the primary migration periods for adult salmon and trout.

Hatchery impacts include interference with hatchery operations during construction and associated impacts to fish rearing and release. Period of high environmental sensitivity at the hatchery are during egg incubation between September 15 and November 31. Other periods have moderate to low levels of impact sensitivity depending on the activities occurring at the hatchery (Figure 30). Hatchery operations occur year-round so staging of equipment and movement of materials can interfere with necessary feeding and maintenance operations if not coordinated. Release of juvenile salmon into the White River through the fish trap facility can also be problematic if not coordinated.

*Project Conclusions* — Heavy loads of total dissolved solids occur naturally in the White River although they vary with time of year along with turbidity. During winter when salmon returns are low, TDS and turbidity levels can drop making construction related releases more evident unless high flows cause TDS to elevate. During summer low flow, TDS can be lower during reduced inflows however snow-melt and rain events can cause recurring high turbidity levels. Releases during these times could coincide with fish returns between spring and early fall (March to October). Elevated TDS can also have effects on foraging success of raptors and aquatic furbearers such as river otter. Adherence to existing erosion control measures and careful attention to cofferdam construction will minimize releases associated with the project. Onsite monitoring of construction releases and for maintenance of sediment control features will be necessary to ensure excessive releases with the potential to affect aquatic resources do not occur. A monitoring and mitigation plan will address any remaining potential for adverse impact.

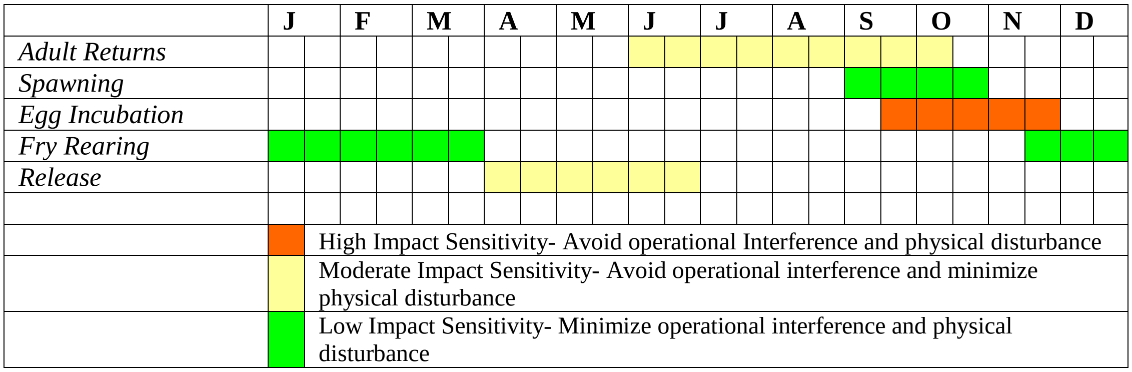


**Figure 30. Relative sensitivity of White River hatchery salmon to construction activities.**

Where not required for structural stability, armor rock removal will be required as a condition of construction. Major efforts will be made at the time of cofferdam decommissioning to ensure all large rock is removed. It remains possible that some class 1 rock (12-14 inches) and 2 rock (16-22 inches) may be transported downstream by flow and be undetected in turbid conditions. Efforts will be made by mechanical means to ensure as much rock is removed as practicable throughout the construction period.

Hatchery impacts will be avoided through close coordination with tribal hatchery staff. The proximity of equipment and materials near the hatchery will need to be coordinated to avoid egg mortalities. Operational interference between the hatchery and the construction will require daily coordination between hatchery staff and construction representatives.

Potential stress or injury to fish during operation

*Summary-* Operations at the barrier structure required to maintain flows, pass floodwaters, pass debris or support CWA flume operations could potentially cause harm to juvenile or adult fish. As flows increase, water velocity increases causing elevated potential for debris to move downstream and become lodged against the gates. Turbulent conditions may then be created.

*Mechanisms for Impact-* When screens, concrete or steel structures are placed into a situation where juvenile or adult salmon are present, the potential exists for fish to contact these structures and be injured. Gate settings are controlled by fish passage criteria and are designed to minimize injury, usually from excessive flow velocities through small gate openings. Woody debris, rocks and other material being transported downstream must pass over the new barrier dam. When debris collects on gates, weirs or intakes, water turbulence and head increases and can be a source of injury to fish moving through the blockage (Grette and Salo 1985). Screening criteria are provided by agencies to minimize impacts to juveniles migrating downstream that could be harmed at water intakes or by accumulation of debris (NMFS 2014). Flow manipulations at the site are also a potential source of injury as flow discharges may increase or decrease suddenly in response to these manipulations for flume outages, floods or other maintenance needs.

*Project Conclusions*- Established fish criteria were used to design weir and gate sizes and operational constraints. Most debris will be transported downstream at high winter flows or via short-term flushing events.

Reduced potential for fish impacts or stranding due to barrier operation.

*Summary*- The existing barrier structure is built to allow passage of high flows by controlled water releases through metal and wooden flashboards. Subsequent repair of these flashboards requires significant coordination and, in some cases, flow manipulation. Flow manipulations have been implicated in the dewatering of downstream fish habitat and resulting in the juvenile coho and Chinook mortality.

*Mechanisms for Impact*- Flows at the existing barrier structure over 3000 cfs approach the upper limit of its ability to withstand high flows. When these limits are approached, several steel panels are manually removed on the left and right bank to relieve pressure on the flashboards. This action usually prevents the barrier structure from losing wooden flashboards until flows reach above 4,000 cfs. When these higher flows occur, particularly in the presence of debris, flashboards can begin to topple providing the channel cross section needed to pass flows without damaging the White River fish hatchery, diversion flume or the fish trap. When flows recede, the downed flashboards need to be reinstalled. That action requires incoming flow to be less than 500 cfs to allow workers to access the flashboards being replaced (Figure 7). The reduction of flows to accommodate this flashboard repair has been shown to cause a reduction in water stage downstream to a degree sufficient to cause pothole stranding and possibly side channel stranding of coho and Chinook salmon. Once stranded fish can die from predation, heat stress (during summer), or complete dewatering of shallow habitats.

The construction of a new fish passage barrier, with weirs and control gates will render this operation unnecessary since the flashboards will not be a component of the new design. This will greatly reduce the potential for future impacts as a result of barrier maintenance from floods.

*Project Conclusions*- The avoidance of flow manipulations in support of barrier structure repair and removal of barrier features that can harm or kill jumping fish (jagged timbers and spikes) represents an opportunity to reduce potential mortality in Chinook salmon, along with long-term improvements in sediment transport and enhanced fish attraction. These features are considered beneficial aspects of this project for Chinook salmon. No mitigation is anticipated.

### 5.7.2 Flow Management

Potential deposition and scour of spawning habitat adjacent to the proposed project

*Summary*-Although not typically considered a heavily utilized spawning area for any species of salmon; adequate gravels exist within the project area to support spawning activity. During the construction of the project and subsequent operations, the potential for scour of potential spawning habitat exists downstream of the project and inundation of habitats are possible upstream.

*Mechanisms for Impact*- Downstream scour would be caused by hydraulic conditions created by water moving through or over the diversion barrier. Scour is likely to increase with the addition of higher minimum instream flows particularly in the summer where it could coincide within periods of salmon spawning.

Upstream inundation could be caused by a higher backwater pool during high flows but the duration and frequency will not be any longer and higher than the current backwater. The adjustable gates of the barrier will have more control over water surface elevation. A temporarily larger pool could increase settlement of fines as water velocity slows at the head of the pool and potentially embed spawning habitat.

Deposition fine materials and gravels below the proposed project on the right bank may continue to occur but are less likely given the ability to manage flows. The presence of multiple gates in combination with a hardened apron should reduce the tendency for sediment to build up and cause impacts. There will be operational flexibility with the new facility to remove sediment if it continues to cause impacts.

*Project Conclusions*- Downstream scour issues have been largely addressed through design of adequate aprons to prevent deep scour. Scour effects will be held close to the barrier in an area ill-suited for spawning and, in some instances, considered beneficial to keeping the right bank hatchery trap entrance clear of material. Upstream effects are expected to be minor with the ability to move sediments . The area is considered an underutilized spawning location which reduces the potential for salmon or resident fishes to be affected by additional inundation.

Increased ability to provide instream flows and flow reliability
*Summary*- Instream flows have recently been increased between 70 cfs and 220 cfs in the past 5 years. The existing barrier structure has no mechanism for ensuring minimum instream flows are passed. The new structure will increase the reliability of downstream flow by eliminating current operational restrictions and need for water fluctuations during repair.

*Mechanisms for Impact*- The existing barrier structure does not have a dedicated spillway to pass water over the barrier nor gates to manage flows and materials. Water passes the existing barrier at various locations depended on inflow but the left bank consistently passes water. The new fish passage structure will have multiple gates to allow for manipulation of flows and movement of sediments or woody debris. This will enhance attraction flows to the new fish trap.

*Project Conclusions*- The ability to increase attraction flow on the right bank is vital to ensuring fish passage during moderate to high flows. The ability to pass materials quickly will provide better access for upstream migration and holding and reduce maintenance requirements. The ability to ensure additional flows are carried through the fish trap should provide better security for downstream fish resources. The new structure will eliminate the need for repair that requires river level fluctuations which increases reliability of the structure overall and the ability to provide adequate downstream flow.

### 5.7.3 Operation and maintenance of equipment in and near aquatic habitats

Leaks or spills of chemicals including fuels, lubricants, adhesives, and other chemicals used in maintenance or repair of barrier and associated facilities

Construction and subsequent operation of a new diversion structure at Buckley will require the use and maintenance of a large variety of equipment. This includes heavy machinery used to remove the existing barrier dam, install cofferdams and construct the new diversion structure. Equipment will be required to operate gates and clear debris. Maintenance of the facility may require short term uses of smaller equipment for washing or repairing the structure and related structures. All equipment has the potential to leak lubricants or fuels. However, the Corps has a regular maintenance program designed to keep equipment in top working order to prevent spills or releases of hazardous materials.

All equipment that may come into contact with the water will be regularly inspected and cleaned. Although there is the potential for the introduction of contaminants into the water, it is unlikely that this would occur in sufficient magnitude to adversely affect species of concern. A monitoring and mitigation plan will address any remaining potential for adverse impact.

### 5.7.4 Resident Fish

**Bull Trout -** The White River contains fluvial, resident and anadromous subpopulations. Of which the resident subpopulation is least likely to encounter the project area. The fluvial and anadromous subpopulations are trapped and hauled at the Buckley fish trap. Potential impacts to bull trout from the proposed project are similar to those of anadromous fishes for the subpopulations that may encounter the project area. However, there is much life history diversity and interaction between bull trout sub-populations and life history strategies. This warrants consideration of project impacts on both individual fish and various life history strategies. A summary of these effects is presented below.

*Subpopulation Size* - Corps fish trap bull trout tagging and unpublished spawning inventories conducted by the PIT over the past 4 years have yet to determine a population size though a range of 50 and 500 individuals is probably realistic. Spawning inventories have identified a resident population in upper watershed areas, and monitoring by the Corps and PIT has identified that that bull trout captured at the trap are either fluvial or anadromous. Thus, the effects are most likely limited to the fluvial or anadromous sub-populations. Replacement of the existing barrier structure and fish trap is expected to provide improved collection of bull trout and contains no long-term adverse impacts that could significantly alter the sub-population size. Catch returns at the fish trap show a substantial increase in the population indicating a positive response to available prey resources and recent improvements to the White River (e.g., increased instream flow and reduced water diversion).

*Growth and Survival* - Corps fish trap data indicate rapidly increasing returns and there are generally good habitat conditions upstream of MMD. Replacement of the existing barrier structure and fish trap would not alter current conditions.

*Life History Diversity and Isolation* - Bull trout are moving from the lower to the upper watershed via the Corps fish trap, and resident forms are known to spawn in two tributary streams to the Greenwater River (Silver Springs Creek and Klickitat Creek) (Ladley, 2007). However, the size and genetic relationship between fluvial (or anadromous) and resident subpopulations is still the subject of investigation. Replacement of the existing barrier structure will continue to provide unbiased transportation of all bull trout above the Mud Mountain Dam reservoir. The movement of fluvial and anadromous subpopulations is consistent with these life history strategies and should not represent a significant impact to that portion of the population. Tagging data from the Buckley fish trap suggest sub-adults and adults can return on an annual basis and exhibit significant growth between years. Existing constraints to distribution outside the project area will not be altered.

*Persistence and Genetic Integrity* - The interactions between the various subpopulations of bull trout in the White River is not known but movement of bull trout from the White River to other portions of the basin has been shown with the possible exception of resident bull trout residing in the upper watershed. Similarly, extraspecific interactions (particularly hybridization) is also not known but potential for hybridization with non native brook trout are remote. Brook trout were outplanted into limited areas in Mt Rainer national park high elevation areas, but they are limited to 1-2 streams above migratory barriers. The proposed project will continue to provide connectivity between lower river bull trout and resident bull trout through the fish trap operations. No brook trout, lake trout or hybridized char that could represent a threat to genetic diversity have been identified in the trap and are not expected to in the future. Non-native char presence is considered limited in the upper watershed though interactions may occur.

**Other Resident Fishes -** It can be reasonably assumed that resident fish will remain in the area during construction. Unless trapped however, adequate habitat will be available for these fishes to modify their location to avoid short-term impacts. Displacement is most likely for cutthroat and rainbow trout though less so for dace and sculpin, that establish small territories.

The project contains actions to reduce and avoid trapping fish. Resident fish do not appear to be reliant upon the fish trap for survival. Some whitefish are captured annually but these fish are common in mainstem river systems and most likely represent local fish that move into the trap from nearby areas.

## 5.8 Terrestrial Resources

Effects to wildlife, if any, will likely be temporary in nature and occur primarily during construction through noise and visual disturbance. Wildlife may temporarily be displaced during construction, but given their mobility and the available surrounding habitat, the overall effect will be minimal. The riparian plantings and potential addition of woody material will be added to the site increasing some habitat values. In addition, the increase in fish passage success will provide more adult fish upstream benefiting numerous species. The level of human disturbance at the project location will remain similar to the baseline condition. Overall effects, both adverse and favorable, will be insignificant.

## 5.9 Federally Threatened And Endangered Species

### 5.9.1 Chinook Salmon

The proposed action has been evaluated for Puget Sound Chinook salmon using the matrix of pathways and indicators (NMFS 1996). NMFS found in its 2014 BiOp that the proposed action would jeopardize the continued existence of the Puget Sound Chinook and would destroy or adversely modify Puget Sound Chinook designated critical habitat. However, through the implementation of the RPA proposed by NMFS, the Corps may avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of proposed critical habitat.

The proposed action is expected to cause, a short-term degradation of baseline indicators related to coarse and fine sediment transport, increased risk of contaminant release and scour. These changes are expected to occur despite implementation of conservation measures that maybe in place and that are intended to minimize or avoid such effects. These changes are an unavoidable consequence of performing replacement activities and long-term operation. Long-term changes from barrier replacement include improvement in sediment transport conditions and flow attraction to the fish trap from the ability to manage flows and associated materials, and reductions in fish stranding and barrier related injury and fewer flow manipulations for maintenance. The new fish trap with a large fishway attraction flow, new separation and holding facilities, and truck transport, will collect and transport wild and hatchery Chinook salmon in a safe (objective 98 percent survival), timely (objective 95 percent attraction, less than 24-hr holding), and effective manner. It includes the ability to separate out Chinook from other species with direct delivery of hatchery Chinook to the MIT facility.

### 5.9.2 Bull Trout

Unlike Chinook, the proposed action would affect only selected life stages of bull trout, including upstream migration and juvenile rearing. The proposed action could have a temporary impact on bull trout but should produce long-term benefits due to a reduction in impacts to bull trout due to the elimination of the current barrier structure maintenance procedures and potential injury to bull trout from ascending the barrier, with improvements from ability to manage flows and sediments. The new fish trap and associated facilities will greatly improve the attraction to the trap, the safe collection and timely transport of sub-adult and adult bull trout. The sorting capability of the trap would allow for separation of bull trout from other species for monitoring and evaluation.

The USFWS found in its 2015 BiOp that the proposed action is not likely to jeopardize the continued existence of the bull trout and is not likely to destroy or adversely modify designated critical habitat.
Based on the analysis for critical habitat, the proposed actions may affect, and are likely to adversely affect critical habitat for bull trout.

### 5.9.3 Puget Sound Steelhead

As is the case for Chinook, the proposed action would affect all life stages of steelhead, including spawning, egg incubation, and juvenile rearing. The proposed action is expected to cause, a short-term degradation of baseline indicators related to coarse and fine sediment transport, increased risk of contaminant release and scour. These changes are expected to occur despite implementation of conservation measures that maybe in place and that are intended to minimize or avoid such effects. These changes are an unavoidable consequence of performing replacement activities and long-term operation. Long-term changes from barrier replacement include improvement in sediment transport conditions and flow attraction to the fish trap from the ability to manage flows and associated materials, and reductions in fish stranding and barrier related injury and fewer flow manipulations for maintenance. The new fish trap with a large fishway attraction flow, new separation and holding facilities, and truck transport, and will collect and transport wild and hatchery steelhead in a safe (objective 98 percent survival), timely (objective 95 percent attraction, less than 24-hr holding), and effective manner. It includes the ability to separate out steelhead from other species with direct delivery of hatchery steelhead to the MIT facility.

NMFS found in its 2014 BiOp that the proposed action would jeopardize the continued existence of the Puget Sound Steelhead and would destroy or adversely modify Puget Sound steelhead proposed critical habitat. However, through the implementation of the RPA as proposed by NMFS, the Corps may avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of proposed critical habitat.

### 5.9.4 Eulachon

Eulachon spend almost their entire lives in marine waters, and enter freshwater (lower reaches of rivers) only to spawn, in winter and possibly as late as spring. Eggs may adhere to sand or gravel, and hatch after several weeks.

There is essentially no such risk of sedimentation of eulachon eggs as a result of diversion barrier repairs, even if those happen in March, since the mobilization of sediment is very minor and transitory. Construction of a new fish passage barrier would also have little to no such effect.

Overall, the proposed action may affect, but is not likely to adversely affect eulachon. There is no critical habitat designated for eulachon in the action area; the proposed actions will have no effect on designated critical habitat for eulachon.

### 5.9.5 Bald Eagle

The de-listed bald eagle is still protected under the Bald and Golden Eagle Protection Act. The project will not result in any direct effects to the bald eagle. The nearest eagle nest is located in a cottonwood tree on the North bank of the river adjacent to the White River hatchery about 400 feet from the proposed new fish trap facility. This is an alternate nest site which was constructed after the nest site identified in the Priority Habitats and Species (PHS) database blew down. The PHS database indicates the old nest was active in 2006 and MIT Hatchery staff indicate that nesting has occurred in the alternate nest site.

In the summer and fall, mature eagles are frequent visitors to the project area as it lies within a habitat corridor used by eagles. It is common to find birds perched in the large deciduous trees on both sides of the river downstream of the barrier dam. Mature eagles have been known to feed on salmon within the project area but are not seen to congregate in response to the presence of the fish trap or barrier structure possibly because the principal foraging habitat exists in the upper watershed where most salmon spawning occurs.

The alternate nest site is not visible from the fish trap facility construction site but is within line of site of the access road to the site. No usable habitat will be altered or removed in association with the project though some road related tree removals may occur, roosting trees and nesting habitat of the resident pair are well known and these resources will not be altered. Although the nest and occupying adults are familiar with heavy equipment and human disturbances, the duration of construction required by the proposed project may result in an effect to the nearby eagle nest. It appears the mated pair nesting in the vicinity of the fish trap are extremely adaptable and tolerant of human disturbance.

In 2005 the Corps made a determination of *may affect but not likely to adversely affect* on the then listed bald eagle, and the Services concurred with this determination. This determination was based largely on the construction impacts from the re-build of the Buckley fish passage barrier structure. Noise, movement and human interactions onsite would result in a period of elevated disturbance to terrestrial species in the project area.

Bald eagle impacts from construction would include elevated noise, human movement and disruption to surrounding lands, however as noted above the pair utilizing this nest appear to be extremely adaptable and tolerant of human activities. Construction activities between October 31 and August 30 are most likely to impact wintering and nesting bald eagles.

No potentially suitable bald eagle nesting or roosting habitat would be altered or removed in association with the project. Any projected rebuild of the existing right bank levee would require vegetation removal which would reduce riparian cover along the river. Potential foraging within the project area would continue to be less than optimum due to transportation of migrating salmon around MMD. Since the project would not alter or remove bald eagle nesting or roosting habitat, it is compliant with the Pacific States Bald Eagle Recovery Plan. No cumulative effects have been identified.

One conservation measure would be to limit construction most likely to cause disturbance between the nesting period of January 1 and August 15 to the extent practicable. Avoidance of all potentially disturbing construction activities within the environmental windows would however, be impracticable due to the long time period required for construction and potential impacts to fish migration and human elements of safety. Daily construction periods can be designed to minimize disruption within the nesting period and may be limited to daylight hours to provide the normally daytime oriented birds a period of rest at night. Still, increased noise and disturbance that would accompany construction of the new fish passage barrier would warrant monitoring of the existing eagle nest for disruption. Wildlife biologists would be onsite or available to other on-site biological monitors to observe bird behavior and ensure disruption of the nesting birds is minimized.

### 5.9.6 Marbled Murrelet

Current PHS data show that the nearest marbled murrelet sighting occurred in 1998 approximately 8.7 miles to the East of the existing barrier dam. The project site is about 20 straight-line miles from Puget Sound. Forests in the project vicinity are typically second- or third-growth forests of generally less than 70 years old (and dominated by hardwoods), with only a few scattered coniferous trees of adequate size to support nesting. These trees are isolated and not part of extensive mature stands making nesting unlikely. The project will have ***no effect*** on the marbled murrelet or its critical habitat.

### 5.9.7 Northern Spotted Owl

Current PHS data show that spotted owls were detected in 1991 approximately 8.0 miles east of the barrier dam. As there isn't any spotted owl nesting, roosting, or foraging habitat in either the project area or action area; the project will have ***no effect*** on the spotted owl or its critical habitat.

### 5.9.8 Grizzly Bear

Current PHS data do not document any Grizzly bear sightings in the project vicinity. The project area is located outside of the recovery zone (north of Interstate 90). The potential for grizzly bears to occur in the project vicinity is low due to human activity.

Grizzly bears are unlikely to occur in the action area, the project will have ***no effect*** on grizzly bears. There is no recovery or management plan for the grizzly bear in the project area. The North Cascades Grizzly Bear Recovery Area is north of Interstate 90.

### 5.9.9 Gray Wolf

Current PHS data do not document any gray wolf observations in the project area. A history of disturbance, including high road density to the south, and road and human disturbance levels to the north decreases the likelihood they are present. The project will have ***no effect*** on gray wolves.

### 5.9.10 Canada Lynx

Current PHS data do not document any lynx in the project vicinity. Site specific surveys have not been conducted. However, lynx are boreal, typically residing in upper elevation forests. Since Canada lynx are not known to occur in the action area, the proposed project will have ***no effect*** on Lynx. The action area is outside of suitable habitat for the Canada lynx (Ruediger et al. 2000) and so it is unlikely that the project could be designated a lynx management area.

### 5.9.11 Southern Resident Killer Whale

The effects of the proposed action on the Southern Resident killer whales is primarily through impacts on killer whale prey items including Chinook salmon. Since operations may decrease the abundance of Chinook and other salmonids in the White River, it is possible this could translate to a slight decrease in the amount of salmon prey available for killer whale. NMFS found in its 2014 BiOp that the proposed action may affect and is likely to adversely affect the Southern Resident Killer Whales. NMFS also found that the proposed action may affect, and are likely to adversely affect, designated critical habitat for Chinook salmon. However, through the implementation of the RPA as proposed by the Corps may avoid the likelihood of jeopardizing the continued existence of Southern Resident Killer Whales or resulting in the destruction or adverse modification of critical habitat.

## 5.10 Cultural Resources

The barrier structure and fish and haul facility are components of the National Register eligible WRHP historic district and are located within the APE for this project. In 2004, the Corps initiated consultation with the Washington State Historic Preservation Officer (SHPO). The SHPO responded on November 4, 2004 agreeing with the APE. In 2005, the Corps initiated consultation with the Muckleshoot Indian Tribe and the Puyallup Indian Tribe. At that time neither the Muckleshoot Indian Tribe nor the Puyallup Indian Tribe indicated any concerns regarding the proposed project at that time. The Corps determined that removal of the barrier structure is an adverse effect on the WRHP historic district. The SHPO responded in a letter dated November 30, 2007 concurring with the Corps determination of adverse effect to the WHRD specifically the barrier dam. The Corps reengaged in Section 106 consultation in February 2015 with the SHPO, Tribes, CWA and the Advisory Council of Historic Preservation (ACHP). The ACHP declined to participate in the development of the MOA by letter on March 16, 2015. Memorandum of Agreement (MOA) to mitigate the proposed project's adverse effect to the White River Hydropower Project Historic District was developed in coordination with Cascade Water Alliance (CWA) and the State Historic Preservation Officer (SHPO). Signatories to the MOA include the Corps, CWA and the SHPO. The MOA was signed by all signatories with the final signature by the SHPO on April 29th, 2015 (Appendix F).

## 5.11 Climate and Air Quality

Air quality impacts in the immediate area of the construction will occur but will be minor and temporary. Air quality disturbances from the construction, primarily from construction equipment, will not occur at levels considered significant to fish and wildlife resources. The construction air quality disturbances will not cause direct mortality, latent mortality or other physiological damage. Notable, behavioral avoidance of the project area by wildlife is not anticipated. The project location next to the river and at the base of the floodplain terrace will reduce noise that would other affect the few surrounding homes. Existing mature tree cover will further reduce this affect.

During construction, there will be a temporary and localized reduction in air quality due to emissions from earthmoving equipment and dump trucks operating during soil excavation and disposal activities. These emissions will not exceed EPA's *de minimis* threshold levels (100 tons/year for carbon monoxide and 50 tons/year for ozone) or affect implementation of Washington's Clean Air Act implementation plan. State trigger levels for an air operating permit to include $PM_{10}$ and $PM_{2.5}$ are 100 tons/year of an air pollutant, 10 tons/year of a hazardous air pollutant or 25 tons/year of a combination of a hazardous air pollutant (WDOE, 1994). Significant impacts are not anticipated.

Wildlife resources, particularly birds and mammals are most likely to be temporarily impacted by air quality degradations. Birds, including raptors, may also be temporarily affected by noise and additional human disturbance. Air quality may be affected locally by large equipment activities but will not significantly affect fish and wildlife resources.

At the Federal level, GHG is not regulated directly; however, some policies and guidance from the Council on Environmental Quality (CEQ) do provide some direction on how to address greenhouse gases in environmental impact statements. CEQ regulations and guidance further elaborate on how the analysis for GHGs should be formulated with the recognition that not only are there no formal thresholds for GHG emissions analyses, but also of the scientific limitations on how the analyses can be prepared. Specifically, the CEQ guidance states "agencies should recognize the scientific limits of their ability to accurately predict climate change effects, especially of a short-term nature, and not devote effort to analyzing wholly speculative effects." Thus, the following analysis acknowledges to the extent scientifically possible the GHG emissions and sequestration of each alternative.

Estimating the total quantity of GHG that would be produced by each project alternative would require extensive analysis and numerous assumptions about each alternative's final design and construction. Qualitative comparisons, however, can be drawn from a simplified estimation of GHG production. Therefore, the Corps performed a simplified estimation of GHG emissions for hauling activities for all alternatives and compared the results.

This alternative would have localized short-term increases in air quality and GHG during the two year construction schedule. Machinery and vehicles employed for the proposed repair work will release greenhouse gases. For every gallon of diesel fuel burned, 22 pounds of $CO_2$ are produced, and every gallon of gasoline produces 19.4 pounds of $CO_2$ (EPA 2009). Table 8 outlines assumed air pollutants and GHG emissions based on EPA (2009) and Sacramento Metropolitan Air Quality Management District (SMAQMD) (2008). Based on the amount of equipment needed for construction, including but not limited to dump trucks, compactors, graders, front end loaders, cranes, rollers, pile hammer, and excavators, operating varying hours, an estimated 626.9 tons of $CO_2$ would be emitted using a construction emissions spreadsheet model for non-road equipment from the SMAQMD and EPA's estimates of $CO_2$ emissions (SMAQMD 2008; EPA 2009). Carbon monoxide (CO); reactive organic gases (ROGs), which are ozone precursors; nitrogen oxides ($NO_x$); particulate matter (PM); and sulfur oxides ($SO_x$) were also calculated for dump trucks and construction equipment.

**Table 8. Estimated emission (tons) of air pollutants and greenhouse gases under the Right Bank Alternative**

| | Tons CO | Tons reactive organic gases | Tons $CO_2$ | Tons $NO_X$ | Tons PM | Tons $SO_x$ |
|---|---|---|---|---|---|---|
| Trucks and equipment emissions * | 7.8 | 3.4 | 626.9 | 6.8 | 15869.5 | 0.1 |

*Based on spreadsheet model from SMAQMD (2008); assumes 500-hp diesel engines working 8 hrs per day, modeling data

## *5.12 Noise and Traffic*

Noise impacts in the immediate area of the construction will occur but will be minor and temporary. Noise disturbances from the construction, primarily from construction equipment, will not occur at levels considered significant to fish and wildlife resources. The construction Noise disturbances will not cause direct mortality, latent mortality or other physiological damage. Notable, behavioral avoidance of the project area by wildlife is not anticipated. The project location next to the river and at the base of the floodplain terrace will reduce noise that would other affect the few surrounding homes. Existing mature tree cover will further reduce this affect. Truck traffic in and around the site will be kept to major roads and will not travel through residential neighborhoods. However, two private residences exist adjacent to the project area will experience higher noise levels from higher than usual truck traffic . Temporary or permanent relocation of these residences might be necessary.

Wildlife resources, particularly birds and mammals are most likely to be temporarily impacted by noise degradations. Birds, including raptors, may also be temporarily affected by noise disturbance.

On a long-term basis, there will be slightly lower truck traffic on public roads every other year, due to the larger capacity of the trucks used to haul fish to the release site during peak pink run periods. Traffic flow patterns should remain the same.

## 5.13 Hazardous and Toxic Wastes

The concerns of HTRW impacts on the left bank led to greater consideration for the right bank which is assumed to have no significant HTRW issues. Based on the analysis of existing information, no HTRW sites are anticipated to be impacted by the proposed action. All material removed from the existing barrier structure will be disposed of in an approved disposal facility.

## 5.14 Mitigation for Adverse Environment Effects

NEPA requires that agencies identify and include in the action all relevant and reasonable mitigation measures that could reduce negative effects of the Federal action. Implementation of the proposed project would involve demolishing the existing fish trap and barrier structure and constructing a new fish trap and barrier structure along with levee and road improvements, with construction activities in the aquatic environment and in close proximity to other ecological resources. Throughout the planning process, conceptual alternative designs incorporate avoidance and minimization measures to reduce impacts. Construction designs would include practices that avoid and minimize effects to affected significant resources. This section describes methods to avoid and minimize adverse effects of the proposed alternative. The proposed mitigation measures are conceptual at this point and will be further developed during the detailed design phase.

### 5.14.1 Standard Practices to Mitigate Negative Effects of Construction

Specific measurable and enforceable mitigation measures would be developed for the project based on the specific impacts of the project. The TSP’s designs and construction timing would include the following standard measures:

- USACE would schedule tree clearing work to occur during designated periods before or after the migratory bird breeding season.
- USACE would conduct survey for eagle nests and limit construction activities during breeding season.
- Construction contractor would be required to prepare an Environmental Protection Plan for approval by a USACE staff biologist.
- Traffic alterations would be designed to minimize impediments, with the shortest and least disruptive detours possible, and in coordination with the relevant transportation agency.
- Temporary relocation of two structures adjacent to the construction site.

### 5.14.2 Conceptual Mitigation Measures for Effects to Wetlands Habitat

- The wetland delineation would be verified to confirm the extent and function of wetlands affected by the proposed project; then
- To minimize this potential impact, the project footprint would be reduced to maximum extent possible; and
- To compensate for any remaining impacts, in-lieu-fee credits would be purchased from the Boise Creek In-Lieu-Fee program.

### 5.14.3 Conceptual Mitigation Measures for Effects to Threatened and Endangered Species, Fish, and Aquatic and Riparian Habitats

- To minimize impacts, the project footprint would be reduced to maximum extent possible; and
- To compensate for any remaining impacts, a combination of some or all of the following options could be implemented:
- Planting of riparian vegetation per ETL 1110-2-583,
- Planting riparian vegetation at the project site or elsewhere in the Mud Mountain Dam Project area. Advanced planting will be considered to reduce temporal impacts.
- Construct new access road to avoid vibration impacts to the MIT Hatchery.

### 5.14.4 Conceptual Mitigation Measures for Effects to Cultural Resources and Best Management Practices

The Corps has determined that the proposed project will have an adverse effect on the WRHP historic district. The Corps has proposed the following mitigation measures: large format photography of buildings and structures to be removed during the project and submittal of an essay to an on-line heritage website that provides an overview of the original barrier structure and fish collection and construction.

### 5.14.5 Best Management Practices to Protect Water Quality

The proposed construction activities would involve, by necessity, in-water work and areas of ground clearing. Protecting water quality from storm water runoff would require implementation of best management practices (BMPs) to avoid excessive runoff and elevated turbidity in the receiving water body. It is important to avoid excessive pulses of sediment during the construction phase that are more than what the surrounding aquatic life can easily tolerate. The proposed alternative would have a Stormwater Pollution Prevention Plan, which includes a Temporary Erosion and Sedimentation Control Plan, approved by a USACE staff biologist. Construction contractors would be required to obtain a Construction Stormwater Permit under Section 402 of the Clean Water Act. Standard construction stormwater BMPs can be incorporated into site designs, operational procedures, and physical measures on site. The following are some examples of frequently used BMPs:

- Minimize area of ground disturbance and vegetation clearing.
- Use the site's natural contours to minimize run-off and erosion.
- Do not expose the entire site at one time; avoid bare soils during rainy months.
- Stabilize erodible surfaces with mulch, compost, seeding, or sod.
- Use features such as silt fences, gravel filter berms, silt diking, check dams, and gravel bags for interception and dissipation of turbid runoff water.
- Shutdown of project construction if exceedances of state water quality standards cannot be controlled.
- Isolation of site to prevent runoff from curing concrete from entering the White River.

In addition, BMP's are also requirements of the NMFS BiOp (NMFS 2014, Appendix B). As described on Page 55 the BiOp includes directions for minimizing harm to ESA listed fish by coordinating with NMFS and WDFW to identify workable windows, and to employ the best management practices as modeled after the Portland District Corps' Standard Local Operating Procedures for Endangered Species (NMFS 2014, Appendix B).

The BiOp and Appendix B with full listing of BMP's can be accessed on the NMFS webpage:
https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts
Search on: NMFS tracking NumberNWR-2013-10095

### 5.14.6 Best Management Practices to Minimize Effects of Greenhouse Gas Emissions

There are no legal requirements to mitigate for GHG emissions; however, BMPs are available for fuel and material conservation during construction. Such BMPs include the following:

- Maximizing use of construction materials that are reused or that have a high percentage of recycled material content, such as recycled asphalt pavement, concrete, and steel.
- Obtaining construction materials and equipment from local producers or vendors to minimize energy use for shipping.
- Encouraging construction personnel to carpool or use a crew shuttle van.
- Turning off equipment when not in use to reduce idling.
- Maintaining equipment in good working order to maximize fuel efficiency.
- Routing truck traffic through areas where the number of stops and delays would be minimized, and using off-peak travel times to maximize fuel efficiency.
- Scheduling construction activities during daytime hours or during summer months when daylight hours are the longest to minimize the need for artificial light.
- Implementing emission-control technologies for construction equipment.
- Using ultra low sulfur (for air quality) and biodiesel fuels in construction equipment.
- Using warm mix asphalt or cool pavement rather than hot mix asphalt.
- Using renewable energy produced onsite or offsite. For example, using solar-powered generators to supply electricity for field offices and construction lighting.

# 6 ENVIRONMENTAL EFFECTS OF THE NO ACTION ALTERNATIVE

The no action alternative represents the continuation of baseline conditions as described in Section 4.0 and the perpetuation of all existing beneficial and adverse effects associated with the fish trap and barrier structure and its operation and maintenance. For most parameters of environmental effect such as, climate and geology, sediment, water quality, land use and potential pollution sources, vegetation, wetlands, terrestrial resources, cultural resources, air, noise and HTRW; the no action alternative represents a perpetuation of current adverse and beneficial environmental effects. It also represents the elimination of short term adverse construction impacts associated with the proposed project. These impacts are assessed in Section 5.0. Other environmental parameters, notably hydrology threatened and endangered species and aquatic resources, do represent an existing adverse effect as part of the baseline condition which can be reduced with the proposed project. Existing adverse effects associated with the baseline condition are reduced potential for fish impacts or stranding due to barrier operation and increased ability to provide instream flows. Failure to comply with NMFS BiOp requirements (passing 95 percent of all fish) will result in a failure to comply with the terms and conditions of the NMFS BiOp. There will be continued mortality of migrating salmonids due to delays at the fish trap.

In the absence of replacement of the existing fish trap and  barrier structure, the Corps will continue to operate the fish passage facility, contracting with CWA to affect repairs of the facility as needed, typically on an annual basis. Impacts of the continued operation of the fish passage facility and repair of the barrier structure will result in similar impacts to aquatic resources as previously encountered. At some point in the future, there is a high likelihood that the barrier structure will experience a catastrophic failure of the foundation which will be beyond of the means of CWA to repair for the Corps. There is a high likelihood that this event will occur within the next eight years.

Since the Corps does not own the barrier dam, repair of the facility will not occur until sufficient authorization and funding is secured under an emergency action and rights to repair the structure (either fee title or easement) are secured from CWA. The timeline for securing the necessary approvals is uncertain. Therefore in the interim, the fish passage facility will temporarily not be able to function with any reliability. Many salmonids will proceed past the fish trap and some will spawn in the reach between the barrier structure and MMD. Recruitment of salmonids above the barrier will be severely curtailed. The operation of the MIT hatchery will also be compromised. It is anticipated that the Corps will undertake emergency measures to rebuild a barrier structure at the site, similar in form and function to the proposed plan.

# 7 CUMULATIVE EFFECTS

The NEPA defines cumulative effects as 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 in the project vicinity, regardless of what agency (Federal or non-Federal) or person undertakes such other actions (40 CFR §1508.7).

## *7.1 White River Hatchery Operations*

The White River Chinook Hatchery located on the same (right) bank from the proposed project will remain associated with the barrier structure and its fish trap operations. The hatchery is dependent on the barrier structure to present a barrier to adult migrating fish and will be dependent on the new trap for collection of those fish. The proposed project will result in better attraction and collection of fish at the hatchery in anticipation of current and future operations. The collection facility and additional attraction water will enhance attraction for hatchery Chinook to return to the trap for use as broodstock. The water supply to the trap facility will include the ability to support hatchery operations with additional water. The proposed project will also be required to ensure the hatchery is protected from high water events and currently proposes to rehabilitate an existing levee for that purpose. While normal pool elevations are similar to the existing condition; at flood flows, the water surface elevations could be lower than today since there will be control at the barrier rather than depending upon the flashboards to fail as the current barrier does.  The hatchery is considered a necessary component to the recovery of White River Spring Chinook and would not be possible without a diversion structure. Cumulative effects to the White River ecosystem from hatchery improvements should be positive in the long term assuming the hatchery follows accepted outplanting and propagation guidelines.

## 7.2 Improved Anadromous and Resident Fish Production

An increase in anadromous fish from a reduction in barrier structure related impacts could affect the current population of resident trout. The upper watershed has always contained some level of salmonid use, including natural spawning and some hatchery supplementation using steelhead fry. The proposed project may result in an incremental increase of Chinook, coho, and steelhead and potentially a large increase in pink salmon. The additional progeny from these fish may translate into a cumulative effect to resident fish through competition for prey resources and habitat. An alternative positive impact to resident fish is that an increase in production from additional progeny and remains from spawned out salmon would create a large forage base for juvenile and adult resident fish. The recent increase in bull trout from 14 fish transported at the trap in 2008 to over 400 fish in 2014, concurrent with the rise of pink salmon run, is indicative of the potential benefits from a large influx of salmon to the nutrient poor Upper White River basin.

## 7.3 Water Supply and Water Rights

Current withdrawals of water by CWA to maintain lake levels in Lake Tapps have resulted in entrainment of fish. CWA has taken measures to reduce entrainment of salmonids in their flume. Screen sare in place in the flume to prevent juvenile salmonids from entering Lake Tapps.

Proposed water withdrawals in support of Municipal and Industrial water supply would not be precluded if the proposed project were constructed. Planning stages have been initiated by private parties to allow water to be diverted for this purpose. The diverted water and its management would fall to private or public entities. The water withdrawal may have an incremental negative effect on mainstem anadromous fishes which require adequate water levels for migration and rearing but would also have incremental beneficial effects on fish resources and water quality of Lake Tapps. Human populations around Lake Tapps and elsewhere that may benefit from this water supply may also be a cumulative effect.

## 7.4 Mud Mountain Dam Operations

As a result of the proposed action, there are few cumulative impacts anticipated that would result in increased impacts to aquatic or terrestrial resources. A reliable and functioning fish passage barrier may eventually reduce environmental impacts from MMD by eliminating a need to support barrier structure repairs and eliminating discharge considerations that may damage the existing barrier dam.

Construction of the proposed project may result in the elimination of flow regulation considerations from MMD intended to protect the barrier structure. Though not a formal requirement, MMD has opted to slightly reduce discharge during smaller floods to protect the barrier structure from damage. This action increases water and sediment storage in the reservoir which must then be released. If sediment is released after the high flow event, it could result in water quality impacts downstream. Following construction, MMD will be able to release natural inflows more reliably and reduce potential water quality impacts from stored reservoir sediment.

As part of the NMFS BiOp RPA 1, the Corps will reevaluate juvenile fish survival through the MMD outlet tunnels so as to inform operation of the tunnels in the future while meeting juvenile passage survival criteria provided by the NMFS BiOp.

# 8 ENVIRONMENTAL COMPLIANCE

## *8.1 Endangered Species Act*

In accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, federally funded, constructed, permitted, or licensed projects must take into consideration impacts to federally listed or proposed threatened or endangered species. The potential effects of the project and conservation measures taken to reduce those effects are summarized in Section 5.0 and are addressed in greater detail in a biological evaluation for the project. In October 2013 NMFS provided a draft BiOp with initial requirements for a new fishway and barrier structure for MMD. Subsequently the Corps and NMFS developed an action plan to meet the expected ESA requirements for fish passage that would be incorporated in the final BiOp. NMFS provided a Final BiOp in October 2014. The key point in the plan was to develop design criteria for the new fish passage facility (RPA 3). In addition to the consultation with NMFS the Corps has consulted with the US Fish and Wildlife Service on the effects of the proposed MMD actions on ESA-listed species and designated critical habitat within their jurisdiction. As with the Corps' intent in regards to the 2014 NMFS BiOp, the Corps will implement actions in the final USFWS BiOp which was received in March 2015. The Corps will implement provisions of both the 2014 NMFS BiOp and the 2015 USFWS BiOp in collaboration with those agencies, MIT, and PTI, as well as the Washington Department of Ecology (see also Clean Water Act, below), WDFW, and CWA, as appropriate.

## *8.2 National Environmental Policy Act*

The National Environmental Policy Act (NEPA) (42 U.S.C. §4321 et seq.) commits federal agencies to considering, documenting, and publicly disclosing the environmental effects of their actions. This Environmental Assessment, prepared March 2015, is intended to achieve NEPA compliance for the proposed project. As required by NEPA, this Final EA describes existing environmental conditions at the project site, the proposed action and alternatives, potential environmental impacts of the proposed project, and measures to minimize environmental impacts. The document determines if the project would create any significant environmental impacts that would warrant preparing an EIS, or whether it is appropriate to prepare a FONSI.

Section 1500.1(c) and 1508.9(1) of the National Environmental Policy Act of 1969 (as amended) requires federal agencies to "provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact" on actions authorized, funded, or carried out by the federal government to insure such actions adequately address “environmental consequences, and take actions that protect, restore, and enhance the environment". This assessment evaluates environmental consequences from the proposed new trap-and-haul facility and fish passage barrier on the White River, Washington.

In some cases, activities associated with the proposed action, Reasonable and Prudent Alternatives and Reasonable and Prudent Measures (RPA and RPMs) will require documentation and public coordination under the National Environmental Policy Act (NEPA). The new barrier and fish trap in particular must be addressed with public review in accordance with NEPA. This Environmental Assessment (EA)/Finding of No Significant Impact and decision document have been completed to support the planned construction contract solicitation and completion of construction of the facility in time for it to start operation in December 2020. NEPA requirements for public review and the EA covers the actions associated with the new fishway and barrier requirement for RPA 3 implementation (RPA 1 is for monitoring and operations and maintenance activities at the dam and RPA 2 is for interim repairs to the existing barrier). A Finding of No Significant Impact is included in Appendix B.

Depending upon the nature of future design changes, a supplemental EA might be prepared and provided for public review if the effects on the human environment are outside of what was considered in this EA.

## *8.3 Tribal Treaty and Trust Responsibilities*

The Corps will execute this project in accordance with our Federal Trust responsibilities and in compliance with Executive Order 13175 on Consultation and Coordination with Indian Tribal Governments. In formulating and implementing activities that may have Tribal implications, the Corps will consult with the affected Tribes and consider their comments prior to making a final decision on the project. Specific items of interest and concern raised by the Muckleshoot Indian Tribe (MIT) in relation to their existing hatchery on the right bank are discussed in the previous sections. The project has also been developed in cooperation with the Puyallup Tribe of Indians (PTI).

The proposed project has been analyzed with respect to its effects on the trust resources described above. We anticipate that:

- The work will not interfere with access to usual and accustomed fishing grounds or with fishing activities or shellfish harvesting;
- The work will have some short-term affects and potential degradation of fish runs as the new facility is constructed;
- The work will not cause long-term degradation of fish runs and habitat; and has the potential to improve fish populations that are part of the tribes’ treaty rights;
- The work will not impair the Treaty tribes' ability to meet moderate living needs;

- The new barrier structure provides auxiliary benefits to the MIT hatchery located adjacent to the proposed project.
- The MIT and PTI participated regularly on the Regional Design Team, providing input and review of the proposed design of both the fish trap, and barrier structure.

The Corps has also conducted numerous government to government level meetings with MIT and PTI. The Corps formally met with the MIT on a government to government basis six times beginning in March 2012 and continuing through February 2015. The Corps has also met formally with the PTI on a formal government to government basis in June 2014 and will again in May 2015.

## *8.4 Magnuson-Stevens Fishery Conservation and Management Act*

In accordance with the Essential Fish Habitat (EFH) requirements of the Magnuson-Stevens Fishery Conservation and Management Act, the Corps has determined that the proposed work would impact areas which are classified as EFH utilized by Pacific salmon (Chinook, coho and pink salmon).

The Action Items of the NMFS BiOp RPA also constitutes their EFH consultation recommendations. Accordingly we agree to implement the RPA and thereby accept the EFH conservation recommendation.

## *8.5 Federal Water Pollution Control Act (Clean Water Act)*

Under Section 404 of the Clean Water Act, before one can place dredge or fill material into waters of the U.S., it must be determined that the work is the least environmentally damaging practicable alternative. The Act also requires federal agencies to comply with state water quality standards. For the new fish trap and barrier a Clean Water Act Section 404(b)(1) analysis will be developed and publicly coordinated. A 404(b)(1) evaluation to serve as a substantive equivalent of this requirement will be prepared during the detailed project design phase of the proposed project. A Clean Water Act Section 401 water quality certification will be sought and obtained from the Washington Department of Ecology (Ecology) and EPA (for work on MIT lands) following more detailed design of the proposed project. A Section 404(b)(1) analysis is contained in Appendix E.

Section 402 of the Clean Water Act provides the statutory basis for regulating the discharge of pollutants from point sources to waters of the United States. Construction sites which disturb over one acre of ground must work with the EPA to control stormwater runoff and receive authorization through a National Pollutant Discharge Elimination System permit. The proposed levee rehabilitation disturbs over one acre of land. A Stormwater Pollution Protection Plan will be developed and a Construction General Permit will be obtained prior to construction.

## 8.6 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 affords 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.

The Corps is coordinating its review of cultural resources impacts for NEPA with agency responsibilities under Section 106 of the National Historic Preservation Act (NHPA). Consultation began in 2005 and is on-going. The Corps initiated consultation with the Washington State Historic Preservation Officer (SHPO) in 2004 (Office of Archaeology and Historic Preservation Log Number 110404-02-COE-P). At the time, the Corps conducted pedestrian archaeological surveys and subsurface testing to characterize the potential for buried archaeological deposits. The Corps also prepared additional narrative and photographic documentation of the individual components of the barrier dam, a component of the WRHP district that would be adversely affected by the project. The results of the archaeological survey and the additional narrative and photographic documentation are documented in the 2007 cultural resources report *Historic Properties Investigation for the Mud Mountain Dam Upstream Fish Passage Barrier Structure Replacement Project, Near Buckley, King and Pierce Counties, Washington.* No cultural material or archaeological sites were identified during the pedestrian survey or subsurface testing. In our consultation at that time, the Corps determined that the removal of the barrier structure and the associated structures would have an adverse effect on properties eligible for listing in the NRHP. The SHPO agreed with the Corps' findings in a letter dated November 30, 2007 (Department of Archaeology and Historic Preservation Log Number 112607-17-COE-S). However, the project was not completed at that time and a memorandum of agreement (MOA) was never developed between the Corps and the SHPO.

On February 5, 2015, the Corps sent a letter to the SHPO to re-engage in Section 106 consultations. The letter provided an update on the proposed MMD Barrier Structure project, revised the APE and reiterated that the proposed project would have an adverse effect to the WRHP historic district. The SHPO responded on February 9, 2015, agreeing with the revised APE. A draft MOA was submitted to the SHPO by email on February 23, after a follow up phone call was made to SHPO staff. In the draft MOA the Corps proposed the following mitigation measures: large format photography of buildings and structures to be removed during the project and submittal of an essay to an on-line heritage website that provides an overview of the original barrier structure and fish collection and construction.

On February 5, 2015, the Corps sent letters to the Muckleshoot Indian Tribe and the Puyallup Indian Tribe to re-engage in consultation, provide an update on the project and to ask the Tribes for any knowledge or concerns they may have with the project. In addition, the Corps asked the Tribes if they want to be concurring parties to the MOA for mitigation of the adverse effect to the

WRHP historic district. No response has been received from the Muckleshoot Indian Tribe or the Puyallup Indian Tribe to date.

The Corps sent a letter to the Advisory Council of Historic Preservation (ACHP) on February 5, 2015 informing them of the adverse effect the proposed project will have to the WRHP historic district and inviting them to participate in the development of the MOA. In a telephone conversation on February 25, 2015 the ACHP requested more information on the Corps tribal consultation. The formal letter requesting more information was received on February 28, 2015. Information regarding the Corps tribal consultation efforts for this project was detailed to the ACHP in an email dated February 25, 2015 following the telephone conversation. The ACHP responded by letter on March 16, 2015 declining to participate in the development of the MOA.

A draft MOA was sent to the SHPO and the CWA on February 23 and 24, 2015, respectively. The SHPO responded with minor changes to the draft MOA on March 10th, 2015. The CWA responded with minor changes on March 27th, 2015. The MOA was signed by all signatories with the final signature by the SHPO on April 29th, 2015 (Appendix F).

## *8.7 Fish and Wildlife Coordination Act.*

The Fish and Wildlife Coordination Act (FWCA, 16 USC 661-666c) requires that fish and wildlife conservation receive equal consideration and be coordinated with other features of new water resource development projects. This goal is accomplished through Corps funding of USFWS habitat surveys evaluating the likely impacts of proposed actions, which provide recommendations for avoiding or minimizing such impacts. The Corps has initiated discussions with USFWS on the proposed project but does not require a FWCA report for project authorization. The Corps continues to work with USFWS and NMFS to give appropriate consideration to fish and wildlife prior to final design. Technical documentation (a FWCA Report or a Planning Aid Letter), as appropriate, will be sought from the USFWS and NMFS under this statute to ensure proper consideration of aquatic resources that may be affected by implementation of a new barrier and trap.

## *8.8 Clean Air Act*

The Clean Air Act requires states to develop State Implementation Plans (SIP), for eliminating or reducing the severity of number of violations of national ambient air quality standards while achieving expeditious attainment of its standards. The Act also requires Federal actions to conform to the appropriate SIP and defines conformity 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 project has been reviewed and determined consistent with Section 176(c) of the Clean Air Act. The proposed area is not considered a ‘non-attainment” area for any pollutant. The project represents temporary, intermittent and minor potentials for air pollution that will not exceed de minimis levels of direct emissions of a criteria pollutant or its precursors (100 tons/year for carbon monoxide and $PM_{10}$ or 50 tons/year for ozone) and are exempted by 40 CFR Part 93.153. The proposed construction would not be considered a major source of pollution requiring the prevention of significant deterioration. It is anticipated that any later indirect emissions will generally not be within the Corps responsibility (hatchery operations, highway traffic or residential emissions) or if so, would be controlled by the Corps to maintain de minimis levels. Such Corps related indirect emissions would be related to movement of vehicles in and around the barrier structure and fish trap.

## *8.9 Coastal Zone Management Act*

The Coastal Zone Management Act of 1972, as amended, requires Federal agencies to carry out their activities in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved State program, which, in Washington State, is the Washington Coastal Zone Management Program. The King and Pierce County Shoreline Master Plans are a part of the Washington CZMA Program. During the detailed design phase of the project, the Corps will conduct a review of the King County and Pierce County Shoreline Master Program to determine if the proposed project is consistent to the maximum extent practicable with enforceable policies of both counties shoreline management programs. Previous analysis in 2007 found the replacement of the barrier structure and left bank fish trap was consistent with the King and Pierce County Shoreline Plans. Final documentation and request for their concurrence with CZM consistency will be transmitted to Ecology at a later design stage.

## *8.10 Migratory Bird Treaty Act*

The Migratory Bird Treaty Act is a federal law enacted in 1916 between the United States and Great Britain (acting on behalf of Canada) to protect migratory birds.  The act prohibits the pursuit, hunting, taking, capturing, killing or selling of any listed species and does not discriminate between live or dead birds.  The act grants full protection to any bird parts including feathers, eggs and nests. Over 800 species are currently on the list.

The proposed construction will not be undertaken in such a way that migratory birds would be harmed or harassed.  Trees within the project footprint would be removed to complete construction, preferably before nesting season occurs. Prior to and during the removal, the trees would be monitored for migratory bird presence.  Mitigation tree plantings will improve compensate for the loss of riparian corridor trees in the area..  Overall no negative impact to migratory birds is expected because of the mitigation and the presence of large blocks of forested areas adjacent to the construction site

## *8.11 Bald and Golden Eagle Protection Act*

The Bald and Golden Eagle Protection Act (BGEPA) (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.

A bald eagle nest is located approximately 400 feet from fish trap construction site on the right bank (WDFW 2015). The nest will not be within the line of sight when riparian trees are removed for construction. The work timing will be throughout the bald eagle nesting season. Disturbance to nesting eagles would be primarily increased noise. Truck and vehicle noise would be similar in nature to existing noise within the project vicinity. On-site construction personnel would visually monitor the nest daily. Based on the eagles current presence in close proximity to the working hatchery and fish trap, no adverse impacts to the eagles is anticipated.

Since the proposed construction activities are within 600 feet of the existing nest, the Corps will consult with USFWS as to whether to obtain a non-purposeful take permit for bald eagles, pursuant under the BGEPA prior to the start of construction.

## 8.12 Executive Order 12898, Environmental Justice in Minority Populations and Low-Income Populations

Executive Order 12898 directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects of agency programs and activities on minority and low-income populations.

The two cities closest to the project area are Enumclaw and Buckley. Buckley has a population of 4,354 and Enumclaw has approximately 10,670 city residents. Buckley had a stable population between 2000 and 2010, while Enumclaw declined 450 residents. In addition to cities, the project area is within the usual and accustomed fishing grounds of both the MIT and PTI. The MIT reservation is located within the city of Auburn but outside the project area. The PTI reservation is located near the town of Tacoma and also outside the project area. The project area is in a predominantly rural area and its population is largely dependent upon the fluctuations of the agricultural and timber industry. Due to the area's natural terrain, residents of the surrounding area enjoy a high quality of life attributable to the numerous recreational opportunities and natural wildlife habitat in the area. Major employers for the cities of Enumclaw and Buckley include the Federal and State government, the health care industry, schools, the timber industry and a mountain ski resort. Agricultural and horse related businesses are also significant. Tribal businesses have also grown with tribal casino gaming for both the MIT and PTI being a large factor in tribal economy.

The 2010 census database and website were reviewed for information that could prove useful in considering whether this project would disproportionately affect disadvantaged groups within the project area (US Census Bureau, 2010). Such groups include low-income and minority communities, are specifically considered in order to assess the potential for disproportionate occurrence of impacts. For the purposes of this analysis, disadvantaged groups are defined as follows:

- Low-Income Population: Persons living below the poverty level, according to income data collected during the U.S. Census.

- Minority Population: Persons of Hispanic origin of any race, Blacks, American Indians, Eskimos, Aleuts, Asians, or Pacific Islanders.
- Youth Population: Children under the age of 18 years.

The 2011 poverty levels were only available for Enumclaw at this time. The poverty level in Enumclaw in 2011 was 11.4 percent versus 12.5 percent for the state of Washington.

Minority persons represent 22.8 percent of the state population. In 2010, the percentage of non-whites in Buckley was 7.0 percent and Enumclaw the percentage was 8.2 percent. Based on the census data provided, it does not appear that the proposed project is located in an area occupied by minority or at risk populations at levels disproportionate to those at the state level. Adverse conditions produced by the proposed project are generally related to slightly notable degradations in noise, air and discharges of water that would not be adverse to human health.

No adverse effects to minority or low-income populations outside the project area would result from the implementation of the proposed project. Adverse effects will occur to tribal residents and aquatic habitats located near the MIT hatchery during the construction and operation of the project. These effects will be minimized or mitigated through project planning via coordination with the MIT. In the long-term there will likely be improved fishing opportunities for minority or low-income populations afforded by the new fish passage facilities.

# 9 PUBLIC AND AGENCY COORDINATION

## *9.1 Public Involvement Process*

Coordination for replacement of the barrier and fish trap has been ongoing with the Services (USFWS and NMFS), MIT and PTI, and CWA over the past three years. The coordination has included quarterly meetings with all parties, individual meetings with each organization, and detailed design discussions with fish passage engineers and biologists from the Services. The meetings included input on design criteria for the fish passage barrier and trap, concerns for impacts to existing uses for water diversion for CWA, impacts to fish collection for the MIT hatchery and ensuring maintenance of flood protection for the hatchery, and future plans for rehabilitation or replacement of the MMD fish trap. In 2014, a Regional Design Team identified in the NMFS BiOp and represented by the agencies listed above developed a set of biological criteria necessary for scoping and design of the fishway and barrier and provided input to the implementation plan for competition of the facility. The issues other than impacts to major uses included in-stream flow requirements, risks from construction of the barrier such as sediment releases and water level fluctuations, and what future conditions would occur with the new ability to manage sediment and flow releases with a completed barrier. A critical design issue for ESA compliance was meeting the fish exclusion criteria for the proposed barrier. To date, NMFS has worked collaboratively with the Corps in designing site-specific structural elements for the MMD fish passage barrier and trap. The design characteristics were developed via coordination with NMFS and USFWS during 2012-2014, and are described along with the specific design criteria in this report. Coordination with Washington State Department of Ecology has been ongoing to identify possible impacts to wetlands and other waters of the U.S.

A copy of the Notice of Availability will be provided to the following agencies, Tribes and the interested public for public review and comment: Muckleshoot Indian Tribe; Puyallup Tribe of Indians, National Marine Fisheries Service, U.S. Fish and Wildlife Service, Washington Department of Ecology, Washington Department of Fish and Wildlife, local residents as well as other stakeholders including CWA and American Rivers. This document serves the public coordination mandates under NEPA. A Notice of Availability for the EA was issued for the proposed project from March 19, 2015 to April 17, 2015. Agency and Public Comments Received

Nine comments were received in response to the public review of the Draft EA. Comments were received from:

1. King County Department of Natural Resources – 10 April 2015
2. City of Enumclaw – 1 April 2015
3. Puget Sound Partnership – 17 April 2015
4. Puyallup Tribe of Indians – 17 April 2015
5. Tahoma Audubon Society – 16 April 2015
6. Washington State Department of Ecology – 17 April 2015
7. National Park Service, Mount Rainier National Park – 17 April 20, 2015
8. American Rivers – 17 April 20, 2015
9. Pierce County – 20 April 2015

Public comments and responses are contained in Appendix C. Where applicable the text of the EA has been updated to address comments.

# 10 CONCLUSIONS

Based on the above analysis, this project is not a major Federal action significantly affecting the quality of the human or natural environment, and therefore does not require preparation of an environmental impact statement. See Appendix B for the Corps' Finding of No Significant Impact.

# 11 REFERENCES

AECOM. 2011. US Army Corps of Engineers Mud Mountain Barrier Dam Physical Hydraulic Model Study. Prepared for Seattle District, US Army Corps of Engineers.

Chow, V.T. 1959. “Open-Channel Hydraulics” McGraw Hill, New York.

Carter, H.R. and R.A. Erickson. 1988. Population status and conservation problems of the marbled murrelet in California. 1892–1987. (Final Report, Contract F67569). California Department of Fish and Game. Sacramento, CA.

Dunn, Thomas, 1986. Sediment transport and Sedimentation Between RMs 5 and 30 Along the White River, Washington, prepared for Puget Sound Power and Light Company, August 1986.

Ebbert, J., 2002. Concentrations of Dissolved Oxygen in the lower Puyallup and White Rivers, Washington, August and September 2000 and 2001. US Geological Survey Water Resources Investigations Report 02-4146.

Ebbert, J.C., 2003, Water temperature, specific conductance, pH, and dissolved oxygen concentrations in the lower White River and the Puyallup River estuary, Washington, August–October 2002: U.S. Geological Survey Water-Resources Investigations Report 03–4177, 21 p.

Grette, G.B. and E.O Salo. 1985. Impacts of Mud Mountain Dam Safety Modifications on the Fisheries of the White River. Final Report. Submitted to US Army Corps of Engineers by Evans Hamilton Inc. Seattle, WA.

Gutierrez, R.J., A.B. Franklin, and W.S. LaHaye. 1995. Spotted owl (Strix occidentalis). In A. Poole and F. Gill (eds.), The birds of North America, no. 179. The American Ornithologists Union. The Academy of Natural Sciences. Washington DC.

Historic American Engineering Record. 1994. Documentation of White River Hydroelectric Project. Library of Congress.

Kerwin, J. 1999. Salmon Habitat Limiting Factors Report for the Puyallup River Basin. (Water Resource Inventory Area 10). Washington Conservation Commission. Olympia, Wa.

Ladley, R., E. Marks, M. Parnel, A. Berger, T. Sebastian and B. Smith. 2007. Movement and Spawning Distribution of Bull Trout within the White River, Washington. Draft Report. Puyallup Tribal Fisheries Department. Puyallup, Washington. 14 pp.

Marks, E.L., R.C. Ladley, B.E. Smith, and T.G. Sebastian. 2008. 2007-2008 annual salmon, steelhead and bull trout report: Puyallup/White River watershed—Water Resources Inventory Area 10. Puyallup Tribal Fisheries, Puyallup, Washington. 253 pp.

Marks, E.L., R.C. Ladley, B.E. Smith, and T.G. Sebastian. 2011. 2010-2011 annual salmon, steelhead and bull trout report: Puyallup/White River watershed—Water Resources Inventory Area 10. Puyallup Tribal Fisheries, Puyallup, Washington.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NWFSC-35. Seattle, WA.

National Marine Fisheries Service (NMFS). 1996. Making Endangered Species Act determinations of effect for individual or grouped actions at the watershed scale. Environmental and Technical Services Division. Habitat Conservation Branch.

National Marine Fisheries Service (NMFS). 1999. Endangered and Threatened Species; Threatened Status for Three Chinook Salmon Evolutionarily Significant Units (ESUs) in Washington and Oregon, and Endangered Status for One Chinook Salmon ESU in Washington; Final Rule. Federal Register 64(56):14308-14328.

National Marine Fisheries Service (NMFS). 2005a. Endangered and Threatened Species: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs: Final rule. Federal Register 70(123):37160-37204.

National Marine Fisheries Service (NMFS). 2005b. Endangered and Threatened Species; Designation of Critical Habitat for 12 Evolutionarily Significant Units of West Coast Salmon and Steelhead in Washington, Oregon, and Idaho: Final Rule. Federal Register 70(170):52630-52858.

National Marine Fisheries Service (NMFS). 2005c. Endangered and Threatened Wildlife and Plants: Endangered Status for Southern Resident Killer Whales. Final rule. Federal Register 70(222):69903-69912.

National Marine Fisheries Service (NMFS). 2007a. Biological Opinion (BiOp) and Magnuson-Steven Fishery Conservation and Management Act Consultation On Routine Mud Mountain Dam Operations and Maintenance and Replacement of Existing Barrier Dam at Buckley, Washington, White River, HUC# 17110014. Northwest Region, Hydropower Division. Portland, Oregon.

National Marine Fisheries Service (NMFS). 2007b. Endangered and Threatened Species: Final Listing Determination for Puget Sound Steelhead. Final rule. Federal Register 72(91):26722-26735.

National Marine Fisheries Service (NMFS). 2010. Endangered and Threatened Wildlife and Plants: Threatened Status for Southern Distinct Population Segment of Eulachon; Final Rule. Federal Register 75(52):13012-13024.

National Marine Fisheries Service (NMFS). 2011a. Anadromous Salmonid Passage Facility Design. NMFS, Northwest Region, Portland, Oregon.

National Marine Fisheries Service (NMFS). 2011b. Southern Resident Killer Whales (Orcinus orca) 5-Year Review: Summary and Evaluation. National Marine Fisheries Service, Northwest Regional Office Seattle, WA. 70 pp.

National Marine Fisheries Service (NMFS). 2011c. Endangered and Threatened Species; Designation of Critical Habitat for the Southern Distinct Population Segment of Eulachon; Final Rule. Federal Register 76(203):65324-65352.

National Marine Fisheries Service (NMFS). 2013. Endangered and Threatened Species; Designation of Critical Habitat for Lower Columbia River Coho Salmon and Puget Sound Steelhead; Proposed Rule. Federal Register 78(9):2726-2796.

National Marine Fisheries Service (NMFS). 2014. Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Conference Opinion And Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation: Mud Mountain Dam, Operations, and Maintenance White River, HUC 17110014 Pierce and King Counties, Washington. NMFS Consultation Number: NWR-2013-10095. National Marine Fisheries Service, Seattle, WA.

Nelson, S.K. 1989. Development of inventory techniques for surveying marbled murrelets (Brachyramphus marmoratus) in the central Oregon coast range. (Publ. No. 88-6-01). Oregon Department of Fish and Wildlife, Nongame Program. Portland OR.

Paton, P.W.C. and C.J. Ralph. 1988. Geographic distribution of the marbled murrelet in California at inland sites during the 1988 breeding season. (Contract No. FG7569.) California Department of Fish and Game. Sacramento, CA.

Ruediger, Bill, Jim Claar, Steve Gniadek, Bryon Holt, Lyle Lewis, Steve Mighton, Bob Naney, Gary Patton, Tony Rinaldi, Joel Trick, Anne Vandehey, Fred Wahl, Nancy Warren, Dick Wenger, and Al Williamson. 2000. Canada lynx conservation assessment and strategy. USDA Forest Service, USDI Fish and Wildlife Service, USDI Bureau of Land Management, and USDI National Park Service. Missoula, MT.

Sealy, S.G., and H.R. Carter. 1984. At sea distribution and nesting habitat of the marbled murrelet in British Columbia: problems in the conservation of a solitarily nesting seabird. Pages 737–756 in J.P. Croxall, P.G. Evans, and R.W. Schreiber (eds.), Status and conservation of the world’s seabirds. (ICBP Technical Seabirds Publication 2.)

SSPS (Shared Strategy for Puget Sound). 2007. Puget Sound salmon recovery plan. Adopted by National Marine Fisheries Service. Seattle, Washington. Online at http://www.sharedsalmonstrategy.org. Accessed Aug 14, 2012.

Strachan, G., M. McAllister, and C.H. Ralph. 1995. Marbled murrelet at-sea and foraging behavior. In, C.J. Ralph, G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt (eds.), Ecology and conservation of the marbled murrelet. (General Technical Report PSW-GTR-152). U.S. Forest Service, Pacific Southwest Research Station. Albany, CA.

StreamNet. 2001. StreamNet Online. Available: <http://www.streamnet.org/>. Accessed: May 30, 2001.

Stuart, D and M. Brett. 2001. A study of periphyton induced pH spikes on the White River, Wa. Prepared for Dept. of Ecology and Center for Streamside Studies, University of Washington. Seattle, Washington.

Tetra Tech. 2012. Mud Mountain Dam Fish Passage Facility 35 % Care and Diversion of Water (CDW) Feasibility Design Report Final, White River, Buckley, Washington. Prepared for the Seattle District U.S. Army Corps of Engineers, Seattle, Washington. May.

U.S. Army Corps of Engineers (USACE). 2002. Section 905(b) General Investigation Reconnaissance Study; Puyallup/White River Basin, Washington. U.S. Army Corps of Engineers-Seattle District, Seattle. 22 pp.

U.S. Army Corps of Engineers (USACE). 2004. Mud Mountain Dam, White River, Washington-Water Control Manual. Seattle District. Seattle, Washington.

U.S. Army Corps of Engineers (USACE). 2005. Final Mud Mountain Diversion Dam, HTRW preliminary assessment report, Buckley, Washington. Seattle District. Seattle, Washington.

USACE.2008. Mud Mountain Dam Fish Passage Project, White River, Washington – 65% Design Documentation Report, ITR Draft. Technical Report dated February.

U.S. Army Corps of Engineers (USACE). 2013a. Report on Fish Rescue Effort along the White River as the Result of the Barrier Dam Repairs in the Lower White River below Buckley, Washington.

U.S. Army Corps of Engineers (USACE). 2013b. Biological Assessment for Operation and maintenance of Mud Mountain Dam, Cascade Water Alliance White River diversion White River diversion dam for fish trap purposes, and Corps Buckley fish trap; and replacement of the Cascade diversion dam with a fish passage barrier. USACE, Seattle District, Seattle, Washington.

U.S. Army Corps of Engineers (USACE). 2013c. Environmental Assessment for Barrier Structure Improvement Mud Mountain Dam Upstream Fish Passage on the White River near Buckley, Washington. Draft Document. USACE, Seattle District, Seattle, Washington.

U.S. Army Corps of Engineers (USACE). 2014a. Barrier Structure Improvement Mud Mountain Dam Upstream Fish Passage Flood Control Act of June 22, 1936, Pierce County, WA. Draft Project Letter Report. USACE, Seattle District, Seattle, Washington.

U.S. Army Corps of Engineers (USACE). 2014b. Mud Mountain Dam Endangered Species Act Fish Passage Action Plan, 14 May 2014. USAC, Northwestern Division, Portland, OR.

USCAE. 2014c. Mud Mountain Dam Regional Team Biological Criteria. Memo September 2014, Seattle District.

U.S. Army Corps of Engineers (USACE). 2015b. Design and Execution Document Mud Mountain Dam Upstream Fish Passage Project, Flood Control Act of June 22 1936, Pierce County, WA. Draft Report.

US Fish and Wildlife Service (USFWS). 1993. Grizzly bear recovery plan. Missoula, MT.

US Fish and Wildlife Service (USFWS). 1999a. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for Bull Trout in the Coterminous United States. Final rule. Federal Register 64(210):58910-58933.

US Fish and Wildlife Service (USFWS). 1999b. A framework to assist in making Endangered Species Act determinations of effect for individual or grouped actions at the bull trout subpopulation watershed scale.

US Fish and Wildlife Service (USFWS). 2005. Endangered and Threatened Wildlife Plants; Designation of Critical Habitat for the Bull Trout; Final Rule. Federal Register 70(185):56212-56311.

US Fish and Wildlife Service (USFWS). 2007. Endangered Species Act – Section 7 Consultation Biological Opinion (BiOp): Mud Mountain Dam Maintenance and Operations and Replacement of the White River (Buckley) Barrier Dam. U.S. Fish and Wildlife No. 1-3-05-F-0517. Western Washington Fish and Wildlife Office, Lacey, Washington.

US Fish and Wildlife Service (USFWS). 2010. Endangered and Threatened Wildlife and Plants; Revised Designation of Critical Habitat for Bull Trout in the Coterminous United States. Final Rule. Federal Register 75(200):63898-64070.

US Census Bureau. 2000. 2000 Census Data. http://censtats.census.gov. (accessed September 2005)

WDOE (Washington Department of Ecology). 1994

Washington Department of Ecology (WDOE). 1998. The 303(d) List of Impaired and Threatened Waterbodies. http://www.ecy.wa.gov/programs/wq/303(d/index.html (accessed July 25, 2001)

Washington Department of Ecology (WDOE). 2006. Waters Requiring Supplemental Spawning and Incubation Protection For Salmonid Species, Pub No. 06-10-038, November 2006.

Washington Department of Ecology (WDOE). 2010. Report of Examination: Change of: purpose of use. WRTS File #CS2-160822CL. Online at https://fortress.wa.gov/ecy/wrx/wrx/fsvr/ecylcyfsvrxfile/WaterRights/ScanToWRTS/hq4/06597570.pdf . Accessed 28 Feb 2013

Washington Department of Ecology (WDOE). 2011. Water quality standards for surface waters of the State of Washington: Publication Summary, Chapter 173-201A WAC, (updated May 9, 2011), 108 p, accessed December 21, 2011, at http://www.ecy.wa.gov/biblio/wac173201a.html.

Washington Department of Fish and Wildlife (WDFW). 1996. 1996 Game Status and Trend Report. Wild. Manage. Prog., Wash. Dept. Fish and Wildl., Olympia. 328 pp.

Washington Department of Fish and Wildlife (WDFW). 1998. Salmonid Stock Inventory (SaSI) Bull Trout/Dolly Varden.

Washington Department of Fish and Wildlife (WDFW). 1998. 1998 Game Status and Trend Report. Wild. Manage. Prog., Wash. Dept. Fish and Wildl., Olympia. 328 pp.

Washington Department of Fish and Wildlife (WDFW). 1999. 1999 Game Status and Trend Report. Wild. Manage. Prog., Wash. Dept. Fish and Wildl., Olympia. 328 pp.

Washington Department of Fish and Wildlife (WDFW). 2001. Washington GAP Analysis Program (GAP). Wash. Dept. Fish and Wildl., Olympia. Website: http://www.wa.gov/wdfw/wlm/gap/dataprod.htm

Washington Department of Fish and Wildlife (WDFW). 2002. Salmon and steelhead stock inventory. Online at http://wdfw.wa.gov/conservation/fisheries/sasi/.

Washington Department of Fish and Wildlife (WDFW). 2015. Priority Habitat Species (PHS) GIS database. February 26, 2015. Wash. Dept. Fish and Wildl., Olympia.

Online at http://wdfw.wa.gov/conservation/fisheries/sasi/.

Washington Department of Fish and Wildlife (WDFW) and Western Washington Treaty Indian Tribes (WWTIT). 1994. 1992 Washington State salmon and steelhead stock inventory, Appendix 1: Puget Sound stocks. Olympia, Washington.

Washington State Historic Preservation Office (SHPO). 2004. Concurrence on APE letter. Dated 21 October 2004. DAHP Log No. 110404-02-COE-P

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California, 258 pp. NTIS No. PB96-106554.

Williams, R.W., R.M. Laramie, and J.J. Ames. 1975. A catalog of Washington streams and salmon utilization, Volume 1, Puget Sound Region. Washington Department of Fisheries.

Wydoski, R.S., and R.R. Whitney. 2003. Inland fishes of Washington. Second edition. University of Washington Press, Seattle, WA.

Zentner, G., 2005. Puyallup and White Rivers Temperature and Dissolved Oxygen July-November 2004. Washington Department of Ecology, Olympia, WA. Publication No. 05-10-053. www.ecy.wa.gov/biblio/0510053.html.

Zimmerman, M. and C. Kinsel. 2011. Migration of Juvenile Bull Trout in the Skagit River, 1990-2009. WDFW.